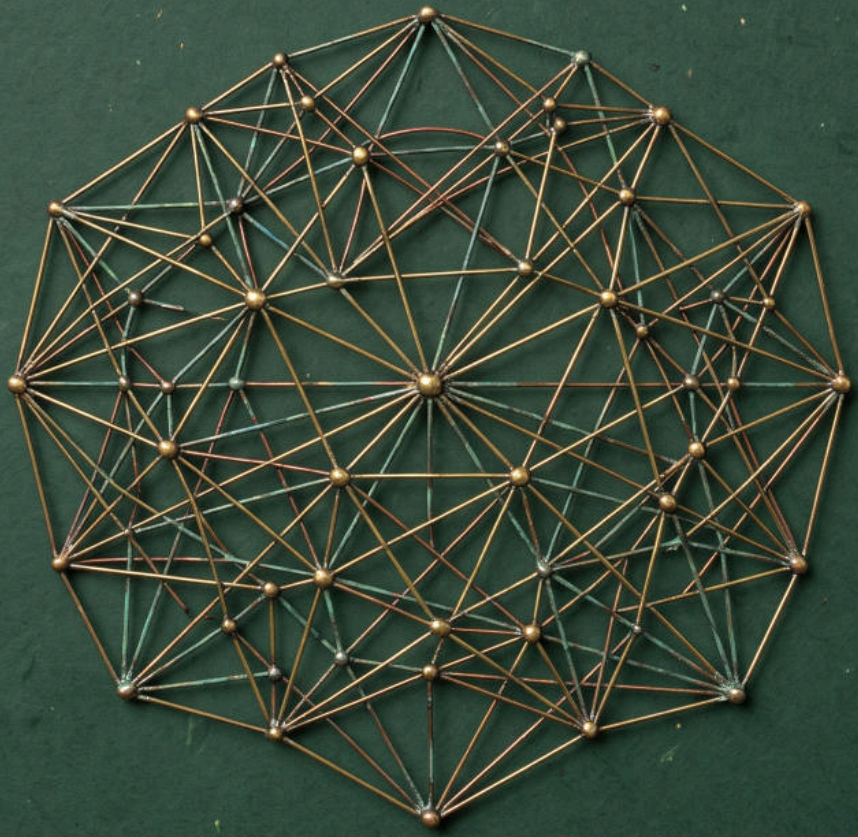
CLEVERINI SERIES

MEMORY
PRACTITIONER GUIDE



Encoding, recall and practical learning

DAVID PETROSIAN MKERVALI

MINDCRAFT INC.

Memory Practitioner Guidebook

David Petrosian Mkervali

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Author's preface

Forgetting something you worked hard to learn is discouraging. You gave it your time. You understood at least part of it. Then, when you needed the information, you couldn't bring it back.

I knew that frustration at school. Memory was one of several things I struggled with, alongside wandering attention and difficulty following explanations. I wanted to learn, yet the effort I put in often seemed to produce very little that I could rely on afterward.



She closes the book and tries to say the idea in her own words.

Those experiences are part of the reason I care about how people study. I don't like the idea of someone spending years believing they are incapable when they have had so little help finding a method that works for them.

My interest in education came from my family. Science and teaching were part of our lives, and I grew up with the belief that helping someone learn was worthwhile work. My own difficulties gave that belief a personal urgency. I needed answers I could use.

As I learned more about mental abilities and began using tools to support them, I found ways to make progress. I could catch up. Learning became something I understood better, and I had more choices about how to approach it.

My PhD research grew from the same concern. I wanted education to give greater priority to the basic abilities on which later learning depends. Memory had an obvious place in that model: whatever subject we study, we need some way to keep what we have learned available for further use.

This guide concentrates on the practical work involved.

Bring something real to it. You might be learning a language, studying for an examination, or trying to become more confident with information you need at work. Choose material you actually care about remembering. It will give the exercises a purpose beyond completing the page.

As you read, take an active part. After an explanation, close the book for a moment and put the idea into your own words. Check what you left out. When you try a method, use it again with different material and compare the experience. Keep a few notes so that you can look back at

what you tried, rather than relying on a vague impression of whether it helped.

I would like you to become curious about your own learning. When something is difficult to remember, where does the difficulty begin? Did you understand it clearly? Can you connect it with something familiar? Have you tried recalling it without looking?

These are useful questions to work through. They give you somewhere to direct your effort.

You will also find opportunities for practice through Cleverini. The games are there to be used, and the books explain approaches you can take into your own studies. There should be room for enjoyment in this work. There should also be a reason to return to it after the novelty wears off.

Access matters to me. I believe a person who wants to learn should be able to get started without having to prove they can afford it. That belief is behind our decision to keep Cleverini free, and it shapes the practical approach of this series.

The part you contribute is your time and attention. Some methods will take a few attempts before you can judge them fairly. Others may need adapting to the material in front of you. Allow yourself that period of finding out.

Perhaps there is a subject you once put aside because remembering it felt too difficult. Keep it in mind while you work through this book. I would like you to have a better way to approach it when you return.

David Petrosian Mkervali

How to Use This Book

The guidebook is **a learning path** that moves forward step by step, like the stairs in a house. Each module builds on the one before it. Module 2 shows how memory works with attention, intellect and creativity.



A path of twelve steps, one per module, climbing gently uphill.

A module brings in new ideas and **goes over earlier ones again**. Bit by bit, it also asks more of your mind. These four habits help you get the most from the time you put in.

> **Key Concept:**
>
> Reading Strategy
>
> Work through the modules in order on your first pass. The order is part of the design.
>
> Allow 3 to 5 hours per module, spread over several days. Avoid reading a whole module in one sitting.
>
> Keep a Memory Journal just for this. It can be a notebook or a file on a screen. In it, you write down ideas, practice exercises and how you rate yourself.
>
> After finishing all 12 modules, go back to the sections you found hardest.

Key idea:

Each module builds on the one before it.



A learner writes in her Memory Journal, with the guidebook open beside her.

Understanding the Box Labels

Some parts of the text sit in **special boxes**. Each box starts with a label that tells you what kind of text comes next. With the labels, you can **see the shape of the text at a glance**, like signs on the aisles of a shop.

The labels also help you choose **how fast and how closely to read**. That way, you meet each part at the right level.



An open page with a labelled box set apart from the text.

Key Concept	A basic idea. Read it slowly and think as you go. These are the building blocks.
Science Says	Research checked by other scientists that backs up the idea. Share these when you talk with people!
Exercise	A hands-on task to finish before moving on. Doing beats reading every time.

You will also meet **four light touches** outside the boxes. A Key idea line gives the one thing to remember from a section. A Definition line gives a new word and its plain meaning. A Caution line warns of a real risk. A Quick check at the end of a section asks two or three short questions and gives the answers.

Module 1: Introduction to Memory

> **Key Concept:**
>
> Module 1 Overview. Before you can train your memory, you need to **understand it**. I follow the story of human memory, from the ancient world to modern brain science. That story gives you a solid science base for everything that comes after.

YOU WILL SEE THAT memory is **much more than pulling up a fact on cue**. Who you are, how clever you are and what people manage to do are all woven from it. Memory is like the thread in a jumper.



Memory is much more than pulling up a fact on cue.

I also look at what memory really is and how it works. And I make the case for training it, with evidence. I think training your memory is **one of the best things anyone can spend time on**.

Key idea:

I think training your memory is one of the best things anyone can spend time on.

Why You Must Train Your Memory

Before the science of how memory works, there is a more urgent question. Why does **memory matter**?

You are about to put real time and real effort into this training. You deserve to know **what you get back for it**. The answer should be clear and solid, and it should reach into every part of your life.

What you get back

You put in	You get back
⊕ Real time	⊖ An answer that is clear and solid
⊕ Real effort	⊖ It should reach into every part of your life

You deserve to know what you get back for it.

I make the case from **five angles**. They are career, relationships, health, learning and identity. Each one is backed by research and shown through real stories.

Each angle also rests on a real difference you can measure, the one a trained memory makes in daily life. Before you start, get clear on **why memory is worth training** at all.

Why memory matters: five angles



Each one is backed by research and shown through real stories.

WHY #1 Your Career: Memory Is the Hidden Engine of Professional Success

In every workplace on earth, one person seems to have **an edge**. The people they work with cannot quite say what it is. That person remembers the client's daughter's name from a meeting six months ago. They recall the exact line in the contract without opening it. They walk into a talk and **own the room without a single note**.

Everyone around them assumes they were simply born gifted, with a special kind of brain. That is wrong. They **have trained**.

Meet Marcus, 38, a senior sales director. Marcus had been selling to other businesses for twelve years. He was good at his job, people liked him, and he was **steadily in the top half of his team**.

But he had watched three colleagues get promoted ahead of him. He couldn't understand why. He worked just as hard, and **his numbers were solid**.

Meet Marcus

M3

Marcus, 38, a senior sales director

- Twelve years selling to other businesses
- Steadily in the top half of his team
- Watched three colleagues get promoted ahead of him

He couldn't understand why.

One Friday, he sat across from a senior client he had met twice before. The client said, in passing, that **his company had just moved offices**.



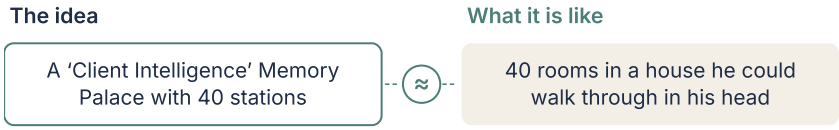
Marcus sits across from a senior client he has met twice before.

Marcus had forgotten. In fact, **he had never even taken it in** the first time. The look on the client's face said everything.

Six months later, Marcus had finished a planned, step-by-step memory training programme. By then, he had built **a 'Client Intelligence' Memory Palace with 40 stations**. Think of 40 rooms in a house he

could walk through in his head, each one holding something to remember.

A 'Client Intelligence' Memory Palace



Every key client had a station. Each one held the client's name, job, company changes, personal details and open jobs to finish. He **walked it every Monday morning**.

At the next big pitch, the CEO of a company he hoped to win said something in passing. A CEO is the top boss. His wife had **just come back from Japan**. Three weeks earlier, Marcus had memorised that from a LinkedIn post.

He asked about it. The CEO looked up from the table. The deal **closed within two weeks**.

Four months later, **Marcus was promoted to Senior Director**. His manager told him, 'You've become someone clients trust completely. I don't know what changed, but keep doing it.'

Marcus's story is not unusual. **The edge a trained memory gives at work** shows up in every field.

Life Area	Without Training	With Training	The Difference
Sales	Forgets client details; asks the same questions again; loses trust	Remembers every meeting; makes every pitch personal	Wins more deals; builds close ties faster
Medicine	Leans on notes for everything; slow to recall facts with patients; worried under pressure	Quickly sorts out what an illness might be; recalls each step of a procedure under stress	Faster, safer, more confident care of patients
Law	Loses the thread in hard cases; keeps needing to look things up	Holds the whole case in mind; quotes past rulings with ease	Wins people over more; gets more done; moves up faster
Management	Cannot recall what each team member did; misses follow-ups; loses details	Remembers every one-on-one talk; tracks open jobs; remembers the team's situation	More trust from the team; fewer dropped balls; a stronger leader
Teaching	Leans on scripts; cannot recall which student said what	Calls every student by name from Day 1; remembers what each one finds hard	Closer bonds in class; better results; respect from other teachers
Finance	Needs to look up every figure; hesitates in meetings	Recalls key numbers easily; answers with confidence, no pausing	Seen as an expert; trusted in big, high-pressure talks

The pattern holds across every part of working life. Look at what happens in single moments with other people. Those moments add up to **a reputation**.

People who used GPS more over their lives had **worse memory for places and routes** (Dahmani & Bohbot, 2020). Following directions also lowered activity in the hippocampus (Javadi et al., 2017). The hippocampus is **a brain area key to memory**.

This also reaches past a few rare stars in unusual jobs. It is about **the gap between two versions of the same worker**.

Two versions of the same worker

The same job	Just as clever	**The only difference:** whether they have trained their memory

Both do the same job, and both are just as clever. The only difference is **whether they have trained their memory**. That gap has a hidden cost.

> **Key Concept:**
> The Invisible Career Tax of a Weak Memory. Forget a client's name, and a colleague trusts you a little less. Every time you ask for information someone already gave you, you send a signal. It says **the other person was not worth your full attention**.

Give a talk from notes and your authority and preparation look weaker. One by one, **these small losses are invisible**. Over a whole career, added together, they are enormous. It works like coins slipping one by one through a hole in your pocket.

Key idea:

Small invisible losses, added together over a whole career = an enormous cost.

The person who always remembers does not seem to do anything special. They just seem to be doing their job well. A trained memory makes **that standard effortless**.

The cost builds up because **it is invisible**. Nobody hands you a report of what you failed to remember. You simply fall a little short of the

bond you might have made, or the good impression you might have left.

Why the cost builds up



Nobody hands you a report of what you failed to remember.

Quick check:

1. What did people who used GPS more over their lives have? Answer: Worse memory for places and routes (Dahmani & Bohbot, 2020).
2. How many stations did Marcus's 'Client Intelligence' Memory Palace have? Answer: 40, and every key client had a station.

WHY #2 Your Relationships: Memory Is How We Show People They Matter

EVERY RELATIONSHIP YOU HAVE is built on **shared moments that you both remember**. That goes for love, family, friends and work alike.

Names, likes and dislikes, stories, promises and important dates are the stuff that connection is made of. When someone remembers what you told them three months ago, **you feel seen**.

When they have forgotten, you feel, just slightly, **rubbed out**. It looks like they don't care, yet the real cause is almost always something else.



Names, likes and dislikes, stories, promises and important dates are the stuff that connection is made of.

It is uncomfortable to hear, but **most people who forget do care**. The information simply never got in properly in the first place. It is a bit like a letter that was never posted, so it could never arrive.

They were half there, distracted, on autopilot. For the person on the other end, the result **feels the same as not caring**.

Meet Priya, 44, and her elderly father. Priya's father, now 79 and living alone, had always been proud of being **a storyteller**. Every time Priya called, he would share memories from his life, like these.

- His first job in Bangalore
- The name of his first manager
- A cricket match he watched in 1974

He told the same stories, often. For years, Priya **half-listened**. She was busy, and she had heard the cricket story five times. She would make agreeing sounds and check her email.

Then she tried a new way. She started **a simple Memory Palace** with just five stations, like five rooms she could walk through in her head. Each station stood for one decade of her father's life.

Every time he mentioned a name, a place or a date, **she memorised it**. She asked follow-up questions. She called back the next week and talked about what he had shared.



Priya on the phone with her elderly father, asking about his stories.

The change in her father came at once, and it went deep. **He called more often**, and he sounded lighter on the phone. Then came a visit. With tears in his eyes, he told her, 'You are the only person who actually listens to me.'

Priya loved her father just as much as before. What she changed was **how well she remembered him**. And that changed everything.

Priya's story shows what is at stake in the closest, most personal part of memory. That part is the relationships that give life meaning. Here **the gap between a trained memory and an untrained one is big**, as you can see side by side.

Without Memory Training	With Memory Training
Forgets names at parties; asks the same person twice	Remembers every name; uses it easily in conversation
Misses birthdays and anniversaries; says sorry again and again	Never misses an important date; sends a message first
Asks again about life events already shared in detail	Brings up past conversations; shows they kept listening
Cannot recall the names of their children's friends or teachers	Knows every child in their child's class by name within a week
Forgets what they promised; comes across as unreliable	Keeps every promise; becomes known as someone you can trust
Feels distant even when there; on autopilot	Fully there; close to people; makes people feel truly seen

A saying puts it well. "The greatest gift you can give someone is your attention. The second greatest is your memory of having given it."

That line catches something deep. Memory is how attention turns into a relationship, and how a relationship turns into influence. Memory is **how attention lasts**.

Key idea:

Through memory, attention turns into a relationship, and a relationship turns into influence.

Quick check:

1. Why do most people forget what others tell them? Answer: Most people who forget do care. The information simply never got in properly in the first place.
2. How many stations did Priya's first Memory Palace have? Answer: Five, and each one stood for one decade of her father's life.

WHY #3 Your Learning: Memory Is the Foundation

Modern schooling has **a stubborn myth**. It says learning by heart is a low-level skill. It calls it the enemy of creativity and of thinking things through for yourself. It also says "understanding" is somehow separate from "remembering".

A stubborn myth

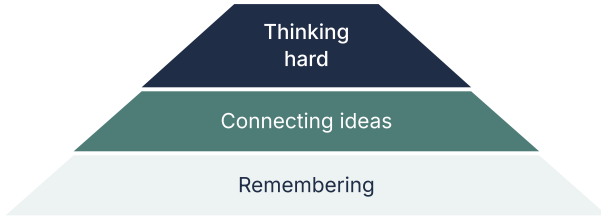
Myth		Fact
Learning by heart is a low-level skill	→	You cannot think hard about things you cannot remember

This myth makes people ignore the single most important speed-up for learning.

This myth is **wrong**. Worse, it harms anyone who believes it. It makes them ignore **the single most important speed-up for learning** they have.

Our age praises creativity over recall, so this may sound backwards. Yet **you cannot think hard about things you cannot remember**.

A trained memory is the foundation



You cannot build a house on a foundation that has crumbled.

You cannot connect ideas you have not kept. You cannot build a house on **a foundation that has crumbled**.

The more you already know about a subject, **the faster you learn new things in it**. New information sticks to what is already there, like a magnet sticking to a fridge. Scientists usually call this the "prior-knowledge effect" (Recht & Leslie, 1988).

A trained memory is **the foundation of intelligence**, the floor it stands on.

> **Science Says:**
>
> Ericsson, Krampe, and Tesch-Romer (1993) studied expert musicians. They argued that **practice, more than inborn talent**, built their skill.

In their view, skill comes from **focused, hard practice aimed at getting better**. Scientists call this deliberate practice. It only works when earlier learning is kept, so it is ready to compare, polish and build on.

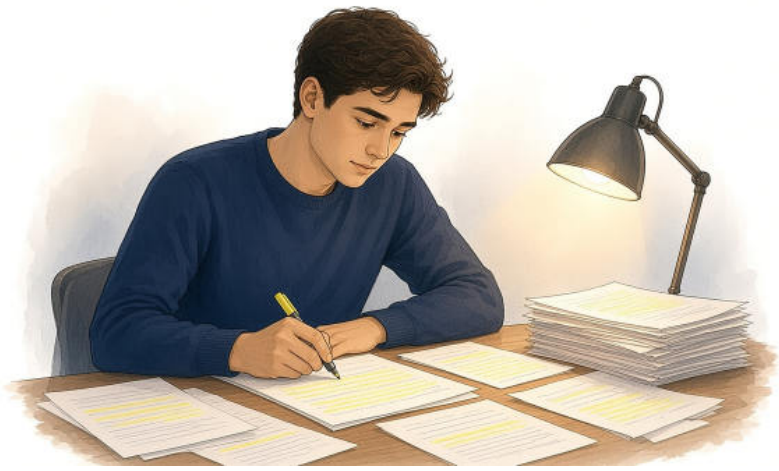
Later work asked **how much practice really explains**. One study combined the results of many studies. It found practice explained **about 12% of differences in performance** (Macnamara, Hambrick & Oswald, 2014).

Think of the expert chess player, surgeon or musician. They beat the beginner, yet they don't think faster. They have **more stored, ready patterns**. These pack messy situations into familiar chunks, like whole words you read at a glance.

Memory is **where expertise is stored**. Without it, experience never builds up. It just evaporates, like a puddle in the sun.

Meet Sam, 22, a final-year medical student. Sam had scraped through his first two years of medical school. He studied for **long hours but kept little**.

Before every exam, he would reread his notes, mark the key lines and watch revision videos. He kept scoring **in the bottom third of his class**.



Sam rereads his notes and marks the key lines before an exam.

In his third year, a professor said something in passing in a lecture. Testing yourself **helps you remember more** than reading again. Scientists call this the testing effect.

Sam looked it up. He spent **three days rebuilding the way he studied**. He used only active recall, which means testing yourself from memory. He used spaced repetition, reviewing after longer and longer gaps, with Anki. And he used Memory Palaces for pharmacology, the study of medicines.

His next exam score was **in the top 20% of his class**. The exam after that, he reached the top 10%. By his final year, he was scoring in the top 5% every time.

The material had not changed. Nor had the amount of studying. If anything, **it had gone down**.

What changed was **how well he took things in**. He also made retrieval practice, pulling facts back out of his head, a fixed habit. Sam had the same brains as his classmates. He had simply **learned how to remember**.

Sam's change was **the expected result** of using the right methods again and again. The research backs this up with figures. They should change how you approach every study session from now on.

Science Says: 50%	**After one week, students who tested themselves recalled 61% of a text. Students who reread it recalled 40%. That is about 50% more. (Roediger & Karpicke, 2006)**

This big gain comes down to **how fast we forget**. Our memory for new information drops fast at first, then more slowly. Picture a ball rolling down a steep hill onto flat ground. Scientists call this the forgetting curve.

Grasping it is **the single most important shift in thinking** any learner can make. Forgetting starts out steep. Ordinary study habits fight it with almost no chance of winning.

Put simply, **testing yourself beats rereading**. It works like a stiff drawer that slides more easily each time you open it. Each time you pull a memory back out, the next pull gets easier. After one week, testing yourself gives about 50% more recall than rereading (Roediger & Karpicke, 2006).

Sam made this switch to **pulling facts back out of his head**, and his scores climbed.

That is a real edge. It comes from **a single decision**. You choose to pull the facts back out of your head, and you skip the rereading.

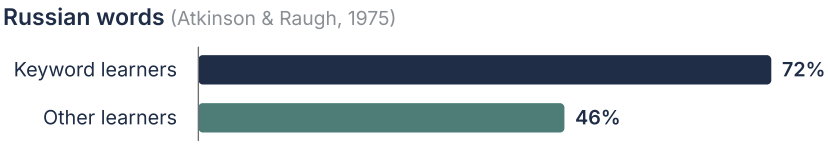
Key idea:

After one week, testing yourself gives about 50% more recall than rereading.

Science Says: 2/3	Ebbinghaus tested himself on nonsense syllables, made-up sounds with no meaning. After about a day, he had lost about two-thirds of what he had learned. He measured this by how much faster he could relearn them. Spaced practice works better than cramming. The best gap grows with how long you need to remember. (Ebbinghaus, 1885; Murre & Dros, 2015; Cepeda et al., 2006)

Fast forgetting is the default every learner is born with unless they act. Each method ahead is, in its own way, a planned attack on that default. Each one turns what would fade into lasting knowledge you can get back, in four areas of life.

- This holds at school and university. Students who test themselves remember more than students who reread.
- Learning at work follows the same rule. Some workers keep what they learned from every training, conference and book. Their knowledge keeps growing. A worker who forgets most of every lesson does not.
- Language learning gains too. The Keyword Method helps with new words. In one study of Russian words, keyword learners scored 72% and other learners 46% (Atkinson & Raugh, 1975).
- Skill learning depends on memory as well. Memory for steps, technique and the rules behind them separates able people from true experts. Every skill is, at its deepest level, a memory.



The Keyword Method helps with new words.

Quick check:

1. After one week, how much did students who tested themselves recall, compared with students who reread? Answer: 61% against 40%, about 50% more.
2. How much of the differences in performance did practice explain? Answer: About 12% (Macnamara, Hambrick & Oswald, 2014).
3. How did keyword learners do on Russian words? Answer: They scored 72%, and other learners 46% (Atkinson & Raugh, 1975).

WHY #4 Your Brain Health: Some Training Gains Last for Years

YOUR BRAIN AT 75 is shaped by **the thinking habits you build today**. I mean that as a real claim about the brain. It is more than a figure of speech.

Over a lifetime, the brain builds up **a store of strength against decline**, a bit like savings in a bank. Scientists call this cognitive reserve. The idea is well established, yet the proof comes mostly from watching how people live, and less from trials (Stern, 2012). Memory training **may be one way to build it**.

Cognitive reserve

The idea		What it is like
A store of strength against decline	≈	Savings in a bank

The brain builds it up over a lifetime.

> **Science Says:**
>
> The ACTIVE trial tested **brain training in older adults**. Chance decided who got which training, like pulling names from a hat. Scientists call this a randomised trial. At the time, it was the largest of its kind, and it followed 2,832 people aged 65 and over.

The 5-year results came first (Willis et al., 2006). The 10-year results came in 2014 (Rebok et al., 2014). **Reasoning and speed training kept their effects** on the skills they trained.

Memory training did not. At 10 years, **its effect on memory had faded**. All three trained groups still said daily tasks felt less hard.

Key idea:

Reasoning and speed training kept their effects. At 10 years, memory training's effect on memory had faded.

These results come from careful, controlled research. One story cannot prove them, but it can show **what is at stake**.

Think about what this means for someone who has watched their memory slip. They may have assumed **the decline could not be stopped**.

Could decline be stopped?

What they may have assumed	The ACTIVE trial
The decline could not be stopped	Reasoning and speed gains lasted 10 years

One story cannot prove this.

Meet Eleanor, 67, a retired headteacher. Eleanor had watched **her mother's memory decline** in her late 60s. In her 70s, it fell faster.

By 78, her mother did not always know who she was. Eleanor lived with **the fear that the same thing awaited her**.

At 65, a friend who was a neurologist, a doctor for the brain, gave her some advice. On that advice, Eleanor began **a planned brain training programme**.

She started with **15 minutes of brain training daily**, before breakfast. She added a Memory Palace for her grandchildren's lives. In it she kept track of their school events, their interests and their friends.

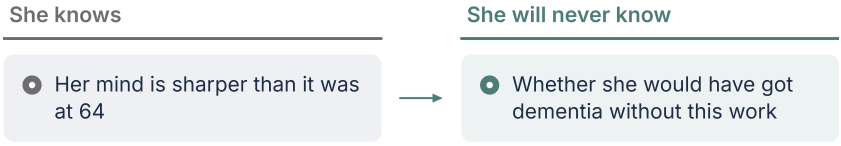


Eleanor does 15 minutes of brain training before breakfast.

She also learned **5 Spanish words a day**. At 67, her yearly thinking test put her well above average for her age.

Eleanor will never know whether she would have got dementia without this work. But she does know **her mind is sharper than it was at 64**.

What Eleanor knows and will never know



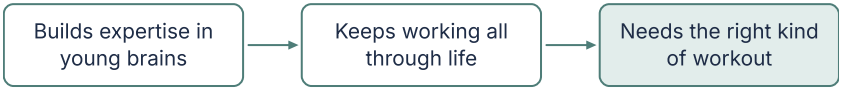
At 67, her yearly thinking test put her well above average for her age.

She has just signed up for an online course in Italian art history. She **remembers every lesson**.

Eleanor's story is **one person's experience**. In the ACTIVE trial, reasoning and speed gains lasted 10 years. Trained groups also reported less decline in daily tasks. Decline is **only a tendency**, and nobody has handed you a sentence the way a judge would.

The brain's ability to change **builds expertise in young brains**. That same ability keeps working all through life. It simply needs the right kind of workout to switch on.

The brain's ability to change



Decline is only a tendency, and nobody has handed you a sentence the way a judge would.

The case for memory training as **a way to protect your health** is still being tested. Four points show where it stands.

- Hippocampal neurogenesis means growing new neurons, or nerve cells, in the hippocampus. In adult humans, some studies find it and others do not (Boldrini et al., 2018; Sorrells et al., 2018). No human study shows that memory training causes it. The hippocampus is the brain region most easily hurt by decline as we age.
- Every new skill, language or memory system you build adds to your cognitive **reserve**. Cognitive reserve is the cushion that delays the start of dementia signs. It works even when disease is present in the brain.
- Some risk factors are things in a person's life that can be changed. In theory, removing all 14 of them could prevent or delay nearly half (about 45%) of dementia cases. That is the 2024 estimate of the Lancet Commission (Livingston et al., 2024). They include hearing loss and less schooling early in life. Memory training is not one of them.
- "Use it or lose it" is a popular saying. It fits the idea of cognitive reserve. But it is only a rule of thumb.

Where it stands

- New nerve cells in adults: some studies find them, others do not
- Every new skill adds to your cognitive reserve
- Risk factors that can be changed: about 45% of dementia cases (2024)
- 'Use it or lose it': only a rule of thumb

The case for memory training as a way to protect your health is still being tested.

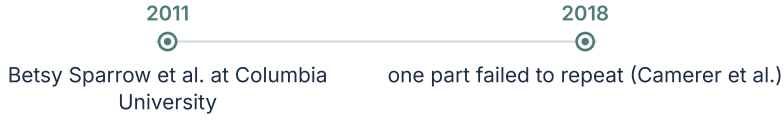
> **Key Concept:**
> The Smartphone Memory Transfer. Every time you use your phone as **an outside memory**, you are making a choice. You might be storing a name, a number, a task or a place.

One choice like that does no harm on its own. Now add up thousands of such choices over years. You are **training your brain to forget**.

Betsy Sparrow et al. (2011) at Columbia University showed something about **how people take in information**. People recalled facts less well when they expected those facts to be saved. But they remembered better where the facts were saved. Their memory worked like knowing which library shelf holds a book while forgetting what the book says.

The researchers called this **the "Google Effect"**. One part of the study later failed when others tried to repeat it (Camerer et al., 2018).

The Google Effect



The researchers called this the Google Effect.

The lesson here is to **use your memory on purpose**. Let your memory and your technology work side by side, like two members of the same team.

Memory training works alongside your smartphone. It keeps **key information safe** from a phone that is lost, stolen or switched off.

These findings make a key point. **Your own memory still matters**, even with a phone in your pocket.

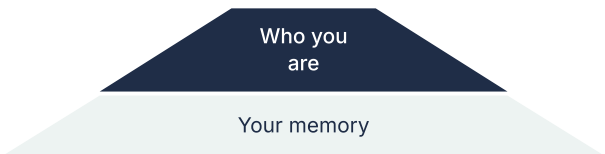
Quick check:

1. In the ACTIVE **trial**, which training had lost its effect on memory at 10 years? Answer: Memory training. Reasoning and speed training kept their effects.
2. How many people did the ACTIVE trial follow? Answer: 2,832 people aged 65 and over.
3. In the Google Effect study, what did people remember better? Answer: Where the facts were saved.

WHY #5 Your Identity: You Are the Sum of What You Remember

Of all the reasons to train your memory, this one is **the most personal**. It is also the deepest one. Your memory shapes who you are. In fact, **your memory is who you are**.

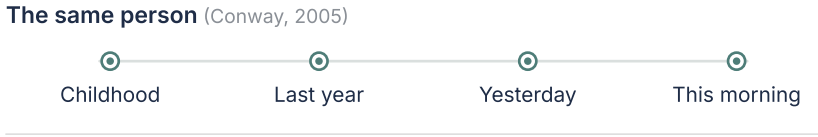
Your memory is who you are



Of all the reasons to train your memory, this one is the most personal.

You sense that the you of this morning is **the same person who lived yesterday**. The same goes for last year, and for childhood. One view holds that this unbroken self is built from memory (Conway, 2005).

Strip memory away, and you lose more than information. You lose **the story of who you are**.



One view holds that this unbroken self is built from memory.

"In the end, we are the sum of our choices. But we can only make choices about what we remember we have. A person who cannot remember has nothing to choose from."

This is why people with advanced dementia are described as **"not themselves"**. Their personality is still there. The memory that brought that personality to life has become **out of reach**, like a room whose door is locked.

Key idea:

Your memory is who you are. Strip memory away, and you lose the story of who you are.

It also explains why very different people reached **the same conclusion**. Stoics, ancient Greeks, medieval scholars and modern memory champions all reached it. To train the memory is **to build the self**.

Meet James, 51, and the life he almost forgot. James was 48 when his father died. At the funeral, he tried to speak, but he could **barely recall specific memories**.

He felt the full weight of a lifetime with his father. But **the details had blurred**. He could not remember a single conversation from his teenage years.

He could not remember the last birthday they had celebrated together. The details **were gone**.

The details were gone

What he felt	What he could recall
The full weight of a lifetime with his father	He could not remember a single conversation from his teenage years He could not remember the last birthday they had celebrated together

He wept for the version of his father he had already lost.

He wept for his father. He also wept for **the version of his father he had already lost**, the father he once knew in sharp detail. That was before James started treating memory as something he could skip.

James began memory training two months after the funeral. His career and his health had nothing to do with it. He did it **for his children**.

Why James began

	Part in his choice
His career	Nothing to do with it
His health	Nothing to do with it
His children	He did it for them

James began memory training two months after the funeral.

He started **taking everything into memory on purpose**. He kept conversations, moments, and his children's exact words at certain ages. He kept the way his daughter laughed on one particular Sunday morning.

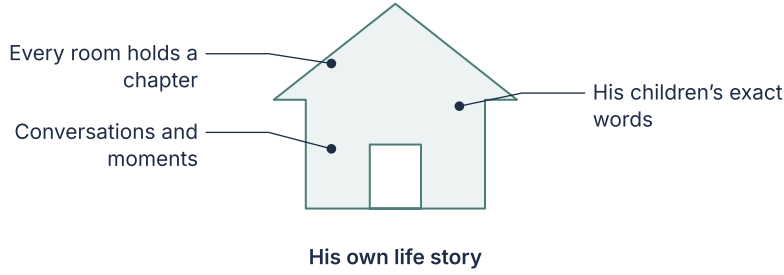


James hears his daughter laugh on a Sunday morning and keeps the moment.

He started **a 'Life Palace'**. This was a Memory Palace of his own life story, like a house where every room holds a chapter. He rebuilt it and filled it out with every technique in this training.

He told a friend about it. 'I am building the memories I want to have access to when I am 80. I am **saving my own life** in a format I can actually find later.'

A 'Life Palace'

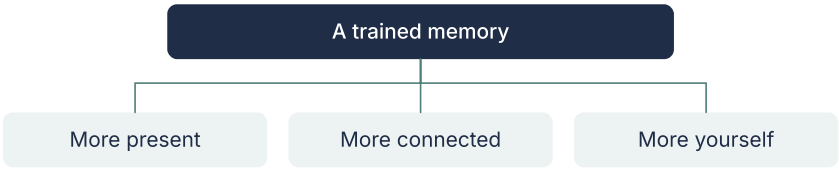


He is saving his own life in a format he can actually find later.

A trained memory makes you more than quicker at things. It makes you **more present**. You know that what is happening right now is worth taking in properly.

It makes you **more connected**, because the people around you feel remembered, and so they feel valued. It makes you **more yourself**. You can reach the moments that make you who you are, more fully and more easily.

A trained memory makes you



It makes you more connected, because the people around you feel remembered, and so they feel valued.

Quick check:

1. In one view, what is the unbroken self built from? Answer: Memory (Conway, 2005).
2. Why did James start memory training? Answer: He did it for his children. His career and his health had nothing to do with it.

The Case In Numbers: The Return on Your Memory Investment

Over the coming weeks, you will put **about 24-36 hours** into this training. That is real time. That time aims to change the following parts of your life.

Life Area	Without Training	With Training	The Difference
Study / Learning	Rereads notes and forgets much of them	Tests themselves and spaces practice	Remembers more, for longer
Recall at work	Forgets points from meetings	Keeps key points, names and promises	Stronger work relationships
Language learning	Learns new words slowly and loses many	Uses memory methods for new words	Learns new words more easily
Presentations	Depends on notes; loses eye contact	Speaks from memory; fully there	Comes across as better prepared
Brain health	No planned mental workout	Regular mental workout	May help build cognitive reserve; no proven delay in decline
Relationships	Ordinary depth of connection	Remembers details, so people feel they count	Deeper trust; stronger bonds

For me, there is no doubt that memory training is worth it. In my view, it is **one of the best thinking investments** a person can make.

The only question left is **whether you will make it on purpose**. The other path is to spend the rest of your life forgetting things that mattered.

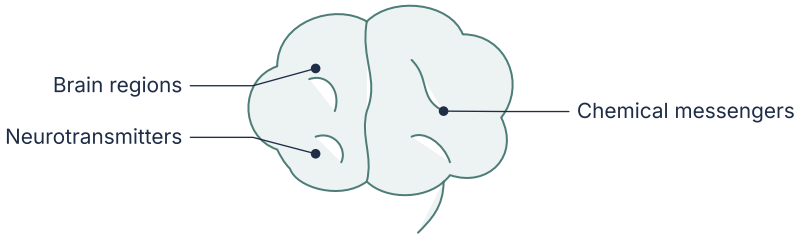
Key idea:

In my view, memory training is one of the best thinking investments a person can make. The only question is whether you will make it on purpose.

Module 1 has **seven goals**. You will work toward all of them, one section at a time, from the ancient world to the brain's chemistry.

- See how ancient peoples built memory techniques that are still used today
- Meet history's greatest memory stars, and learn how they did it
- Say clearly what memory is and how it helps you think
- Tell apart sensory, short-term and long-term memory
- Understand the brain science of encoding (getting a memory in), storage (keeping it) and retrieval (getting it back)
- Name the brain regions and neurotransmitters, the brain's chemical messengers, that are central to memory
- See what memory illnesses do, and what they teach us about good habits

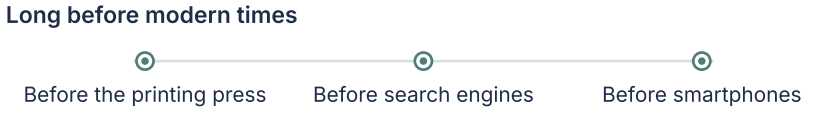
Central to memory



The brain

1.1 Chronicles of Memory

People were training their memory **long before modern times**. They valued it long before smartphones and search engines. They valued it even before the printing press. They saw that keeping facts and calling them back up was **the base of being smart, of culture and of staying alive**.



People were training their memory long before modern times.

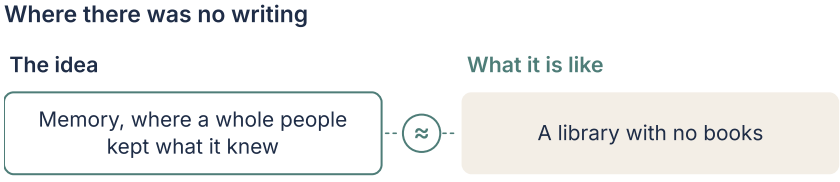
Every great nation of the past built, improved and passed down its own memory tricks. The tricks are **so neat and simple** that scientists who study the mind still find they work today. “Memory is the treasury and guardian of all things.” (Cicero, De Oratore)

Key idea:

Keeping facts and calling them back up was the base of being smart, of culture and of staying alive.

Ancient peoples cared about memory **out of need more than feeling**. It was practical. Where there was no writing, memory was where a

whole people kept what it knew, like a library with no books. That history leads me to the people whose memory **reached its highest form**.



Ancient peoples cared about memory out of need more than feeling.

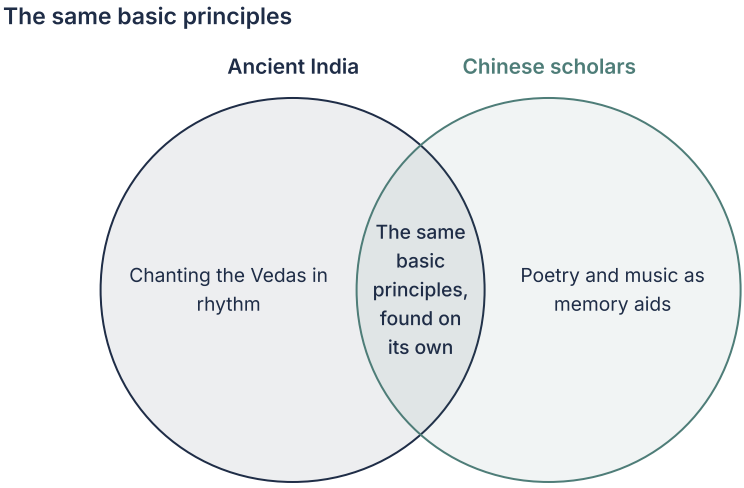
1.1.1 Memory Development Techniques in Ancient Cultures

SEVEN GREAT PEOPLES OF the past show **what people knew about the mind** long ago. They also show what we can borrow from their brilliance.

Civilisation	Purpose of Memory Development	Techniques & Achievements
Ancient Egypt	Keep sacred knowledge and the culture's past safe	Repeating sacred texts; studying hieroglyphs (picture writing); ritual meditation; picture symbols as memory anchors.
Ancient Greece	Speech-making, philosophy and formal schooling	The Method of Loci (the Memory Palace method, using places as a frame for memory); linking ideas to real places; speaking aloud in public. Simonides of Ceos is credited as its inventor.
Ancient India	Spiritual awakening and mastery of oneself	Repeating mantras; picturing mandalas; chanting the Vedas in rhythm (the Rigveda has about 10,552 verses). Passing knowledge on by mouth kept it alive for thousands of years.
China	Keep Confucian teachings and social order safe	Memory links (mnemonics); poetry and music as memory aids; sorting knowledge into levels, from big groups to small ones. The Imperial Examinations (from about 605 CE) demanded mastery of the Four Books and Five Classics.
Persia	Passing stories on by mouth and keeping the culture's tales safe	Chanting in rhythm; telling long epic stories; the Zoroastrian Avesta memorised by priests. Ferdowsi's Shahnameh (about 50,000–60,000 couplets, finished around 1010 CE) had reciters at Mahmud of Ghazni's court. Later came Safavid court reciters and coffeehouse storytellers, called naqqali (Yamamoto, 2021).
Ancient Rome	Speech-making, law, politics and schooling	Took over the Greek Method of Loci and built on it; learned law and history by heart through repetition. Roman speakers gave hours-long speeches from memory.
Mesopotamia	Running the state and religious practice	Cuneiform (wedge-shaped writing) as a frame to hang memories on; learning law codes and epics by heart, out loud.

The tricks vary a lot. Even more striking, **the same basic principles show up again and again**. They popped up on their own in several traditions, such as India and China.

Chinese scholars mastered the Four Books and Five Classics for the Imperial Examinations. Each culture **found the same thing on its own**.

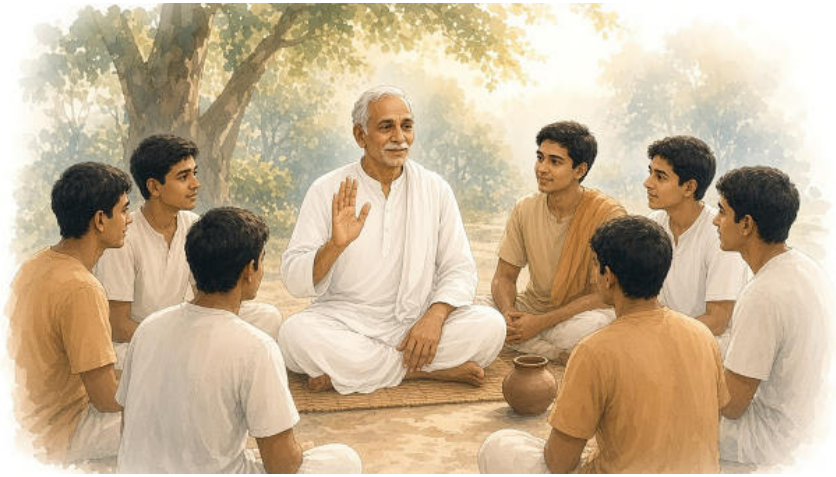


Chinese scholars mastered the Four Books and Five Classics for the Imperial Examinations.

The human brain works best when it gets **structure, rhythm, images and emotional meaning**. That is brain science at work, thousands of years before the word “neuroscience” existed. Neuroscience is the science of the brain.

The Indian tradition of passing texts on by mouth is a striking example. The Rigveda is **one of the oldest known texts** in any Indo-European language.

For hundreds of generations, people passed it on by mouth, almost perfectly, with nothing written down. It travelled through **a careful system** of chanting, saying lines in rhythm and students checking each other.



People chant ancient verses together, passing them on without writing.

Trained memory passed these texts on **with very few mistakes** (UNESCO). It may often have been truer to the original than early written copies. With the right methods, the brain proved **a very reliable place to keep knowledge**.

Across the ancient world, the same pattern repeated. Ancient Greece had a strong tradition of public speaking. Its speakers could **talk for hours without a single note**.

Cicero called memory "the treasury and guardian of all things". He meant it plainly. He was describing **real life in a world without paper**.

A person's worth in public life rested entirely on **what they could hold in their head**. The Method of Loci was their answer. It is the Memory Palace you will master later.

One study combined 13 trials of this method, where chance decided who used it. The method helped by **a medium-to-large amount** ($g = 0.65$). But most of the studies had **a high risk of bias**, meaning their

design could tilt the results (Twomey & Kroneisen, 2021). A biased study is a bit like a race where some runners start a step ahead.

> **Science Says:**
>
> Ancient Greek speakers first described the Method of Loci. Top memorisers using it show **the hippocampus and nearby areas at work** on brain scans (Maguire et al., 2003). The hippocampus is the brain's centre for finding your way through space, like a map inside your head.



Top memorisers using the Method of Loci show it at work (Maguire et al., 2003).

The ancient users of the method had no scans. Your brain is literally **designed to use space as a frame for memory**. Each place works like a hook on a coat rack, holding one thing for you to pick up later.

The people who invented these methods knew nothing of how the hippocampus stores memories. They knew nothing of **the brain's systems for seeing and space** either.

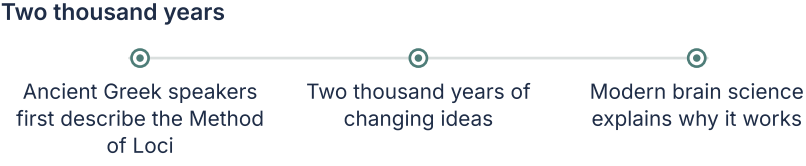
They found the principles **by trying things and watching the results**. And their methods still work.

Key idea:

They found the principles by trying things and watching the results. And their methods still work.

> **Key Concept:**
>
> Why Ancient Techniques Still Work. These methods have survived for a reason. They use **the brain's deepest built-in strengths**. Those strengths are memory for places, spotting patterns, strong feelings and the power of doing things again.

Modern brain science has explained **why these methods work so well**. The methods themselves are still the same ones.



Modern brain science has explained why these methods work so well.

They have lasted through two thousand years of changing ideas, and chance cannot explain that. It is **the fingerprint of a discovery**. Without knowing it, people matched the deep design of human memory.

Quick check:

1. How many trials of the Method of Loci did one study combine, and how much did the method help? Answer: 13 trials, with a medium-to-large benefit (g = 0.65), though most had a high risk of bias.
2. What do brain scans show in top memorisers using the Method of Loci? Answer: The hippocampus and nearby areas at work (Maguire et al., 2003).

1.1.2 People With Rare Memory Powers

Some people in history have had **extraordinary memories**. Scientists studied them. The public was gripped, and over the years legends grew up around these few people and the strange things they could do.

What they could do is hard to believe. Even bigger is what their abilities reveal. They show **the potential hidden inside every human mind**.

Where the feats came from

	Where it came from
Kim Peek	A rare brain condition
Several others	Planned, step-by-step practice

Their stories carry an important message for the rest of us.

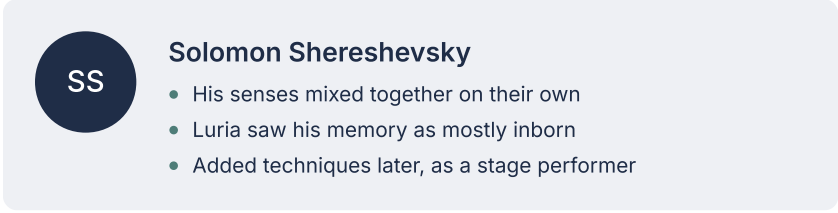
Name	Era	Key Method/Trait	What They Did
Solomon Shereshevsky	Russian journalist, died 1958 (birth year disputed)	Synesthesia, where the senses mix. Each number or word set off its own feeling in his senses	Luria reported that he recalled long lists years later. He once recalled a formula 15 years after seeing it a single time.
Kim Peek	American savant (a person with one rare, outstanding skill), 1951–2009	Born without the corpus callosum, the band joining the brain's two halves; reportedly read two pages at once (one per eye)	Reportedly memorised over 12,000 books. Inspired the film Rain Man.
Joshua Foer	Present-day USA	Steady, daily Method of Loci practice; bright, clear pictures in his head	Won the 2006 USA Memory Championship after a year of training (Foer, 2011); shows that extreme memory can be trained.
Nikola Tesla	Serbian-American inventor, 1856–1943	By his own account (My Inventions, 1919), designed entire machines in his mind	Said he ran all his test runs in his head before building anything.
Lu Chao	Chinese student	An image for each digit pair from 00 to 99, linked into stories (Hu et al., 2009)	Recited Pi to 67,890 decimal places from memory in 2005. It was a world record at the time.
Giordano Bruno	Italian philosopher, 1548–1600	The Renaissance 'Art of Memory'; complex memory systems built from symbols	Built whole systems of ideas inside his memory.

The people above stand at **the outer edges of what human memory can hold**. But their stories carry an important message for the rest of us. Kim Peek's abilities came from a rare brain condition. Several others built their feats through **planned, step-by-step practice**.

Solomon Shereshevsky's senses mixed together on their own. Each word or number came with a feeling in his senses. Luria saw his memory as

mostly inborn. He added techniques later, as a stage performer (Luria, 1968).

Solomon Shereshevsky



Each word or number came with a feeling in his senses (Luria, 1968).

Lu Chao recited **67,890 digits of Pi** in 2005. It was a world record then.

Nikola Tesla is **a very useful case**. As a child, Tesla reportedly suffered from strong hallucinations that came without his asking. These were sharp, lifelike pictures in his head that he could not control. He did not push this ability away.

He **learned to direct it**. As an adult, he said, he could design entire electrical systems in his mind. He ran them at full speed and even spotted wear. All this came before he touched a single real part. His mind worked like a flight simulator, where a plane is tested before it ever leaves the ground.



Nikola Tesla pictures a whole electrical machine running in his mind.

His “laboratory of the mind” was **a skill he practised**, more than a gift. The picturing techniques taught later grow from this same ability. Mental imagery means the pictures you make in your head. A review suggests that it **can be shaped or trained** (Pearson et al., 2015, Trends in Cognitive Sciences).

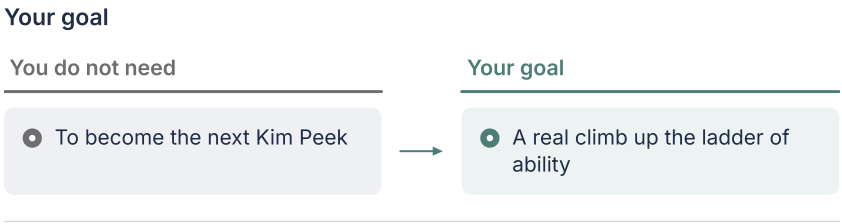
Nikola Tesla

As a child	As an adult
Strong hallucinations he could not control	Designed entire electrical systems in his mind Ran them at full speed and spotted wear

He did not push this ability away; he learned to direct it.

Memory stars teach us **what is possible**. Their lesson does not shut anyone out. Their lives show what human memory is built to do.

You do not need to become the next Kim Peek. Your goal is to **climb a real way up the ladder** of ability.



Memory stars teach us what is possible.

Anyone can make that climb by using **the right methods, steadily enough**. Every technique in this training was once the private edge of someone extraordinary.

Key idea:

With the right methods and regular practice, you make a real climb up the ladder of ability.

> **Key Concept:**
>
> The Core Lesson from Memory Prodigies
>
> Apart from rare cases like Kim Peek and Shereshevsky, many top memory achievers used methods. Those methods can be learned and taught. You are about to learn them.

The meaning is clear at once. Suppose extraordinary memory is **a learned skill**, built by practice. Then the question changes from whether you can build it to **how you will**. Learning how memory works is where that work begins.

Where the work begins



Quick check:

1. How many digits of Pi did Lu Chao recite in 2005? Answer: 67,890. It was a world record then.
2. Can mental imagery be trained? Answer: A review suggests that it can be shaped or trained (Pearson et al., 2015).

1.2 Understanding Memory

1.2.1 Definition and Importance of Memory

MEMORY IS THE THINKING ability to **take in, keep and bring back information and experiences**. That definition carries real, everyday weight. To see it, I start with what poor memory habits actually cost when you add them up across many people.

Memory

> Definition
>
> ### Memory
>
> The ability to take in, keep and bring back information and experiences.

That definition carries real, everyday weight.

This dry definition barely scratches the surface of **what memory means for human life**. Memory is who we are. Without it, we cannot recognise the people we love or keep up relationships. We cannot even know who we are from moment to moment.

Memory is **intelligence**. Without it, we cannot learn, reason or solve problems. Memory is also survival. Without it, we cannot remember danger, find our way around, or build on what we have lived through.

Science Says: 84%	of college students in one survey said they reread to study. Only 11% said they tested themselves. Yet a major review rated rereading low and self-testing high. (Karpicke, Butler & Roediger, 2009; Dunlosky et al., 2013)

That gap is **a mostly invisible waste** in how people learn. Better techniques can help, but they will not fix everything (Dunlosky et al., 2013).

Science Says: 50%	Students who tested themselves remembered about 50% more after one week than students who reread. (Roediger & Karpicke, 2006) Same material, same study time. The only thing that changed is the method.

What is memory, really, beyond what it produces? I mean **what it stands for in a human life**. That question has busied the greatest minds of every age. Their answers turn out to fit the science better than they might seem.

> 🔑 **Key Concept:**
>
> Three Philosophers on Memory. Aristotle saw memory as **the ability to hold an image of experience and revisit it**. For him, it was the foundation of knowledge.

Plato believed **all learning is recollection**, remembering what you once knew, because knowledge already exists in the soul. St. Augustine wrote about memory in his Confessions (X.8). He spoke of 'the fields and spacious palaces of my memory'. Together, they made memory the cornerstone of human awareness.

Philosophy sensed early what brain science has confirmed. Memory is **an active system**, far from a tape recorder that just sits there. It builds what we remember, and it can be trained. It decides the quality of everything built on top of it.

Philosophy and brain science



It builds what we remember, and it can be trained.

The research makes this worth taking seriously. Dunlosky and colleagues (2013) found that many students lean on **weak techniques**. In their words, these "do not consistently boost students' performance". Some of the best techniques go unused.

Many students who struggle may have **nothing wrong with their minds**. They may just be missing the right strategies. They sit in lectures, colour their textbooks with markers and reread their notes.

They believe that seeing facts is the same as learning them, and they are wrong. **Seeing facts without working on them** does much less for memory.

The philosophers' ideas and the scientists' data point to the same conclusion. **We actively build our memories**, the way you build a model from a kit.

Aristotle saw memory as revisiting a held image on purpose. That idea already points to something modern science studies. We **reach for a memory in our head** and skip the passive rereading.

Revisiting on purpose



We actively build our memories, the way you build a model from a kit.

That act of reaching makes **the trace the memory leaves in the brain** much stronger. It works like tracing over a faint pencil line until it turns dark. Scientists call it retrieval practice.

Think about what this means for real study. Two students study **the same material for the same amount of time**. One rereads their notes three times.

The other reads once and **puts the notes away**. Then they try to rebuild everything from memory, checking afterwards and fixing mistakes.



One student rereads notes. The other closes them and writes from memory.

Roediger and Karpicke (2006) ran a study published in Psychological Science. They found that the second student keeps **about 50% more material after one week**. The gap widens over time. Effort builds memory. Just seeing things does not.

So **put the notes away** and rebuild from memory, then check and fix your mistakes.

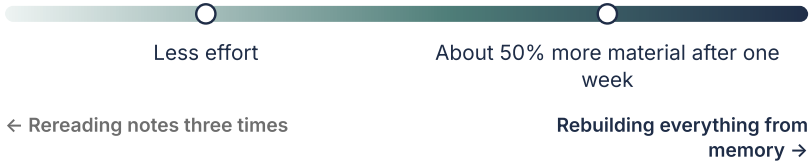
The modern science of the mind has backed up and added to these old ideas. It did so through the work of Baddeley, Tulving and others, with careful experiments. Memory involves **three core steps**.

- First, the brain turns what our senses pick up into a pattern in nerve cells, like pressing a shape into clay. That pattern can be stored. This is called **encoding**.
- Next, the brain keeps that pattern over time. It does this by settling it in and going over it. This is called **storage**.
- Last, the brain reaches the stored pattern and rebuilds it when needed. This is called **retrieval**.

Key idea:

Memory = encoding + storage + retrieval.

Effort builds memory



Roediger and Karpicke (2006).

Before building any skill, you need **an honest starting point**. Exercise 1.1 shows where your memory stands right now.

It is the exact starting point for measuring your growth, with **no grade attached**. Do it without rereading or checking notes. The only useful result is the one done without help.

> **Exercise:**
> 1.1, Your Memory Baseline. Follow these four steps.

1. Write down everything you can remember about what you ate yesterday. Include every meal, snack and drink, in order.
2. Next, write down the names of every teacher you had in primary school.
3. Finally, recall the last three phone numbers you dialled (without looking).
4. Think back. Which was easiest? Which was hardest? Why? Keep this baseline, because you will come back to it later.



Finally, recall the last three phone numbers you dialled (without looking).

This baseline exercise teaches more than it might seem to at first. Most people find that **yesterday's meals are fairly easy to reach**. These memories are tied to a running story of time and place.

Memories of events from our own life like these are called **episodic memories**. Phone numbers are different. They are pure facts, with no story to hold them, no pull on your feelings and no picture to anchor them.

Meals and phone numbers

	Yesterday's meals	Phone numbers
Held by	A running story of time and place	No story, no pull on your feelings, no picture

Memories of events from our own life are called episodic memories.

Phone numbers **vanish from short-term memory within seconds** unless we go over them on purpose. Most of us never do, because our phones do it for us.

Leaning on memory outside our heads is **a hidden thinking cost of the digital age**. We store information outside the brain, in our phones and other tools. It is like handing your shopping list to a friend to carry. Scientists call this "cognitive offloading".

Sparrow, Liu, and Wegner (2011) published research in Science. People recalled facts **less well when they expected them to be saved**. The study tested that expectation. It did not test habits over time. Part of it later failed when others tried to repeat it (Camerer et al., 2018).



It did not test habits over time.

Quick check:

1. Why are yesterday's meals easier to recall than phone numbers? Answer: Meals are tied to a running story of time and place. Phone numbers are pure facts, with no story to hold them.
2. After one week, how much more did the self-testing student keep? Answer: About 50% more material, and the gap widens over time.
3. What did Dunlosky and colleagues (2013) find about how students study? Answer: Many lean on weak techniques, and some of the best techniques go unused.

1.2.2 Types of Memory

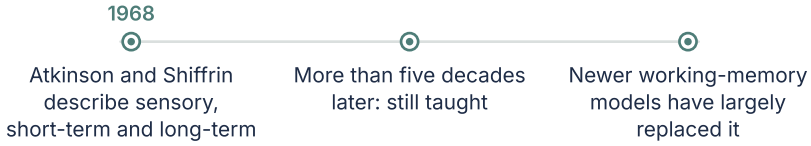
Memory is **a whole web of linked processes** working together, like the different parts of a kitchen. Each process has its own rules, limits and weak spots. Understanding this design is **the first step to making the most of it**.

Type	Duration	How Much It Holds	Key Features	Everyday Example
Sensory Memory	A fraction of a second	Very large (but almost all of it is thrown away)	The 'snapshot' holding space. Iconic memory (for sight) lasts ~0.5 sec; echoic memory (for sound) lasts ~2–4 sec.	You see a word flash on screen. Your brain briefly holds the image even after it disappears.
Short-Term Memory (STM)	20–30 seconds (without going over it)	About 4 chunks (Cowan, 2001); older estimate 7 ± 2 items (Miller, 1956)	Active, fragile, easily knocked out. The doorway to long-term memory. Not the same as working memory, which also works on what it holds (Baddeley & Hitch, 1974).	Holding a phone number in mind while you walk to another room to dial it.
Long-Term Memory (LTM)	Hours to a lifetime	Effectively unlimited	Includes explicit (declarative) and implicit (non-declarative) memory. Needs consolidation, a settling-in over time.	Remembering your childhood home, how to ride a bicycle, or the rules of grammar.

At first glance, this may look like a dry list of labels. Memory has **three levels**, which are sensory, short-term and long-term. Atkinson and Shiffrin first described them in a careful way in 1968.

Their model is **still taught more than five decades later**. But newer working-memory models have largely replaced it.

A model of three levels



Atkinson and Shiffrin first described them in a careful way in 1968.

Think about the last time you met someone new at a party. You heard their name. Your sensory memory caught it, and **almost at once it began to fade**. Sensory memory works like the glowing trail a sparkler leaves in the dark, there for a blink and then gone.

Without paying attention on purpose and going over it, **that name was gone within 20 seconds**. Yet you probably still remember the face, the handshake and the tone of voice. Why?



At a party, you shake a stranger's hand and hear their name.

Those sense impressions carried **weight from your feelings, or from the setting**. Your brain flagged them as worth keeping. The name, a string of random sounds, had no such flag.

This is why simply being told information is **almost never enough** for reliable long-term memory. Something must make it meaningful, connected or important to your feelings.

What happened at the party is a small copy of a bigger challenge. Long-term memory works on **rules that seem odd next to digital storage**.

A hard drive stores all data in the same way. The brain stores memories **by meaning, by links and by how much they matter to your feelings**.

Storing memories

	A hard drive	The brain
Stores	All data in the same way	By meaning, by links and by feelings

Long-term memory works on rules that seem odd next to digital storage.

New information that fits with what we already know **settles in faster**. It is also easier to bring back. This is why experts learn new material in their field far faster than beginners. They have more associative hooks, meaning **more links to what they already know**.

Think of these links as **hooks and paths back to a memory**. The techniques taught later build a rich network of these links. That uses this design directly.

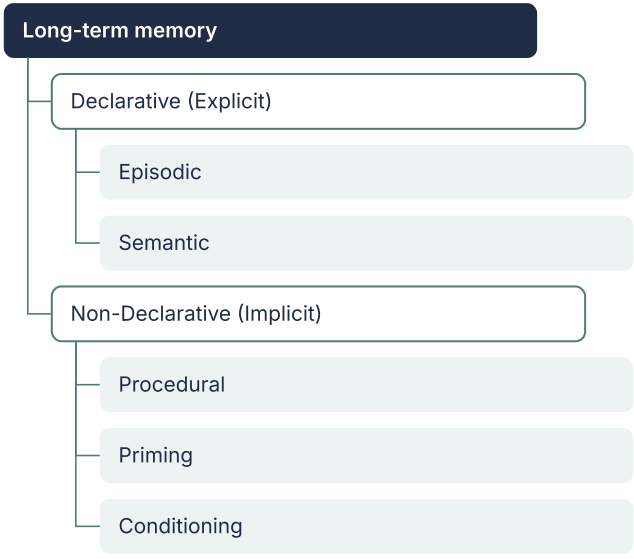
Long-Term Memory: A Closer Look

Long-term memory is **the most important of the three levels**. This training sets out to develop it. It has its own inner design. It splits into **two broad families**, and each family runs on different brain systems.

- Declarative (Explicit) Memory. These are memories we can reach on purpose and describe.
- Episodic Memory. These are personal experiences and events ('I remember my first day of school').
- Semantic Memory. This is general world knowledge and facts ('Paris is the capital of France').
- Non-Declarative (Implicit) Memory. These are memories that shape behaviour without us knowing we are remembering.
- Procedural Memory. These are body skills and habits ('how to drive a car', 'how to type').

- Priming. Seeing or hearing one thing changes how you react to a related thing.
- Conditioning. These are learned emotional and behavioural responses.

Two broad families



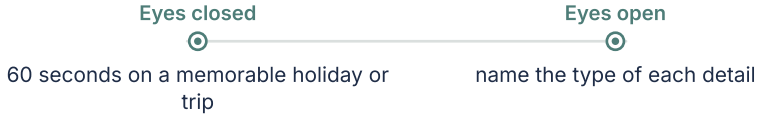
Each family runs on different brain systems.

With all the memory types mapped, it is worth seeing **how they show up in ordinary life**. They often show up at the same time. Exercise 1.2 puts several types side by side. All of them come from **a single, unbroken slice of your own recent life**.

> **Exercise:**
> 1.2, Memory Taxonomy Walk. Follow these four steps.

1. Close your eyes. Spend 60 seconds recalling the details of a memorable holiday or trip.
2. Open your eyes and name the type of memory each detail is. Is it episodic, semantic or procedural?
3. Notice how your memories of that event mix several types at the same time.
4. Write three sentences describing a skill you have that is now 'automatic'. This is procedural memory in action.

Memory Taxonomy Walk



Is it episodic, semantic or procedural?

You likely noticed the memory types **blending together** in the exercise. This is one of the most important insights in the science of the mind. We rarely use **a single type of memory** on its own.

When you recall a holiday, you use several types at once. Episodic memory holds **the events and their order**. Semantic memory holds the names of places and what you know about the culture.

Procedural memory holds **how you drove or found your way**. Emotional memory holds the feelings that coloured every moment. These types **work as a team**, each one helping the others.

That is why the best memory systems **store things in many layers**. **Spare copies** are the brain's best defence against forgetting, like a spare house key left with a neighbour. Scientists call this redundancy.

Each extra layer of encoding adds one more hook and path back to a memory. Any one of them can **bring back the whole memory**.

Some facts are stored only as **a bare statement**. One example is "the Battle of Hastings was in 1066". Such a fact is kept poorly.

Put the same fact inside a bright, lively story instead. Give it pictures, an emotional hook and a place in a Memory Palace. It is then **kept far more firmly**. It is stored across several systems at once.



Put the same fact inside a bright, lively story instead.

So give each fact you need **several layers**, such as pictures, a feeling, a story or a place.

Key idea:

More layers of encoding give more hooks and paths back to a memory.

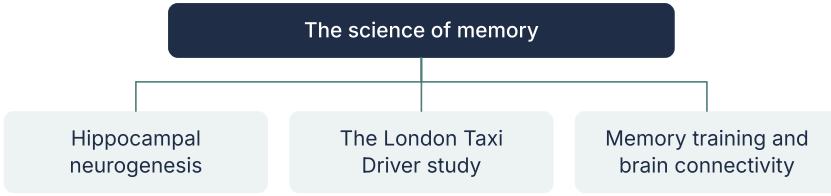
Quick check:

1. Why did the name fade at the party while the face stayed? Answer: The face, the handshake and the tone of voice carried weight from your feelings or the setting. The name had no such flag.
2. What are the three levels of memory? Answer: Sensory, short-term and long-term.
3. Which kind of memory holds body skills such as typing? Answer: Procedural memory.

1.3 The Science of Memory

Ancient techniques and the many types of memory all rest on **a foundation of neuroscience**, the science of the brain. This is far more than background. Three findings matter most. They shape **how you train, review and protect your memory** for life.

Three findings



Three findings matter most.

> **Science Says:**
>
> The first finding is Hippocampal neurogenesis and memory (Eriksson et al., 1998, *Nature Medicine*; Kempermann et al., 2018, *Cell Stem Cell*). For a century, brain scientists held that **the adult brain could not grow new cells**. This finding overturned that.

The human hippocampus, a brain area key to memory, **may make new nerve cells** throughout adult life. Scientists call this adult neurogenesis.

Some research points to it playing a part in forming episodic memories, the memories of our own life events. In humans, this is **still debated** (Kempermann et al., 2018).

New cells in the adult brain

For a century, scientists held	This finding
The adult brain could not grow new cells	→ The hippocampus may make new nerve cells

Scientists call this adult neurogenesis.

Some activities **boost this growth** in the hippocampus. These are aerobic exercise (the kind that gets you out of breath), mental challenge, enough sleep and low long-term stress. They may support the body's tools for forming memories.

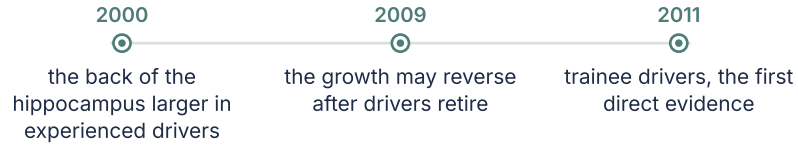
Other activities **hold the growth back**. These are long-term stress, lack of sleep, sitting still too much and too much alcohol.

The second finding is The London Taxi Driver study (Maguire et al., 2000, *PNAS*; Maguire et al., 2006, *Hippocampus*). London taxi drivers sit 'The Knowledge' examination. They must memorise **25,000 street names and 320 standard routes**. Eleanor Maguire scanned their brains.

She compared experienced drivers with similar people who were not drivers. **The back part of the hippocampus was clearly larger** in the experienced drivers. Its size grew with their years of experience.

In small early studies, the findings suggest the growth may reverse after drivers retire (Woollett, Spiers & Maguire, 2009). A later study followed trainee drivers over time (Woollett & Maguire, 2011). It gave **the first direct evidence that this training changes the brain**.

Taxi drivers' brains



Its size grew with their years of experience.

If so, changes **may last only with continued use**, like a path through grass that stays only if people keep walking it.

Key idea:

A study of trainee drivers gave the first direct evidence that this training changes the brain. If so, changes may last only with continued use.

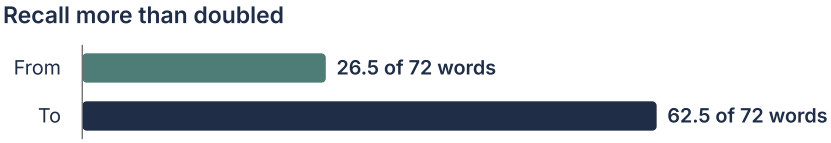
The third finding is Memory training and brain connectivity (Dresler et al., 2017, *Neuron*). This study compared 23 memory athletes with matched controls, people picked for comparison. Their **brain anatomy was the same**. The way their brain areas worked together was different.

In a separate part, 51 men new to memory training were put into three groups by chance. One group did **6 weeks of Memory Palace training**.

Afterwards, the trained group showed **clearly stronger links in two places**. One was the default mode network, brain areas that get busy when your mind wanders. They switch on a bit like a screensaver that appears when you stop typing. The other was the medial temporal lobe, the part of the brain that holds the hippocampus.

These are the circuits most used for taking in and bringing back episodic memories. Recall in this group **more than doubled**, from 26.5 to 62.5 of 72 words. Gains were still there 4 months later.

Memory Palace training **strengthens these circuits**. They support all kinds of complex episodic and semantic memory. Semantic memory is our memory for facts.



Gains were still there 4 months later.

Quick check:

1. After 6 weeks of Memory Palace training, how much did recall rise? Answer: From 26.5 to 62.5 of 72 words, and the gains were still there 4 months later.
2. How much must London taxi drivers memorise? Answer: 25,000 street names and 320 standard routes.
3. Is new cell growth in the adult human hippocampus settled? Answer: No. In humans, it is still debated (Kempermann et al., 2018).

1.3.1 Memory Processing: Encoding, Storage, Retrieval

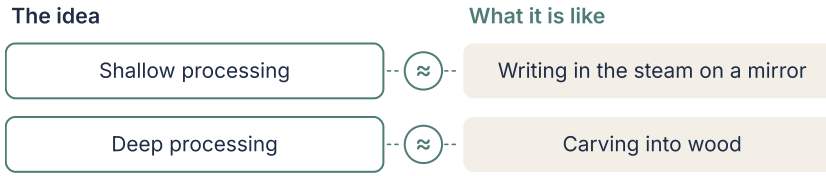
EVERY MEMORY YOU HAVE ever formed has passed through **the same three-stage pipeline**. It is like water through three pipes in a row. Knowing these stages shows **where memory succeeds or fails**. It also shows the points where we can push to improve.

Stage 1: Encoding (Getting It In)

First, the brain turns what our senses take in into **a form it can store**. That form is the language of nerve cells. This is called encoding. **Deep, good encoding** means a memory is stored firmly and comes back easily later.

The deeper you work with information, **the better you remember it**. Shallow processing works like writing in the steam on a mirror. Deep processing is like carving into wood.

Shallow and deep processing



The deeper you work with information, the better you remember it.

> **Science Says:**
> Craik & Lockhart (1972) proposed that 'depth of processing' predicts how well memory lasts. It means how deeply you work with information. Craik & Tulving (1975) later showed it in experiments. **Shallow processing**, such as noticing how a word looks, produces weak memories.

Deep processing, such as understanding meaning and making connections, produces strong, lasting ones. How you work with information counts far more than how often you reread it.

Craik and Lockhart's "levels of processing" idea changed how psychologists think about learning. **Their key insight** was simpler than it looks.

The mental work you do during encoding decides **how well you later remember** the information. This holds no matter how long you spend studying.

One student spends ten minutes really working out the meaning of an idea. That student will **remember it far better**. The other student spends an hour rereading the same paragraph without thinking about it. That student remembers less.

Two students

	Ten minutes	An hour
What they do	Really works out the meaning	Rereads without thinking about it
Result	Remembers it far better	Remembers less

The mental work you do during encoding decides how well you later remember.

So **work out the meaning** of each idea, and make connections. Do this before you reach for another reread.

Key idea:

How you work with information counts far more than how often you reread it. Deeper processing gives stronger, lasting memories.

Three things decide how deep encoding goes. The first one counts most. Attention is **the most important doorkeeper** of encoding. Even mild distraction during study can lower memory a great deal. That hits hard in a world of constant alerts and open-plan offices.

Every time you check your phone while studying, you **damage the quality of the memory trace** being formed. You lose more than a few moments of learning.

Everyone needs focused, full attention, whether they are top learners or not. It is **the minimum condition** for good encoding.

The minimum condition

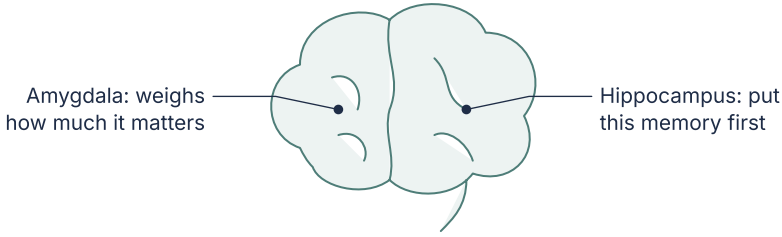


Everyone needs it, whether they are top learners or not.

The second factor is **emotional weight**. It explains one of memory's most striking qualities. Memories formed during strong feeling often feel sharp and full of detail.

The amygdala is **a small brain area that weighs how much something matters** to your feelings. When feelings run high, it signals the hippocampus to put this memory first.

When feelings run high



The brain

Memories formed during strong feeling often feel sharp and full of detail.

Think of when people heard life-changing news. They feel sure they remember where they were. Yet one study found those memories **no more correct than everyday memories** (Talarico & Rubin, 2003). The strong feeling mostly made people more sure.

We can **add feeling to dull study material** on purpose. Curiosity, personal meaning or lively storytelling all do this. This copies the brain's natural process, with results you can measure.

Three factors **strongly shape** how well encoding goes.

- Attention. Split attention produces much weaker memories. The brain cannot properly encode information it is not fully working on. Multitasking means doing several things at once. Multitasking during learning is one of the most damaging habits you can have.
- Emotional Weight. The amygdala is a 'memory priority flag'. It is like a sticky note on the page you need. Experiences full of feeling are encoded more deeply and brought back more easily. This is why you remember your wedding day but not last Tuesday's lunch.
- Context. Your place, mood and body state all become part of the memory itself. Matching the setting at recall to the setting at encoding helps recall. But the effect is modest (Smith & Vela, 2001).

Stage 2: Storage (Keeping It)

Storage is **an active, living process**. It does much more than file things away. The links between nerve cells that make up a memory slowly grow stronger and steadier. It is like wet concrete setting hard. This is called consolidation.

Two processes are central.

- Synaptic Consolidation. This happens within hours of learning. It strengthens the links between nerve cells that fired together during

encoding. The slogan 'Neurons that fire together, wire together' sums up Hebb's 1949 idea.

- System Consolidation. This happens over weeks, months and even years. Memories slowly move from the hippocampus (first storage). They go to networks spread across the brain's outer layer (long-term storage). Sleep is essential to this process.

Two consolidation processes



They go to networks spread across the brain's outer layer (long-term storage).

Stage 3: Retrieval (Getting It Back)

Bringing a memory back works **like rebuilding a model from a few saved pieces**. The brain rebuilds the memory from traces spread around it, guided by cues. This is called retrieval, and it is a rebuilding process. A simple recording would just play back.



This is **both a strength and a weak spot**. Memories are rich and can bend to fit new uses. But they can also be bent by context, expectations and suggestion.

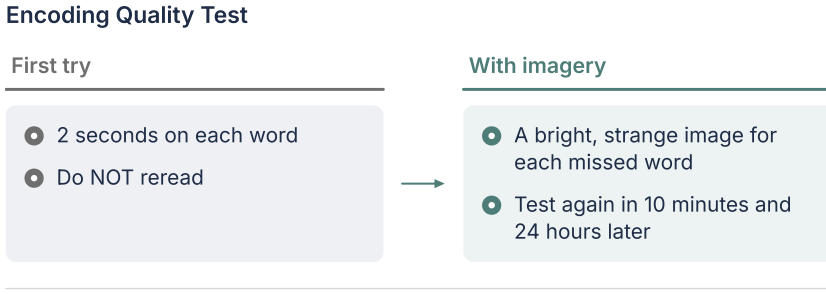
- Cue-Dependent Retrieval. We reach memories most easily when the cues at recall match the cues at encoding. A smell, a song or a place

can bring back memories that seemed completely lost. Each cue is one of the hooks and paths back to a memory.

- State-Dependent Memory. Your inner state (mood, body condition) at recall can affect what you can reach. Some studies find people recall more in the same mood as when they learned. But this effect is fragile and patchy.
- The Retrieval Practice Effect. Pulling a memory back out strengthens it far more than looking it over. Testing yourself checks what you know. It is also one of the strongest memory training tools there is.

> **Exercise:**
> 1.3, Encoding Quality Test. Follow these five steps.

1. Read the list in this step once, spending 2 seconds on each word. Do NOT reread. The list is apple, parliament, seventeen, elephant, Tuesday, mercury, cathedral, whisper, gratitude, volcano.
2. Now cover the list and write down every word you can remember.
3. Uncover the list and check. For each word you missed, ask why. Were you distracted? Did the word have no emotional hook? Did it feel alone (no links to anything)?
4. Now learn the missed words again using a bright, strange image for each. Test yourself again in 10 minutes.
5. Repeat the test 24 hours later. You should notice a big improvement from the imagery technique.



Now learn the missed words again using a bright, strange image for each.

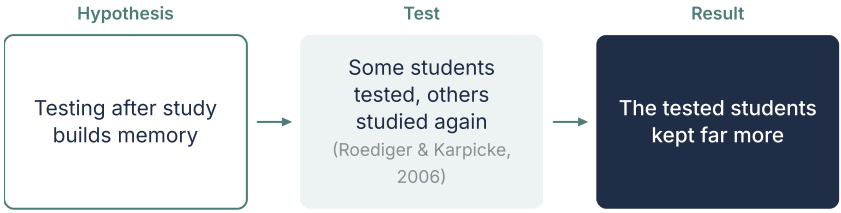
The gain you saw in the exercise shows **the most important principle** in this training. The gap between just seeing information and working on it actively, with a plan, is **huge**. It transforms the way you learn.

The imagery technique used **several brain systems at once**. It used seeing areas, feeling circuits and networks of linked ideas. Rereading used almost none of these. The "forgotten" words were simply never worked on deeply enough to settle in.

This exercise also shows something important about retrieval. **Trying to recall the words**, even imperfectly, strengthens the trace of each word you found.

Henry Roediger III and Jeffrey Karpicke ran a study in 2006. It was published in Psychological Science. Some students were tested on material after studying. They **kept far more** than students who simply studied it again.

Tested or studied again



It was published in Psychological Science.

Pulling a memory out tests it, and **it also builds it**. Each time you reach for a memory and find it, it gets easier to find.

Quick check:

1. One student works out an idea's meaning for ten minutes. Another rereads it for an hour without thinking. Who remembers more? Answer: The first student, because deeper processing builds stronger memories.
2. Were memories of life-changing news more correct than everyday memories? Answer: No. The strong feeling mostly made people more sure (Talarico & Rubin, 2003).
3. What are the three stages of memory? Answer: Encoding (getting it in), storage (keeping it) and **retrieval** (getting it back).

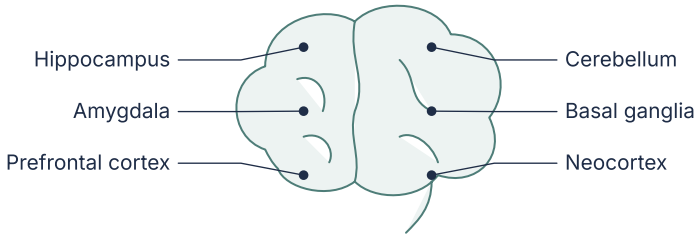
1.3.2 Neuroscience of Memory: Brain Regions

Memory lives in **a network spread across the brain**, with no single home. Different parts play their own roles, like players on a football team. Those roles **depend on one another**.

Brain Region	Main Memory Role	What It Means for Health and Daily Life
Hippocampus	Forming new long-term memories; finding your way around; memory for settings	Damage means a person can no longer form new declarative memories, the kind we can recall on purpose (anterograde amnesia). One case: Henry Molaison (H.M.) could not form new memories after brain surgery.
Amygdala	Handling feelings; strengthening the storing and recall of events full of feeling	The 'fear memory' centre. Also turns up good memories. Explains why emotional events are remembered more brightly.
Prefrontal Cortex (the front of the brain, behind the forehead)	Working memory; executive function, the brain's planning and control; organising, planning, and recall of long-term memories	Damage harms planning, decision-making, and the ability to work with information in working memory.
Cerebellum	Procedural memory; learning body skills; timing and conditioning	Makes 'muscle memory' possible. A pianist's fingers know what to do without thinking because the cerebellum has partly made the sequence automatic.
Basal Ganglia	Forming habits; learning from rewards; procedural memory	The 'autopilot' system. Habits live here, both useful routines and unhelpful urges people find hard to stop.
Neocortex (the brain's wrinkly outer layer)	Long-term storage of semantic and episodic memories (spread across regions)	Where settled memories finally live. Visual memories in the seeing areas; sound memories in the hearing areas, and so on.

Together, these regions show **what memory training really does in the brain** when it works. Each part has its own job.

Each part has its own job



The brain

Together, these regions show what memory training really does in the brain.

Memory storage is **spread across the brain**. This is one of brain science's most important discoveries, and one of the most surprising.

For much of the twentieth century, scientists searched for **the physical trace of a memory**. They called it the "engram". They searched as though it might sit in a single spot.

What they found was far neater. Memories are stored as **patterns of links across several brain regions**. It is like a picture made from many puzzle pieces. Each region adds a different side of what you lived through.

The clearest evidence for this spread came from **a single patient**. Henry Molaison was known in research for decades as "H.M.". His case changed our view of the hippocampus.

In 1953, he had surgery on both sides of the brain to treat **severe epilepsy**. Epilepsy is an illness that causes seizures.

Henry Molaison

HM

Henry Molaison, "H.M."

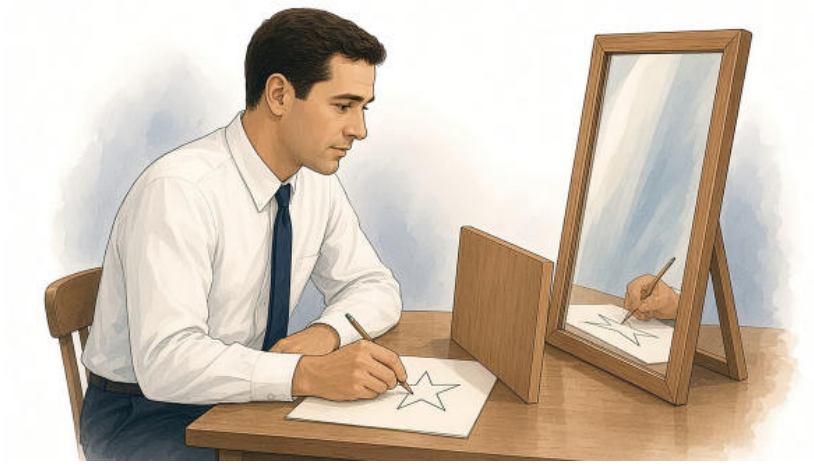
- Known in research for decades
- 1953: surgery on both sides of the brain
- His case changed our view of the hippocampus

The surgery was to treat severe epilepsy.

The surgery removed the inner part of each temporal lobe, including the amygdala. Part of the hippocampus survived (Annese et al., 2014). Molaison could then **no longer form new declarative memories**, ones we can recall on purpose.

Every morning, he woke **as if the previous day had not happened**. He could not recognise doctors who treated him daily.

Yet researchers taught him to **trace a star-shaped path** while looking in a mirror. He got better session after session. And all the while, he had no memory of ever doing the task.



Henry Molaison traces a star shape while watching his hand in a mirror.

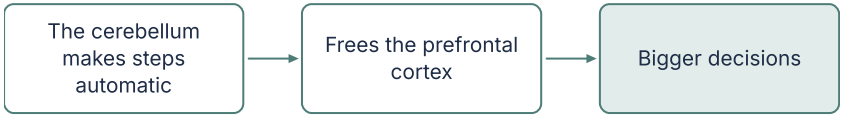
His procedural memory was stored in the cerebellum and basal ganglia. That is **the memory for skills**. It was perfectly intact. Most of his hippocampus was gone, but the muscle memory was still there.

The split has **direct effects on daily life**. Skills, habits and steps you have done many times settle into procedural memory. As they do, they become **harder to knock off course**.

Highly trained surgeons, pilots and athletes can do complex tasks **under extreme stress**. Part of the reason is that the cerebellum has made those steps automatic.

That frees the prefrontal cortex for **bigger decisions**. Seen from the brain's side, building good habits is itself a form of memory training.

Under extreme stress



Part of the reason is that the cerebellum has made those steps automatic.

Key idea:

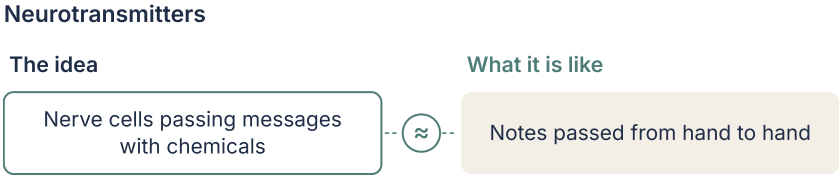
Memories are stored as patterns of links across several brain regions. One memory = many regions working together.

Quick check:

1. What could Molaison still learn after his surgery? Answer: A skill. He got better at tracing a star-shaped path in a mirror, with no memory of ever doing the task.
2. Why did Molaison have surgery in 1953? Answer: To treat severe epilepsy.

1.3.3 Neurotransmitters and Memory

MEMORY IS **made of chemistry**. Nerve cells pass messages with chemicals called neurotransmitters, like notes passed from hand to hand. The five below are **the chemical messengers of learning and recall**.



Memory is made of chemistry.

Knowing them shows why everyday choices **change how well your memory works** so much. These choices are sleep, exercise, food and handling stress.

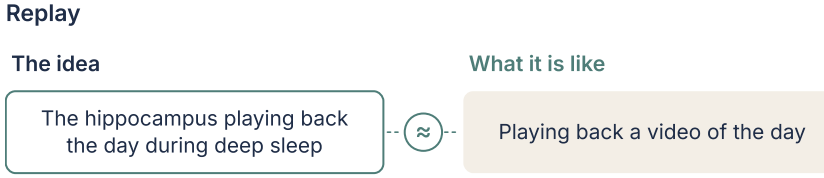
Neurotransmitter	Role in Memory	How to Support It	Why It Counts
Acetylcholine	Attention and encoding; links between nerve cells changing (synaptic plasticity); helping the hippocampus work	Eggs, fish, nuts (foods rich in choline); mental challenge; aerobic exercise	Alzheimer's disease is marked by a big loss of acetylcholine.
Dopamine	Learning from rewards; storing what you want or care about; working memory	Setting goals; exercise; music; rewards from other people; enough sleep	High dopamine = better memory for rewarding experiences. Low dopamine = not caring about anything and poor learning.
Glutamate	The main 'go' messenger that switches nerve cells on; Long-Term Potentiation (LTP), the lasting strengthening of links between nerve cells; memory forming	Balanced diet; enough sleep; handling stress; avoiding too much alcohol	Too little harms memory forming; too much poisons nerve cells. Balance is everything.
Serotonin	Steadying mood; settling memories full of feeling; tuning learning	Exercise; sunlight; foods rich in tryptophan; time with others; mindfulness	Depression often comes with poorer memory. Low serotonin as its cause is now doubted (Moncrieff et al., 2023).
Noradrenaline	Alertness and being stirred up; storing important events; the stress response	Moderate exercise; new things; enough sleep (for rest and repair)	The 'yellow marker'. Noradrenaline flags important events so they get stored first. Too much (long-term stress) damages nerve cells in the hippocampus.

With these chemicals in view, the table becomes **a map for daily choices**. But for healthy adults, the evidence for the food and sunlight tips is **weak**.

Each choice about sleep, food, exercise, stress and time with others **shapes your brain's chemistry**. Each one is also a choice about how well you can learn and remember.

Sleep is perhaps **the strongest memory tool** anyone has. Yet it is the one people skip most often. It works a bit like the brain playing back a video of the day.

During slow-wave sleep, our deepest sleep, the hippocampus replays the day's experiences to the neocortex, the brain's outer layer. Scientists call this memory consolidation replay. It **really moves memories** out of short-term storage in the hippocampus. They go to long-term networks in the brain's outer layer.



Sleep is perhaps the strongest memory tool anyone has.

Students who sleep after learning **keep far more** than those who stay awake. This finding has been found again in dozens of studies (Walker and Stickgold, 2006, Annual Review of Psychology).

Staying up all night before an exam does more than make you tired. It **blocks the settling-in** of everything from the whole day of study before it.

So **sleep after you learn**, and skip the all-nighter.

Key idea:

Sleep after learning, and you keep far more. Sleep is perhaps the strongest memory tool anyone has.

Exercise **counts just as much**. Aerobic activity makes the body produce a substance called Brain-Derived Neurotrophic Factor (BDNF), which helps new nerve cells grow. It is often called "Miracle-Gro for the brain".

BDNF helps **new nerve cells grow** in the hippocampus, which is called neurogenesis. It also strengthens the links between nerve cells that forming memories depends on.

A 2016 study in Current Biology tested **about 35 minutes of interval exercise**, bursts of hard effort with rests between. It came 4 hours after learning, and it improved memory for picture-location pairs. Exercise straight after learning did not (van Dongen et al., 2016).

Exercise builds memory, but **long-term stress takes it apart**. Stress of this kind is among the most damaging forces on memory.

Builds or takes apart

Builds memory	Takes it apart
⊕ Exercise	⊖ Long-term stress

It came 4 hours after learning, and it improved memory for picture-location pairs.

Cortisol is a stress hormone. When it stays high for a long time, it **slowly shrinks the hippocampus**. Brain scans show a smaller hippocampus in people with long-term depression or PTSD (McEwen, 2001; Schmaal et al., 2016).

Handling stress helps you feel good. It is also **a must for clear thinking**. The parts of this training on mindfulness and on handling stress are core parts of memory training.

Quick check:

1. When did exercise improve memory in the 2016 study? Answer: About 35 minutes of interval exercise, 4 hours after learning. Exercise straight after learning did not.
2. What happens when cortisol stays high for a long time? Answer: It slowly shrinks the hippocampus.
3. What does sleep after learning do? Answer: Students who sleep after learning keep far more than those who stay awake.

1.3.4 Memory Disorders: What They Teach Us

Memory disorders are tragedies, but they are also **windows for science**. Each illness shows just what is lost. That shows **how finely tuned the brain's memory design is**, like a watch where every tiny part has a job.

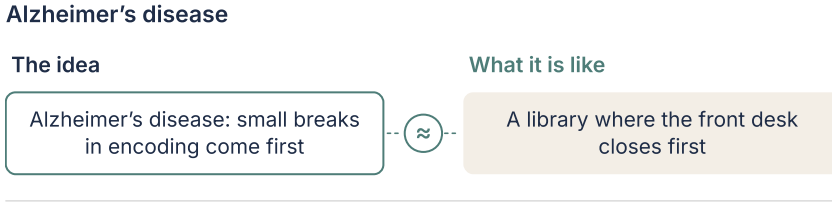
Disorder	What Happens in the Brain	Effect on Memory	Ways to Manage It
Alzheimer's Disease	Nerve cells slowly die, and it gets worse over time; amyloid plaques (sticky clumps); tau tangles (twisted threads) in the hippocampus and the brain's outer layer	Early: trouble forming new memories. Later: loss of long-term memories of one's own life. In the end: loss of language, of knowing people, and of self.	Keeping the mind busy; physical exercise; time with others; Mediterranean diet (trial evidence mixed); enough sleep
Anterograde Amnesia	Damage to the hippocampus or the medial temporal lobe	Cannot form new long-term declarative memories. Implicit and procedural memory are often kept.	Training to rebuild thinking skills; memory aids outside the head; routine and structure; support from therapists
Retrograde Amnesia	Injury to the networks that settle memories in	Loss of memories formed before the injury. Often, recent memories are easier to lose than older ones.	Planned recall therapy using cues; storytelling; photos and objects as prompts
Korsakoff Syndrome	Lack of thiamine (vitamin B1), usually from long-term alcohol use	Severe anterograde amnesia; confabulation (making up memories without knowing it)	Taking extra thiamine; no alcohol; training to rebuild memory

Read backwards, this table is **a guide to keeping memory healthy**. Each illness above is like a study that nature ran by itself.

When one part of the memory system is damaged, we can see what fails. That shows us **what the part does**. Scientists call a study of damage like this a lesion study. It works like pulling out one wire in a radio to see what stops.

Each disorder also reveals something about **how a healthy brain works**. Take Alzheimer's disease. It begins with **small breaks in encoding**, the brain's way of taking memories in. The big memory loss comes later.

Picture a library where **the front desk closes first**. New books can no longer be checked in, yet the books already on the shelves stay put for years. The library picture shows only the order of loss.



The big memory loss comes later.

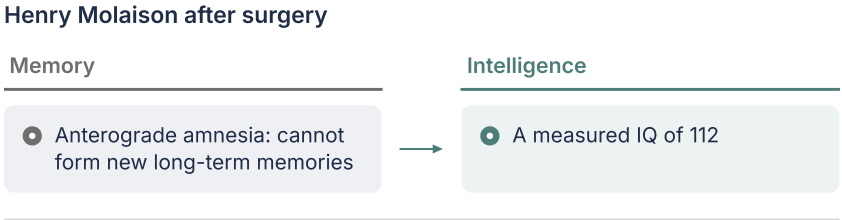
This uneven pattern follows from the brain science. The hippocampus **breaks down first**. Old memories are spread across the brain's outer layer, so they last far longer.

A person can no longer form clear new memories. But **long-held memories stay intact for years**. They may forget a conversation from an hour ago. Yet they perfectly remember their wedding day from decades earlier. In brain terms, Alzheimer's is **a growing loss of the future more than the past**.

Key idea:

In brain terms, Alzheimer's is a growing loss of the future more than the past.

Some people cannot form new long-term memories. Scientists call this anterograde amnesia. It gives the clearest proof that **memory and intelligence are systems that can be pulled apart**. Even after his brain surgery, Henry Molaison had a measured IQ of 112. An IQ is a score on a test of how smart you are.



Memory and intelligence are systems that can be pulled apart.

He could hold a conversation brilliantly and reason clearly **for a short time**. Then the memory faded, and the talk started over.

His mind was as sharp as before. His power to add new knowledge to long-term storage was destroyed. This split shows for sure that memory and being smart are two different things. Memory is **the ground that intelligence works on**, like the soil a plant grows in.

If you care about brain health, the ways of managing these illnesses matter to you now. They are **ways to protect the brain** that we can use today.

Keeping your mind busy, exercise, time with friends, good sleep and eating well all **affect memory**. They may change how fast it declines with age.

Some things may **protect against decline in thinking**. People who stay mentally, socially and physically active tend to have a lower risk of dementia (Livingston et al., 2020).

This training is about more than doing better tomorrow. It **builds the quality and strength of your mind** for decades.



This training is about more than doing better tomorrow.

Quick check:

1. Why do old memories outlast new ones in Alzheimer's? Answer: The hippocampus breaks down first, and old memories are spread across the brain's outer layer.
2. What was Molaison's measured IQ after his surgery? Answer: 112.
3. Who tends to have a lower risk of dementia? Answer: People who stay mentally, socially and physically active (Livingston et al., 2020).

What memory loses in illness shows us **what it needs to stay healthy**.

Key Concept:

Module 1 Key Takeaways

Memory is **a skill you can train**. Your body does not fix it in place. History and brain science both back this up.

All memory runs in three stages: Encoding (get it in), Storage (keep it) and Retrieval (get it back). You can get better at each one.

Your brain keeps memory in many parts that work as a team. No one part does it all. So what counts is looking after your whole brain and building it up.

Neurotransmitters, the brain's chemical messengers, link everyday choices straight to how well memory works. Sleep, exercise and food can help it. For healthy adults, the evidence for food is weak.

Memory disorders show how finely tuned the system is. They remind us that the brain needs care every day, before problems start.

Exercise: Module 1 Completion Checklist. The Science of Memory: Understanding How Your Brain Works	
Core Ideas to Remember	
[ ]	Memory is a skill you can train. Biology does not fix it in place
[ ]	Three stages: Encoding (get it in), Storage (keep it), Retrieval (get it back)
[ ]	Your brain is a memory network spread across many parts. No single region does everything
[ ]	Neurotransmitters tie everyday choices straight to how well memory works
[ ]	Sleep, exercise and food can help memory. For healthy adults, the evidence for food is weak

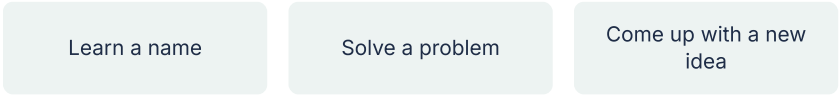
[ ]	Explicit memory = facts & events; Implicit memory = skills & habits
[ ]	Long-term memory can hold so much that it is, in effect, unlimited
[ ]	Memory disorders show how finely tuned the system is, and why it is worth protecting
Foundational Exercises to Complete First	
[ ]	Exercise 1.1, Your Memory Baseline (measure where you start)
[ ]	Exercise 1.2, Memory Taxonomy Walk (identify the memory types in one day)
All Exercises: Work Through the Full Set	
[ ]	Exercise 1.1, Your Memory Baseline
[ ]	Exercise 1.2, Memory Taxonomy Walk
[ ]	Exercise 1.3, Encoding Quality Test
Daily Practice Habits	
[ ]	Notice which memory type you are using in each daily situation
[ ]	Spot one encoding failure each day and its likely cause
Actions to Take This Week	
[ ]	Complete Exercise 1.1 to record your baseline score in your Memory Journal
[ ]	Look back at your scores from Exercise 1.2. Which memory types feel weakest?
[ ]	Commit to enough sleep each night as your first step for memory
[ ]	Set up your Memory Journal (on paper or on a screen) for tracking progress
[ ]	Pick one lifestyle factor (sleep, exercise, or food) to improve this week



Module 2: How Memory Works with Attention, Intellect and Creativity

MEMORY NEVER WORKS ALONE. When you learn a name, solve a problem or come up with a new idea, **memory is working with another ability** at the same moment. This module looks at those partnerships one at a time. It then shows when memory should lead a task and when it should step back.

Memory never works alone



In this book's terms, memory is the thinking ability to **take in, keep and bring back information and experiences**. The other books define their own abilities in their own words, and I use those words when I name them here.

The Attention book defines attention as "choosing what is important and staying with it". The Intellect book describes intellect as solving tasks where the variables are identified. **The Creativity book describes creativity** as solving tasks where the variables are not identified.

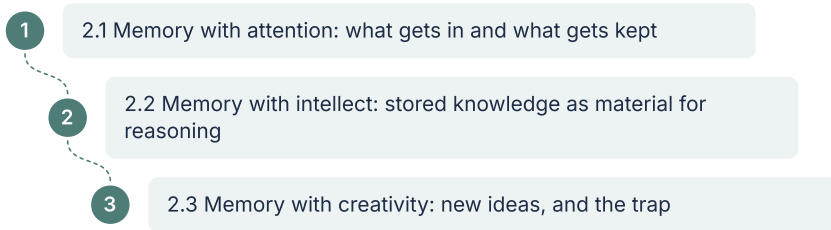
Memory and its three partners



The module has three chapters. **Chapter 2.1 pairs memory with attention**, and looks at what gets in and what gets kept. Chapter 2.2 pairs memory with intellect, and shows how stored knowledge becomes the material that reasoning works on.

Chapter 2.3 pairs memory with creativity. It looks at **how stored knowledge turns into new ideas**, and at how the same knowledge can trap you. Its last section brings the three partnerships together on one real task.

Three chapters, three partnerships



My model of the four pillars, in Module 6, covers some of the same ground, and this module does not repeat it. **Here the focus is the working link** between memory and each partner. Bring one real task of your own, such as a report or a plan, and try each section's ideas on it as you go.

2.1 Memory and Attention: What Gets In and What Gets Kept

2.1.1 You Cannot Keep What You Never Took In: Attention at Encoding

THE PLUMBER KNEELS BY your boiler and shows you how to reset it if it cuts out again. Halfway through, a text arrives and you read it. **A week later the boiler stops, and the steps are nowhere.** You were standing right beside him, yet the steps never stayed.

This chapter pairs memory with attention. In this book's terms, memory is the thinking ability to take in, keep and bring back information and experiences. **This section is about the first of those three jobs**, the moment when something new reaches you and has to be taken in.

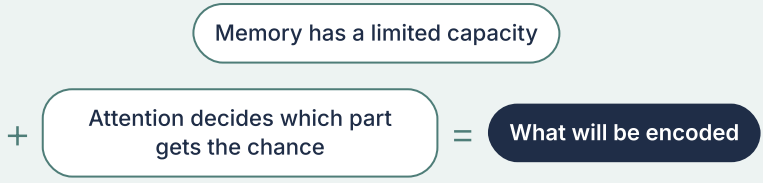
Three jobs, intake first



Taking information in is called encoding, the first step of every memory. In the boiler scene, **encoding was the job that failed**. The reset steps were spoken clearly, and some of them never made it in.

> **Science Says:**
>
> One review of attention and memory gave a plain reason why the two belong together. It said that "memory has a limited capacity, and thus attention determines what will be encoded" (Chun & Turk-Browne, 2007). Limited capacity means **memory cannot take in everything at once**. Attention decides which part of a moment gets the chance.

Why attention picks



The attention side has a book of its own. The Attention book defines attention as "choosing what is important and staying with it", and **I use its words here**. Both halves show up at encoding, since you have to pick the steps and then stay with them until they are in.

In my model of the four pillars, this intake side has its own name. I call it **extractivity**, your skill at taking in information from the world, and 6.1 sets it out. This section looks at one narrow part of it, the few seconds when new information arrives.

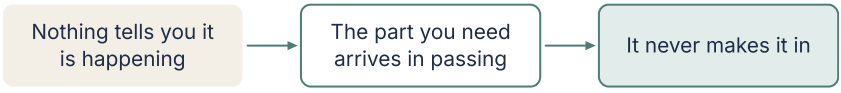
One intake side, two names

	The Attention book	This book
Its words	Choosing what is important and staying with it	Extractivity: taking in information from the world
At encoding	Pick the steps, then stay with them	Set out in 6.1

Splitting attention while you learn has been studied directly (Craik et al., 1996), and 8.3.1 tells what that study found. **I will not repeat its results here.** This section asks a different question, which is how to guard the moment of intake on an ordinary day.

On this book's reading, intake fails most often **when nothing tells you it is happening**. The plumber did not announce which sentence you would need a week later. Ordinary life is full of moments like that, where the part you need arrives in passing.

When intake fails



Think of a train announcement on a busy platform. The voice says your train has moved to platform four, and you are mid-conversation. **You catch the word "four" and lose the rest.** Ten minutes later you are standing in the wrong place, sure you heard something about your train.

Noise makes the problem worse. A busy platform, a loud café or a television in the corner all compete for the same few seconds. **Move**

closer to the voice, or step away from the noise, and the words have a much better chance of getting in.

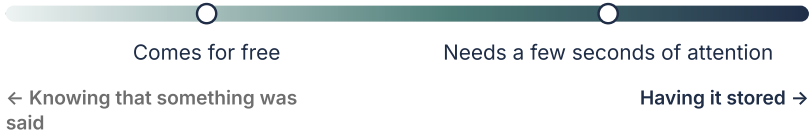
On a busy platform

Mid-conversation	Closer to the voice
You catch the word "four" and lose the rest Ten minutes later you stand in the wrong place	Step away from the noise The words have a much better chance of getting in

That half-heard feeling is a useful warning. On this book's reading, **knowing that something was said** is a long way from having it stored. The first comes for free. The second needs a few seconds of attention while the words are still arriving.

This is why I put intake first in any memory plan. **Every technique in this book works on something that already went in.** Revision, spacing and memory palaces all need raw material, and the moment of intake is where that material is made.

Said is not stored



Think of a photograph taken while the camera was moving. **No amount of editing brings back detail** that the lens never caught. On this book's reading, a blurred intake behaves the same way, and the cure is to hold still for those few seconds.

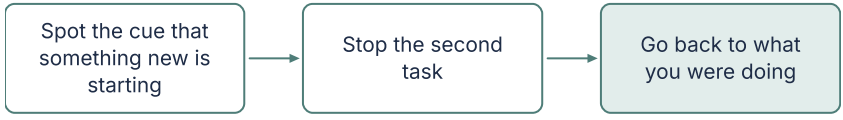
A camera that moved

The idea	What it is like
A blurred intake	A photograph taken while the camera was moving
The cure	Hold still for those few seconds

Intake is also the cheapest place to fix a memory problem. **A few seconds of attention at the start** can save an hour of searching later. You might be hunting for a manual, a message or the person who told you. On this book's reading, that trade is one of the best a busy person can make.

> **Key Concept:**
>
> Protect the moment of intake. It means **treating the seconds when new information arrives as a separate task**, with its own start and finish. When they are over, you go back to whatever else you were doing.

Guarding one intake moment



Some intake moments can be spotted in advance. A handover at work, a doctor's instructions or a lesson on a new tool all announce themselves. **Decide before they start that they get your full attention**, and put the phone in a pocket before the first word.

Other moments arrive without warning. For those, the habit is to **notice the cue that something new is starting**. A person says "so what you do is", a sign changes, or a voice comes over a speaker. That cue is your signal to stop the second task.

Intake moments, announced or not

They announce themselves	They arrive without warning
A handover at work	A person says "so what you do is"
A doctor's instructions	A sign changes
A lesson on a new tool	A voice comes over a speaker

Some cues come from inside you. **A small jolt of "I will need this"** is easy to brush aside when you are busy. Treat that jolt as a cue in its own right, and give the next few seconds to the information it points at.

Stopping the second task takes very little. **Lower the phone, turn towards the voice and let the screen wait.** The whole act takes a second. On this book's reading, that second does more for your memory than a great deal of effort later.

Stopping the second task

- [x] Lower the phone
- [x] Turn towards the voice
- [x] Let the screen wait

Intake also has a speed limit. When someone reels off ten steps in a row, **the early ones can be gone before the last one arrives**. Ask the speaker to pause after each step, so each one has time to go in before the next comes.

Children test this every afternoon. A child climbs into the car and starts telling you about her day while you watch the traffic. **If the story is one you want to keep, wait until you are parked.** Then ask her to tell it again with your eyes on her.



A father in a parked car turned round in his seat, listening to his daughter as she talks with her hands.

Saying the information back is the next step. **A short repeat in your own words** shows you at once whether it got in. If you stumble, ask again while the person is still there, since a second chance at intake costs almost nothing.

Writing helps when the information is long. A list of reset steps, a set of directions or a run of dates will not all fit in your head at once. **Write them down while they are being given**, and you hand part of the intake job to paper.

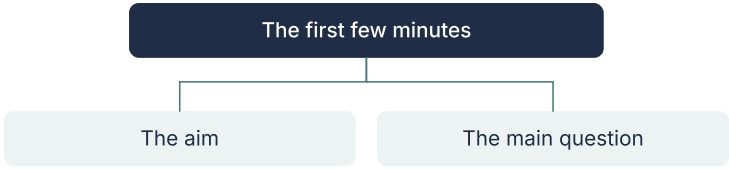
Two checks while it is said

> - Say it back in your own words, and ask again if you stumble
> - Write long information down while it is being given

On this book's reading, the start of a lesson or meeting often carries its frame. That frame might be the aim or the main question. **Guard the first few minutes**, and the rest of the session has something to hang on.

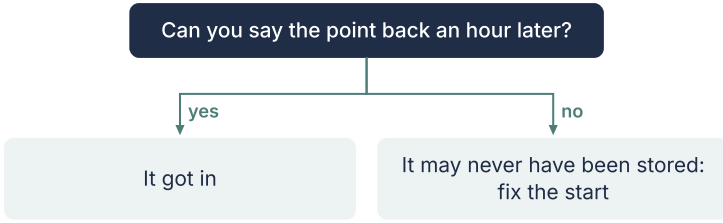
Protecting intake leaves room for doing two things in a day. You **give the few seconds that count to one thing**, and then return to the other. The text could have waited until the plumber finished his sentence, and nothing would have been lost.

The frame of a session



A simple test tells you whether intake happened. If you can say the point back an hour later, it got in. If it is gone within minutes, **it may never have been stored at all**, and the fix lies at the start.

Did intake happen?



Over time, guarding intake becomes a habit. **You start to feel the moment coming**, much as a driver feels a bend before reading the sign. On this book's reading, that early feel is what turns a rule you remember into something you simply do.

The exercises below come from this section's own picture of intake, and **no study has tested them as training**. Treat them as practice ideas. The cue hunt trains you to spot when intake starts, and the intake log shows where your own gaps tend to appear.

Two practice ideas

The cue hunt: spot when intake starts	**The intake log:** where your gaps tend to appear

Read your results with care. **One day of logging is a small sample**, so look for a pattern over a week. If most of your gaps come from one kind of moment, such as phone calls, start your guarding there.

Where to start guarding

If	When	Then
Most of your gaps come from one kind of moment	After a week of logging	Start your guarding there

Exercise:

Try it. The next time someone explains how to do something, put your phone away first. Then say the steps back once.

Exercise:

Catch the moment.

1. Starter. Before a planned explanation, such as a handover or a lesson, put everything else away. Afterwards, write the main points from memory.
2. Middle. Run a cue hunt for one day. Each time someone starts to explain something, note whether you stopped the second task.
3. Advanced. Keep an intake log for a week. Each evening, list three things you meant to keep, and **check which ones you can still recall**.

A week of intake log

Day	1	2	3	4	5	6	7
List three things you meant to keep	☐	☐	☐	☐	☐	☐	☐
Check which ones you can still recall	☐	☐	☐	☐	☐	☐	☐

Key idea:

Attention decides what gets encoded, so **protect the moment of intake** as a task of its own.

Quick check:

1. Why must attention choose what gets encoded? Answer: Because "memory has a limited capacity, and thus attention determines what will be encoded" (Chun & Turk-Browne, 2007).
2. What does this book call the intake side in its model of the four pillars? Answer: Extractivity.
3. What cue tells you to stop the second task? Answer: A sign that something new is starting, such as a person saying "so what you do is".

2.1.2 Working Memory: The Focus of Attention Inside Memory

THE ELECTRICIAN ON THE phone tells you which switches to flip in the fuse cupboard. Turn off the third one, then the kitchen one, then the main switch. **By the time you open the cupboard door, you are not sure which came second.** You held all three a moment ago, and now one has gone soft.

The electrician's three switches

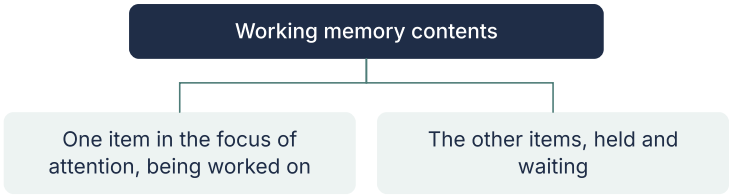


That juggling happens in working memory, the small space where you hold and use information right now. **Working memory is where memory and attention meet most closely.** This section looks at how

attention works inside it, and at what that means for using your memory well.

> **Science Says:**
>
> One review sums up where the research stands. It opens with the line "There is broad agreement that working memory is closely related to attention" (Oberauer, 2019). It then adds that "Within working memory contents, a single item is often selected into the focus of attention for processing" (Oberauer, 2019). **Of the few things you hold, one is being worked on.**

Of the few things you hold



On this book's reading, that picture explains a common slip. **You can hold something and still not be using it.** The second switch was in your head the whole time, yet it was waiting, and a waiting item can fade while you deal with another.

Processing here means doing something with the item, such as comparing, adding or checking it. In the fuse cupboard, **the switch under your hand is the one being processed**. The other two steps wait their turn.

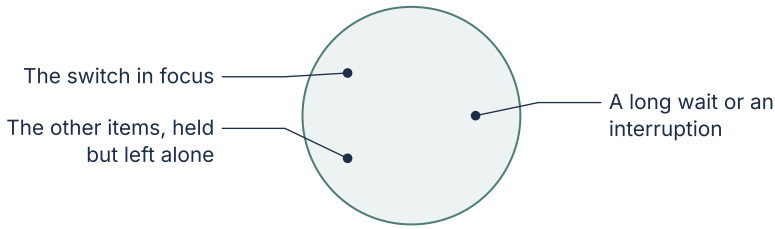
Held, or in use

	Being processed	Waiting
In the fuse cupboard	The switch under your hand	The other two steps
Risk	Being worked on	Can fade while you deal with another

On this book's reading, the waiting items are the ones at risk. **While your attention is busy with one switch**, the others are held but left alone. If the wait is long or something interrupts you, a waiting item can slip away before its turn comes.

How many items can wait at once is a separate question, studied in a review of short-term memory (Cowan, 2001). **That limit is told in 3.1.1**, which also shows how chunking, grouping items into units that mean something, works around it. This section looks at the focus inside the limit.

Waiting items at risk



Attention also helps before anything reaches working memory. **The work starts while you are still hearing the words.** A second review looked at both moments, the hearing and the holding.

> **Science Says:**
>
> A review of attention and working memory found that "Attention facilitates target processing during both perceptual and postperceptual stages of processing" (Awh et al., 2006). Perceptual means **while you see or hear the thing**, and postperceptual means afterwards, while you hold it in mind. Facilitates means makes easier.

Attention helps twice



In plain words, attention helps twice. **It helps the words get in** while the electrician speaks. It helps again after the call, while you keep the steps in mind and walk to the cupboard under the stairs.

A friend's bus directions show the same two moments. She says take the 42 and get off after the bridge, and **you need attention while she speaks**. You need it again on the bus, so the stop stays with you until the bridge goes past the window.

Two moments in the bus directions

While she speaks	On the bus
Take the 42 and get off after the bridge	The stop stays with you
You need attention	You need it again until the bridge goes past

The two moments need different care. While the words arrive, **cut the noise and face the voice**. Once they are in, keep them alive by saying

the next step to yourself, or move them onto paper so they no longer need holding.

Care at each moment

While the words arrive	Once they are in
Cut the noise	Say the next step to yourself
Face the voice	Or move them onto paper

Chunking changes what fits in the waiting area. Three separate switches are three items. **"Third, kitchen, main" said as one phrase** can travel as a single unit, so the focus has fewer places to visit. On this book's reading, that is one reason chunking helps under pressure.

> **Key Concept:**
> The focus of attention. It is **the one item in working memory you are working on at this moment** (Oberauer, 2019). You can find it by asking what your next small action will change.



A cook at a stove stirring one pan while two other pans wait on the back burners.

Moving the focus has a cost of its own. **Each time you switch to a new item**, the one you left has to wait. On this book's reading, a task that makes you jump back and forth wears your memory down faster than one taken in order.

Order helps for that reason. A recipe read in sequence **lets the focus move forward** without going back. So does a form filled in from top to bottom. Jumping about forces it to revisit items that may have faded.

The cost of moving the focus

Taken in order	Jumping back and forth
⊕ The focus moves forward	⊖ The one you left has to wait
⊕ A recipe read in sequence	⊖ Wears your memory down faster

Think of a cook with three pans on the stove. She can stir only one at a time, and the others sit and wait. **If she leaves one too long, it catches**, and the same is true of a waiting item in your head that never gets a visit.

The cook's trick is to keep a rhythm. **She visits each pan in turn** before any of them burns. On a task with several waiting items, a quick pass over each one now and then does the same job for your memory.

Three pans on the stove

The idea		What it is like
The item in focus	≈	The pan she stirs
The waiting items	≈	The pans that sit and wait
A quick pass over each one	≈	A visit to each pan before any of them burns

People often ask whether working memory can be trained to hold more. **That question has its own section**, 8.3.3, with the evidence on it. This section stays with how you use the space you already have.

Using the space well starts with **clearing out what the task does not need**. Worries, other errands and half-finished thoughts all take a place. Write them on a scrap of paper before you start, and the focus has fewer things to step around.

Write these down before you start

- [ ] Worries
- [ ] Other errands
- [ ] Half-finished thoughts

Speaking the item in focus aloud can help on fiddly tasks. **"Now the kitchen switch"** tells you, and anyone helping, where you are. If you are interrupted, the last thing you said is a marker you can return to.

Interruptions are the hardest test. A child calls you or the doorbell rings, and **the focus jumps to something new**. When you come back, start from the last step you can name for certain. Then check the waiting items one by one before you carry on.

After an interruption

Try this now

1. Start from the last step you can name for certain
2. Check the waiting items one by one
3. Carry on with the task

Some tasks hold more items than any focus can manage. A long form, a tax return or the instructions for flat-pack furniture can fill the space many times over. **Let the page hold the items**, and use working memory only for the step in front of you.

Phone numbers, codes and reference numbers are a common overload. **Read them back in small groups**, two or three digits at a time, and check each group before you move on. The groups are easier to hold, and a mistake shows up at once.

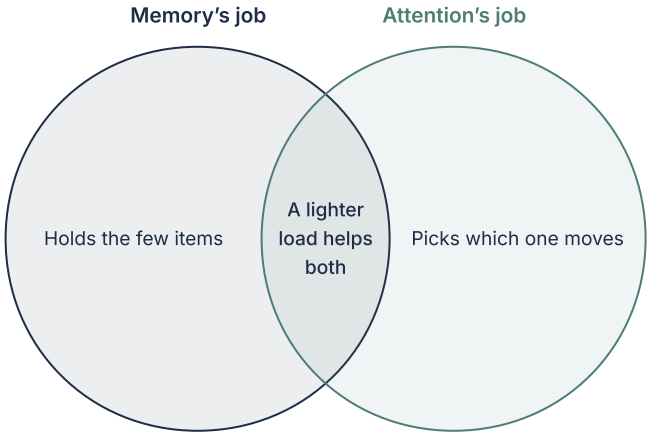
Reading numbers back

Phone numbers, codes and reference numbers	Two or three digits at a time	Check each group before you move on

On this book's reading, this is where memory and attention trade jobs. **Memory holds the few items, and attention picks which one moves.** When either partner is overloaded, the other suffers, so a lighter load helps both at once.

A good everyday sign of overload is the restart. You read the same line of instructions twice, or you count the same coins again. **Treat each restart as a signal to write something down**, so the space has room for the step you are actually doing.

Two partners, one load



None of this needs special equipment. **A pencil, a scrap of paper and the habit of naming your step** cover most of what this section suggests. The skill lies in using them at the moment of overload, before the waiting items start to slip.

The exercises below come partly from the review on the focus of attention (Oberauer, 2019). **No training study has tested them**, so treat them as practice. Naming the item in focus borrows the review's idea, and clearing the space first is this book's own habit.

No special equipment

- A pencil
- A scrap of paper
- The habit of naming your step

Notice what each level does to your errors. You may find that naming the focus **makes it harder to lose your place**, or that it slows you

down at first. The advanced level adds a marker for interruptions, so you can see how quickly you recover.

Naming the focus

May help	May cost
⊕ It makes it harder to lose your place	⊖ It slows you down at first

> Exercise:
>
> Try it. Ask someone to read you four short steps. Carry them out in order, saying each step aloud as it comes into focus.

Four steps, in order

One step in focus	The rest wait their turn

> Exercise:
>
> One step in focus.
>
> 1. Starter. Hold four errands in your head. Do them one by one, and say which errand is in focus before you start it.
> 2. Middle. Before a fiddly task, write down everything else on your mind. Then do the task, naming each step aloud as you reach it.
> 3. Advanced. During a long task, such as a form, **mark your place each time you are interrupted**. Afterwards, note how quickly you got back on track.

A clear space

A clear space	One step at a time	Fewer slips

Key idea:

Working memory holds a few things while attention works on one, so **keep the space clear and move through it in order.**

Quick check:

1. What is the focus of attention? Answer: The one item in working memory you are working on at this moment (Oberauer, 2019).
2. At which two moments does attention help, according to Awh's team? Answer: While you see or hear something, and afterwards while you hold it in mind (Awh et al., 2006).
3. Why does writing extra worries down help? Answer: It clears them out of working memory, so the focus has fewer things to step around.

2.1.3 What You Know Steers What You Notice

Two friends walk into a flat the morning after a party. One of them cleans homes for a living, and within seconds she points at a ring on the table and a stain by the sofa. **The other sees a fairly tidy room.** They stood in the same doorway, yet they did not see the same flat.

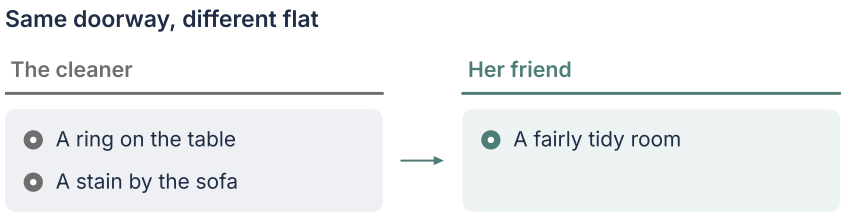
The link between memory and attention runs in more than one direction. **This section turns to memory's side of it**, the way what you already know shapes what you notice next. It is the half of the partnership that people tend to forget.



Two women standing in the doorway of a living room after a party, one pointing at a stain on the rug while the other looks at the ceiling.

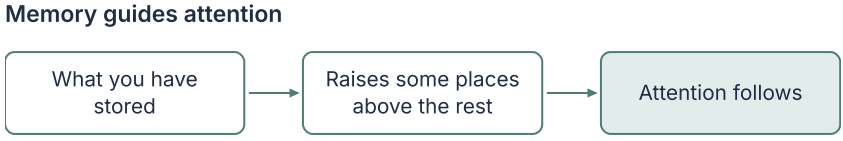
> **Science Says:**
>
> A review of attention and memory described both sides of the link. Alongside its point about intake, it noted that "memory from past experience guides what should be attended" (Chun & Turk-Browne, 2007). **What you have stored helps choose where you look.** Past experience here means everything you have seen, learned and done before.

The cleaner shows that guidance at work. She has seen hundreds of rooms after hundreds of parties. **Her memory sends her eyes to the table edge and the rug** before she has thought about it. That is where marks have turned up before.



On this book's reading, the guidance runs without effort. **She does not decide to check the rug**, any more than you decide to spot your own name on a list. Memory raises some places above the rest, and attention follows.

A reading study on knowledge and understanding (Recht & Leslie, 1988) is told in 6.2. **This section looks at a different step.** What you know changes where your attention goes in the first place, before any understanding or recall begins.



Think of a shopping trip with a list in your pocket. **The items on the list jump out from the shelves**, and everything else becomes background. On this book's reading, memory works like that list. The more you know about a field, the longer the list your eyes carry with them.

A new job makes the difference plain. In your first week, every message, form and face seems equally important. **After a year, your eyes go straight to the line that needs action**, and the rest slides past without effort. Nothing about your eyes has changed, only what is stored behind them.

A list in your pocket

The idea	What it is like
Memory	The shopping list
Knowing more about a field	A longer list your eyes carry

Hobbies show it too. A keen gardener walking down a street notices **which hedges need cutting and which roses look sickly**. Her neighbour, who has never grown anything, sees a pleasant road. Each of them is looking hard, at different things.

> **Key Concept:**
> Memory guides attention. In this book's terms, it means **your stored knowledge sets where you look first** (Chun & Turk-Browne, 2007). Once you know that, you can choose when to follow its lead and when to look past it on purpose.

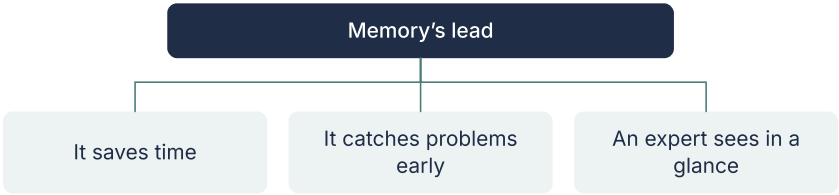
Same view, different store

What is stored	Where the eyes go
A year in the job	The line that needs action
A keen gardener's knowledge	Which hedges need cutting
Hundreds of rooms after parties	The table edge and the rug

That lead is usually a gift. It saves time, it catches problems early, and **it lets an expert see in a glance** what a beginner might miss after an hour. On this book's reading, much of what we call experience is this kind of trained looking.

Children show the lead forming. A child who has just learned the names of cars **starts pointing out every Mini on the street**. The cars were always there. What changed is the stored name that now draws her eyes to them.

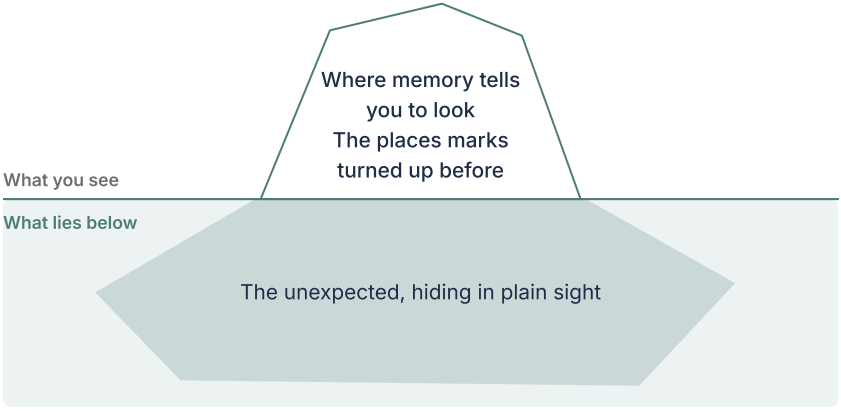
What the lead gives you



The same lead has a cost. If memory tells you where to look, it also tells you where not to bother. **The unexpected can hide in plain sight**, simply because nothing you have stored points your eyes towards it.

Think of a familiar drive home. You know the road so well that **you arrive with little memory of the drive**. On this book's reading, the stored route did so much of the steering that very little new reached your attention on the way.

The cost of the lead



Proofreading your own writing is the everyday proof. You know what you meant to write, so **your eyes read the sentence you intended**. The missing word or the doubled "the" slips past, while a friend reading it cold spots it in seconds.

On this book's reading, the friend has no memory of your intention to guide her. **She has to look at what is actually on the page.** That is a useful clue for how to look past your own guidance when you need to.

Reading your own page

	You	A friend reading it cold
What guides the eyes	What you meant to write	What is actually on the page
The doubled "the"	Slips past	Spots it in seconds

The same thing happens with a document you have read many times. **Each reading feels shorter**, because memory fills in what the eyes skip. That helps you find your place, and it fails you when someone has changed the page.

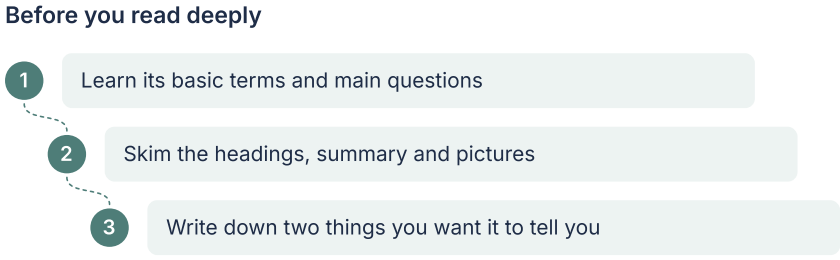
The first use of this link is to build the list on purpose. Before you read deeply in a new field, **learn its basic terms and its main questions**. On this book's reading, that early knowledge gives your attention somewhere to go when the detailed material arrives.

A document read many times

Each reading feels shorter	Memory fills in what the eyes skip	It fails you when the page has changed

A quick skim helps in the same way. Read the headings, the summary and the pictures of a chapter before the body. **You load a rough map into memory**, and your attention then knows which parts of the detail belong where.

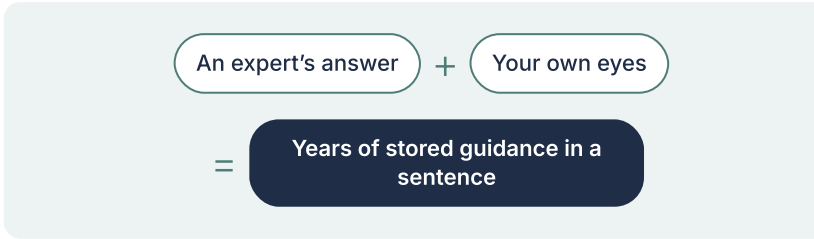
Questions do a similar job. Before you read, **write down two things you want the text to tell you**. On this book's reading, the questions sit in memory while you read, and your attention picks out the parts that answer them.



You can also borrow someone else's list. **Ask an expert what she looks at first** when she checks a car, a contract or a garden. Her answer hands you years of stored guidance in a sentence, and your own eyes can follow it straight away.

A checklist is a borrowed list written down. Many trades use written checklists. **A list on paper does not depend on what you happen to remember** under pressure. On this book's reading, a good checklist points attention where experience would, even on a bad day.

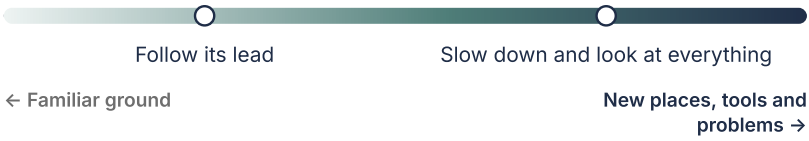
A borrowed list



Labels and fixed places work the same way at home. **A red tag on the spare key** or one shelf for passports means your memory does not have to search. Attention goes straight to the place you trained it to look.

The second use is to know when to step outside the list. New places, new tools and new problems are where memory's lead is weakest. **When the situation is new to you, slow down and look at everything** for a moment before you let old habits steer.

Where memory's lead is weakest



A small ritual can help. Before a familiar job, **pause and name one thing you usually skip**, such as the back of a form or the corner of a room. Then look at it first. The pause takes seconds, and it gives the unexpected a fair chance.

Swapping roles helps at work. **Let a newcomer check your process** and ask about anything that looks odd to her. She carries no list yet, so her attention lands on things that yours has learned to pass over.

Ways to look past the list

- Name one thing you usually skip, and look at it first
- Let a newcomer check your process

For your own writing, change how it looks before you check it. Print it, change the font or read it aloud. **A new look breaks the match with what you meant**, so your eyes have to deal with what is there.

None of this means distrusting your experience. **Most of the time, memory's lead is right**, and following it is what makes you quick and accurate. The skill is to notice the moments when the ground has shifted, and to look again.

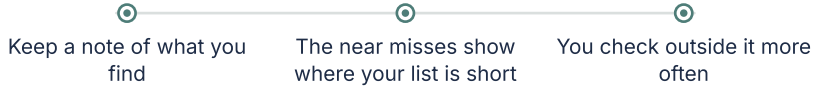
Before you check your own writing

- [ ] Print it
- [ ] Change the font
- [ ] Read it aloud

The exercises below grow from the finding that memory guides attention (Chun & Turk-Browne, 2007). **No study has tested them as training**, so treat them as practice ideas. The expert's first look borrows another person's list, and the fresh-eyes check gives the unexpected a turn.

Keep a note of what you find. **The things you nearly missed are the most useful part**, because they show where your own list is short. Over a few weeks you may notice that you check outside it more often.

Over a few weeks



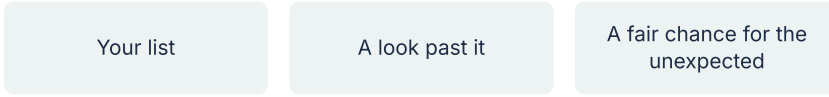
> Exercise:
>
> Try it. Before you open a cupboard you use every day, name three things in it. Then open it and find one you did not name.

Outside memory's list



> Exercise:
>
> Look past your list.
>
> 1. Starter. Ask someone who knows a task well what she looks at first. Try the task with her answer as your guide.
> 2. Middle. Before a familiar job, name one thing you usually skip. Look at it first, and note what you find.
> 3. Advanced. Take something you wrote last week. Print it or read it aloud, and **list every slip your normal reading missed**.

Look past it



Key idea:

Memory points attention at what it expects, so **follow its lead on familiar ground** and look past it when something is new.

Quick check:

1. What did the review say memory from past experience does? Answer: It "guides what should be attended" (Chun & Turk-Browne, 2007).
2. Why do people miss errors in their own writing? Answer: They know what they meant, so their eyes read the sentence they intended.
3. When should you step outside the list memory gives you? Answer: When the situation, tool or problem is new to you.

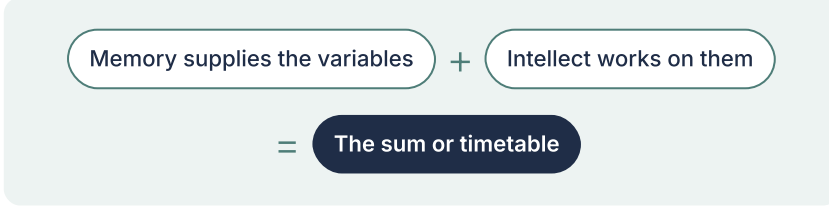
2.2 Memory and Intellect: Knowledge as the Material of Reasoning

2.2.1 Working Memory and Reasoning: Strongly Linked, Not the Same

You stand in a phone shop comparing two contracts. One is cheaper each month but runs for two years, and the other costs more but ends after one. **By the time you work out the second total, the first has slipped away.** The sum was easy, yet holding the numbers while you reasoned was not.

This chapter pairs memory with intellect. In the Intellect book's terms, intellect solves tasks where the variables are identified, such as a sum or a timetable. **Memory supplies those variables** and keeps them in view while intellect works on them.

Facts for the sum



Reasoning of this kind leans on working memory. **The facts have to stay put while you work on them.** If one slips, the reasoning has nothing to work with, however sharp it is.

Studies of how closely working memory and reasoning go together are told in 6.4 (Ackerman et al., 2005; Kane et al., 2005). **This section takes a different angle.** It asks what working memory brings to reasoning, and what else reasoning needs from memory.

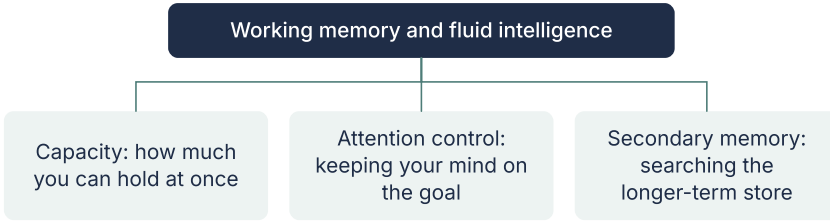
A total that faded

The first total slips away	The facts have to stay put	Reasoning has nothing to work with if one slips

> **Science Says:**
>
> One study looked for what lies behind the link. It found that "capacity, attention control, and secondary memory were uniquely related to WM storage, WM processing, and gF" (Unsworth et al., 2014). It added that "the three factors completely accounted for the relation between WM (both processing and storage) and gF" (Unsworth et al., 2014). **Three separate things explained the link.**

That needs a plain reading. WM is working memory, and gF is fluid intelligence, reasoning with new material. **The first factor is how much you can hold at once.** Attention control is keeping your mind on the goal, and secondary memory is the longer-term store you search when you pull back something learned earlier.

Three factors in the link



On this book's reading, that gives you **three places where reasoning can go wrong**. You may lose a fact you were holding. You may be pulled off the plan, or you may fail to find something you know. Each one calls for a different fix.



Three small trays on a workbench, one holding screws, one holding a pencil and one holding a folded instruction sheet.

The phone shop shows all three. **Holding was the first trouble**, since the first total faded while you worked on the second. A text arriving would have tested attention control. Forgetting how a contract's early exit fee works would have been a failure of secondary memory.

Three failures in the phone shop

Place	What could fail
Holding	The first total faded
Attention control	A text arriving
Secondary memory	How the early exit fee works

Each place has its own fix. **For holding, use paper.** Write the first total down before you start the second, and the space in your head is free for the sum in front of you.

Paper does more than store the number. **It lets you see the two totals side by side**, which no head does as well. On this book's reading, the comparison then becomes a matter of looking, and the reasoning has less to carry.

From holding to looking

In your head	On paper
The first total fades while you work on the second	The two totals side by side The comparison is a matter of looking

For attention control, guard the goal. **Say what you are trying to decide** before you start, such as "which costs less over two years". When a pull comes, that sentence brings you back to the right sum.

Pulls come from inside as well as outside. **A worry about the cost of a holiday**, or a thought about lunch, can take the same place as a text message. Writing the worry down for later lets the goal stay in charge.

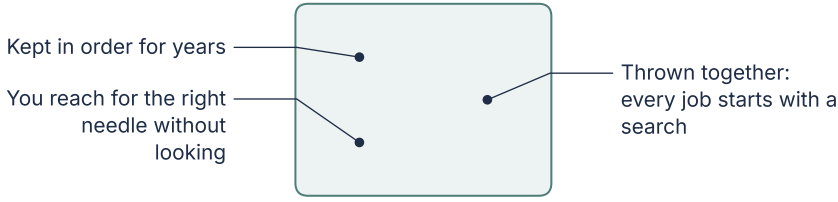
Guarding the goal

- Say what you are trying to decide
- Write an inside worry down for later
- Let the goal stay in charge

For secondary memory, the fix comes earlier. **Knowledge you can find quickly** is knowledge you stored with care and practised pulling back. The memory techniques in this book exist for that job, and reasoning is one of the places they pay off.

Think of a sewing box kept in order for years. **You reach for the right needle without looking.** A box thrown together in a hurry holds the same things, yet every job starts with a search. On this book's reading, stored knowledge behaves the same way, and the order you give it decides how quickly you find it.

The sewing box kept in order



A sewing box

On this book's reading, "strongly linked" is a statement about groups of people. **A link across a group still leaves room for each person to differ.** Your own reasoning may be stronger or weaker than your memory span suggests.

A link across a group

- People still differ
- Your reasoning may be stronger than your memory span suggests
- Or it may be weaker

"Not the same" describes the jobs. Think of a carpenter's workbench. **A bigger bench gives room to lay out the parts**, yet it does not cut a single joint. The skill of the carpenter and the size of the bench are separate, and a good result needs both.

On this book's reading, the same holds for memory and intellect. **Memory lays out the parts, and intellect does the cutting.** A problem can fail because the parts were missing or because the cut was wrong, and the two need different practice.

The bench and the cutting

The idea		What it is like
Working memory	≈	Room to lay out the parts
Intellect	≈	The carpenter cutting the joint
A good result needs both	≈	The skill and the size of the bench are separate

On this book's reading, you can see the split in daily life. Some people remember every detail of a story and still **draw an odd conclusion from it**. Others forget half the details and reason well from the rest.

> **Key Concept:**
> Working memory and reasoning. In this book's terms, they share the work of every sum you do in your head. **You can spot a holding failure by the urge to start again**, because an early number has gone. Muddled steps with every fact still in view point to the reasoning instead.

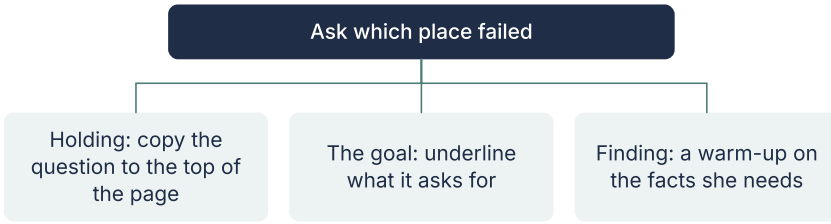
Which part failed?

What you spot	Where to look
The urge to start again: an early number has gone	Holding
Muddled steps with every fact still in view	Reasoning

Whether training working memory lifts reasoning is a fair question (Melby-Lervåg et al., 2016). **8.3.3 sets out the evidence on it**, and this section does not repeat it. Here the aim is to use the memory you have in support of the reasoning you do.

A child doing homework shows how the jobs mix. She knows her times tables, holds the question in mind and works through it. **If she gets it wrong, the cause could sit in any of the three places.** Asking which one failed is kinder and more useful than telling her to try harder.

Help for the homework



Each place suggests a small help. For holding, she can copy the question to the top of the page. **For the goal, she can underline what the question asks for.** For finding, a short warm-up on the facts she needs helps them come back when the real question arrives.

Experts lean on secondary memory more than they realise. **A surveyor reading a crack in a wall** pulls up years of cases in seconds. On this book's reading, much of her reasoning feels fast because the right knowledge is easy to find, and the holding job stays small.

A surveyor reading a crack

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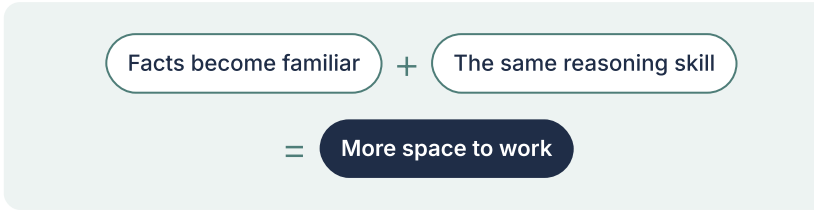
A surveyor reading a crack in a wall

- Pulls up years of cases in seconds
- The right knowledge is easy to find
- The holding job stays small

Beginners carry more in their heads. Every fact is new, so **each one takes a place in working memory** instead of arriving ready to use. That is one reason a hard problem feels harder in an unfamiliar field, even for someone who reasons well elsewhere.

That is a hopeful message for anyone learning a new field. **As facts become familiar, they stop taking up room**, and the same reasoning skill has more space to work. On this book's reading, part of getting better at a subject is this shift from holding to finding.

From holding to finding



You can lighten the holding job in any field. **Lay the facts out on paper** before you start, in a list, a table or a sketch. The reasoning then works from the page, and working memory only has to carry the step you are on.

A table is often the best layout for a choice. **Put the options across the top and the facts down the side**, such as price, length and exit fee. Every fact then has one place, and your eyes can do the holding.

Lay out a phone contract choice

Fact	First contract	Second contract
Price	Cheaper each month	Costs more
Length	Two years	One year
Exit fee	Write the fee down	Write the fee down

The exercises below use this section's three places as a guide (Unsworth et al., 2014). **No study has tested them as training**, so treat them as practice. The fault finder helps you name which place failed, and the laid-out plan takes the holding job off your mind.

Look at your notes after each level. **The same failure may turn up again and again**, such as losing a number or being pulled off the plan. That pattern tells you where your own practice should start.

Read the fault finder

- [x] You lost a fact
- [x] You lost the goal
- [x] You could not find something you knew

> **Exercise:**
> Try it. Before your next sum in your head, say what you are trying to find out. Then write each total down as you reach it.

Goal first, then paper

Guard the goal	The numbers on paper

> **Exercise:**
> Find the failing part.
>
> 1. Starter. Choose a sum you often get wrong, such as splitting a bill. Do it on paper, writing every number down before you use it.
> 2. Middle. Run a fault finder. After a reasoning task goes wrong, note whether you lost a fact, lost the goal or could not find something you knew.
> 3. Advanced. For one real decision, **lay out every fact on one page** before you reason about it. Compare the result with how you usually decide.

Room for reasoning

Facts on paper	A goal in view	Room for the sum

Key idea:

Working memory holds the facts and reasoning works on them, so find which part failed before you decide what to practise.

Quick check:

1. What three factors accounted for the link between working memory and fluid intelligence? Answer: "capacity, attention control, and secondary memory" (Unsworth et al., 2014).
2. What is secondary memory? Answer: The longer-term store you search when you pull back something learned earlier.
3. In the workbench picture, what does the bench stand for? Answer: Working memory, which gives room to lay out the parts without doing the reasoning.

2.2.2 Chunks and Expertise: Why Knowledge Makes Problems Smaller

My neighbour has knitted for forty years. She glances at a pattern and says "two rows of rib, then the cable", and her needles are already moving. **Her granddaughter reads the same line one stitch at a time** and loses her place twice before the end of the row.

They are reading the same page, yet the problem is a different size for each of them. **Stored knowledge makes the problem smaller.** This section looks at how that happens, and at what it means for reasoning in your own field.

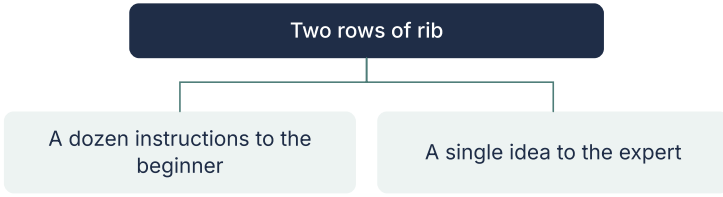
The same page, a different size

The neighbour	Her granddaughter
“Two rows of rib, then the cable”	Reads the line one stitch at a time
Her needles are already moving	Loses her place twice

You have felt this yourself. **A form you fill in every month** takes minutes, while a new form of the same length can take an hour. On this book’s reading, the old form arrives in a few familiar blocks, and the new one arrives in pieces.

The tool behind it is chunking. **A chunk lets many small pieces travel as one.** “Two rows of rib” is a dozen instructions to the beginner, and a single idea to the expert.

A chunk carries the pieces



The classic study of expert memory in chess (Chase & Simon, 1973) is told in 3.1.1. **I will not repeat its findings here.** This section follows the idea one step further, from what experts remember to how that memory shapes the way they reason.

A second line of research looked at how experts and beginners sort problems (Chi et al., 1981), and 5.1.2 tells what it found. **The point for this section is the result for reasoning.** What you see in a problem depends on the chunks you already have.

The point for reasoning

- Chess memory is told in 3.1.1
- Sorting problems is told in 5.1.2
- What you see depends on the chunks you already have



A chessboard in a café window, two players leaning over it while a third watches with folded arms.

On this book's reading, a problem is only as big as the number of pieces you must hold at once. **The expert holds a few large pieces**, while the beginner holds many small ones. Both have the same small working memory.

That changes how each person can reason. With a few large pieces, the expert has room left to compare, check and plan. **The beginner's space is full of pieces**, so very little is left for thinking about how they fit together.

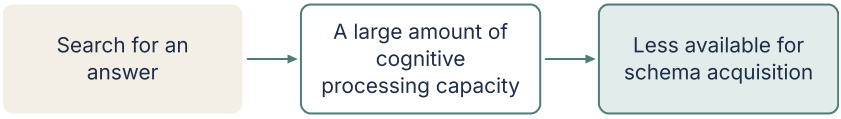
Same small working memory

	Expert	Beginner
Pieces to hold	A few large pieces	Many small pieces
Room for thinking	Compare, check and plan	Space is full of pieces

Think of carrying shopping up the stairs. **Ten loose tins take several trips**, while the same tins in two bags go up at once. The tins are no lighter, yet they travel in fewer units, and your hands are free for the banister.

> **Science Says:**
> One study of problem solving looked at the cost of searching for an answer. It found that means-ends analysis "requires a relatively large amount of cognitive processing capacity which is consequently unavailable for schema acquisition" (Sweller, 1988). **Hard searching can crowd out learning.** A schema is a stored framework of knowledge, the kind of pattern an expert carries.

When searching crowds out learning



Means-ends analysis, in the usual sense of the term, means working on the gap between where you are and your goal. You close it step by step. **It is an easy method to reach for when a problem is new to you.** You look at the goal, look at where you stand and try something to close the gap.

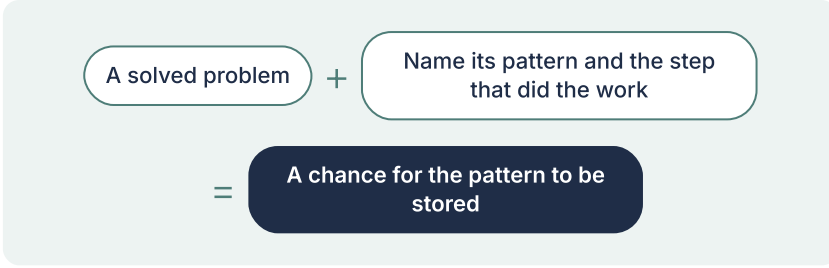
On this book's reading, the trouble is what that leaves behind. **You can solve the problem and learn little from it**, because the search used up the space you would have used to notice the pattern. The next problem of the same kind then feels just as hard.

A solved problem, little learned

The search used up the space	Little room to notice the pattern	The next problem feels just as hard

That points to a habit worth building. **After you solve a problem, go back and name its pattern.** Ask what kind of problem it was and which step did the real work. That short review gives the pattern a chance to be stored once the search is over.

Once the search is over



Think of a hill walk in fog. **You reach the top by feeling your way from cairn to cairn**, and you could not draw the route afterwards. A second walk on a clear day shows you the shape of the whole hill, and the next foggy walk is much easier.

The second walk is the review step in disguise. **It turns a route you survived into a route you know.** On this book's reading, the same is true of any problem you solve once and never look at again.

Two walks on the hill

In fog	On a clear day
Feel your way from cairn to cairn	See the shape of the whole hill
Cannot draw the route afterwards	The next foggy walk is easier

> **Key Concept:**
> Knowledge makes problems smaller. In this book's terms, **you can spot it when a task that once filled your head leaves room to spare**. That is the moment to take on a harder problem in the same field, since your patterns are ready to carry more.

The same idea explains why experts can seem to reason faster. **They are often recognising more and searching less.** A pattern that fits the problem arrives from memory, and reasoning only has to check it.

Recognition leaves room

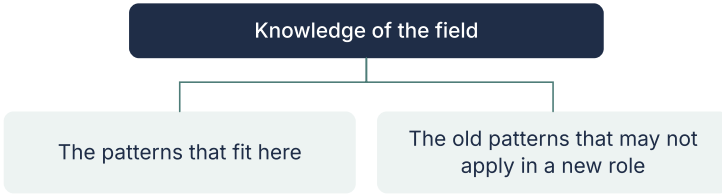
- The doctor recognises a rash
- The student works through a list of questions
- Only one still has room to notice something else is wrong

A doctor who has seen a rash many times **names it before she has finished looking**. A student doctor works through a list of questions to reach the same answer. On this book's reading, both arrive, and only one of them still has room to notice that something else is wrong.

Recognition has limits. A pattern from one field rarely fits another, so **an expert in one area can be a beginner in the next**. On this book's

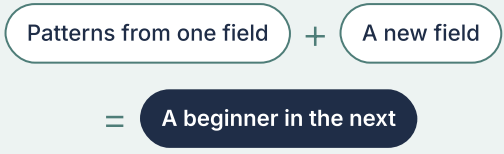
reading, the size of a problem depends on your knowledge of that field, and general cleverness does not shrink it much.

An expert in one area



That is worth keeping in mind when you move into a new role. **Your old patterns may not apply**, even if the work looks similar on the surface. Give yourself time to build new chunks before you judge how well you reason in the new setting.

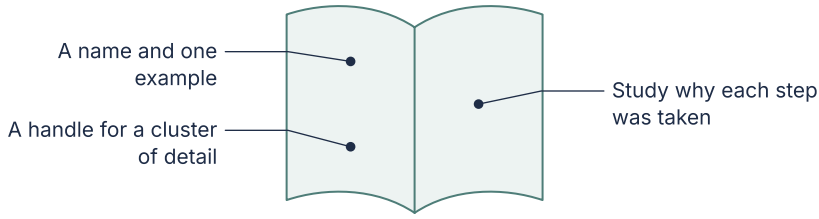
A pattern from one field



You can build chunks on purpose. **Learn the common patterns of your field by name.** They might be the usual faults in a boiler or the typical shapes of a tax question. Each name becomes a handle that holds a whole cluster of detail.

Worked cases help too. **Study a solved problem before you try your own**, and spend your effort on why each step was taken. On this book's reading, that leaves room for the pattern to go in, since you are not also searching for the answer.

The pattern list



The back page of a notebook

Mixed practice tests your patterns. **Solve problems of different kinds in one sitting**, and before each one, say which kind it is. Naming the kind first trains you to see the pattern before you start searching.

Mistakes are useful here. **A wrong label tells you which patterns you confuse**, such as two kinds of question that look alike. Write the pair down side by side, with one line on how to tell them apart.

Building and testing chunks

- [x] Learn common patterns by name
- [x] Study a solved problem before trying your own
- [x] Name the kind before each mixed problem
- [x] Write confused patterns side by side

Teaching shows whether a chunk is real. **Explain a pattern to someone newer than you**, using one example. If you cannot say what makes it a single unit, it may still be a loose bundle of pieces in your own memory.

Talking a problem through with a colleague does something similar. **You hear yourself name the steps**, and gaps in the pattern show up as

places where you stall. On this book's reading, a stall marks a chunk that has not yet formed.

Does the chunk hold?

How you test	What you find
Explain a pattern with one example	Can you say what makes it a single unit?
Talk a problem through	A stall marks a chunk not yet formed

Beginners need patience with themselves. **Every expert once read the pattern one stitch at a time.** On this book's reading, the chunks that make problems small are built slowly, one named pattern after another.

The exercises below come from this section's sources and from this book's own habits. The review step follows the point that searching can crowd out learning (Sweller, 1988). **No study has tested these exercises as training**, so treat them as practice ideas.

The exercise is a practice idea

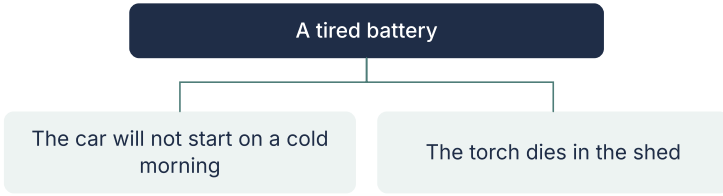
> - The review step follows the point about searching
> - No study has tested these exercises as training
> - Keep a short pattern list as you go

Keep a short pattern list as you go. **Each entry is a name and one example**, such as "split the bill, add first, then divide". Over weeks, the list shows you which patterns your field leans on most.

The back page of a notebook makes a good home for the list. **Some entries can take months to earn a name**, such as the way a car that will not start on a cold morning and a torch that dies in the shed both

come down to a tired battery. Once named, the next flat battery takes minutes.

One name for two troubles



> **Exercise:**
> Try it. After your next solved problem, write one line naming what kind of problem it was and which step did the work.

> **Exercise:**
> Grow your chunks.
>
> 1. Starter. Pick one problem you solved this week. Name its pattern in a few words and add it to a pattern list.
> 2. Middle. Before you try a new problem, study one solved example of the same kind. Note why each step was taken.
> 3. Advanced. Solve five problems of mixed kinds in one sitting. **Name each one's kind before you start**, and check how often you were right.

Give a pattern a handle

A name	One example	A handle for detail

Key idea:

Stored patterns turn many pieces into one, so **name the pattern after each problem** and the next one will feel smaller.

Quick check:

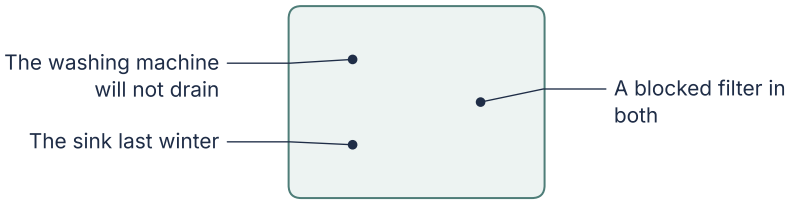
1. What can hard searching crowd out, according to Sweller? Answer: Schema acquisition, since it "requires a relatively large amount of cognitive processing capacity" (Sweller, 1988).
2. Why can an expert reason with room to spare? Answer: She holds a few large pieces, so space is left for comparing and checking.
3. What should you do after solving a problem? Answer: Go back and name its pattern and the step that did the work.

2.2.3 Remembering a Similar Problem: Analogy and Transfer

Your washing machine will not drain, and you are about to ring for a repair. You remember the kitchen sink last winter, and the small filter you had to clean before the water would move. **Behind a little hatch at the front is the same kind of filter.** Ten minutes later the drum is empty.

That rescue came from memory. **You solved a new problem with an old one.** This section looks at how reasoning runs on remembered cases. It also asks why the useful case so often stays hidden, and how to bring it to mind.

Water held back

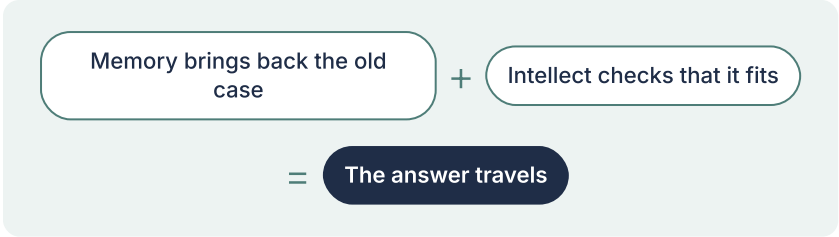


The same kind of filter

The old case did not arrive by luck. **Something about the stuck water** reminded you of the sink, and you let the thought run instead of reaching for the phone. On this book's reading, that small pause is where many good answers begin.

The old case worked as an analogy, a link between two things that work in the same way. **The sink and the washing machine share a structure**, water held back by a blocked filter, even though they look nothing alike. Seeing that shared structure is what let the old answer travel.

Where transfer happens

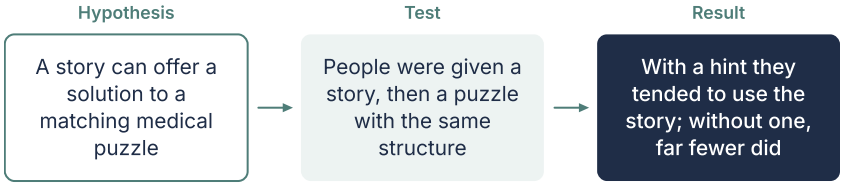


Using what you learned in one place on a new problem is called transfer. **Transfer is where memory and intellect meet in a single**

moment. Memory has to offer the old case, and intellect has to check that it really fits.

> **Science Says:**
>
> A classic study gave people a story and then a medical puzzle with the same structure. They "tended to generate analogous solutions to a medical problem (Duncker's 'radiation problem'), provided they were given a hint to use the story" (Gick & Holyoak, 1980). Yet "when no hint to consider the story was given, frequency of analogous solutions decreased markedly" (Gick & Holyoak, 1980). **The useful memory was there, and mostly unused.**

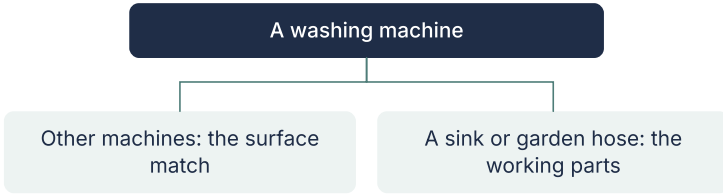
What the hint changed



That needs a plain reading. Analogous solutions are answers borrowed from the matching case. **Without a hint, far fewer people thought to use the story**, even though they had just read it. The groups were small, so the result is best read as a clear warning and a modest estimate.

On this book's reading, the problem is the way memory is searched. **We tend to recall cases that look like the new one on the surface.** A washing machine reminds you of other machines, while the case you need may be a sink or a garden hose.

The useful case may look different





A garden hose lying on a lawn with a kink in it, a thin trickle of water coming from the nozzle.

That gives the first habit. **When you are stuck, ask what the problem is like underneath.** Strip it down to its working parts, such as something blocked, something too slow or two people wanting the same thing. Then search your memory for any case with those parts.

A friend asks for help with a new rota at work. Two people want the same Fridays off, and nobody will budge. **Underneath, it is the same problem as two children wanting the same toy.** Whatever worked at home, taking turns or splitting the prize, becomes a candidate to test.

A rota, and a toy

At work	At home	A candidate to test
Two people want the same Fridays off	Two children want the same toy	Taking turns or splitting the prize

Testing is the second habit, and it belongs to intellect. **An analogy offers an answer, and it does not prove one.** Check where the two cases differ, since a difference in a working part can make the old answer fail.

The rota shows that check at work. Children can take turns by the hour, while Fridays come once a week. **Taking turns still fits, if it runs over months.** On this book's reading, most borrowed answers need a small change of this kind before they work.

Check the working difference

Same structure	Difference	Change to the answer
Two people wanting the same thing	Fridays come once a week	Take turns over months

Think of borrowing a key from a neighbour. **It may open your door, or it may only look similar**, and the only way to know is to try it gently in the lock. An old answer is the same kind of key, and the trying is the checking.

Trying the borrowed key

It may open your door	It may only look similar	Try it gently in the lock

A later study by the same team is told in 6.3.1 (Gick & Holyoak, 1983). **That section also builds a drill on it.** This section adds the reasoning side, which is how to use a remembered case once you have found it.

> 🗝 **Key Concept:**
>
> Transfer. In this book's terms, transfer is **a search you start on purpose, because the helpful case rarely announces itself**. It often comes from a different part of life and matches the new problem only in the way its parts fit together.

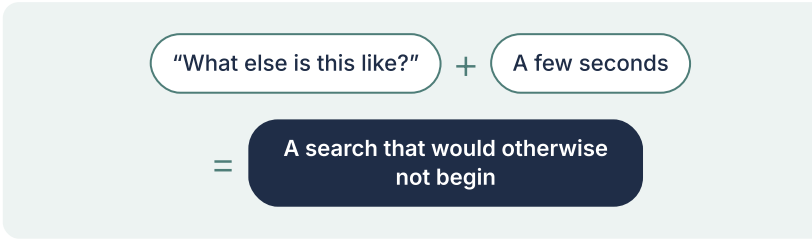
A question to start the search

- Give yourself the hint the groups lacked
- Ask whether you have met anything like it before
- Search any part of your life

The hint in the study points to a third habit. **Give yourself the hint the study's groups lacked.** Before you start on a new problem, ask out loud whether you have met anything like it before, in any part of your life.

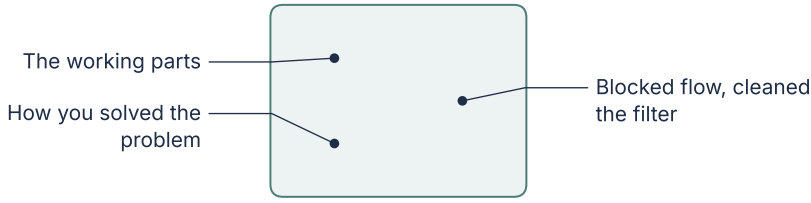
You can make that question routine. Write it at the top of your page, or say it at the start of every meeting about a stuck problem. **"What else is this like?"** costs seconds, and it opens a search that would otherwise not begin.

Seconds that open a search



A store of cases helps the search. **Keep a short note of problems you solved and how**, written in terms of their working parts. "Blocked flow, cleaned the filter" travels better than "fixed the sink", because it names what the problem was like underneath.

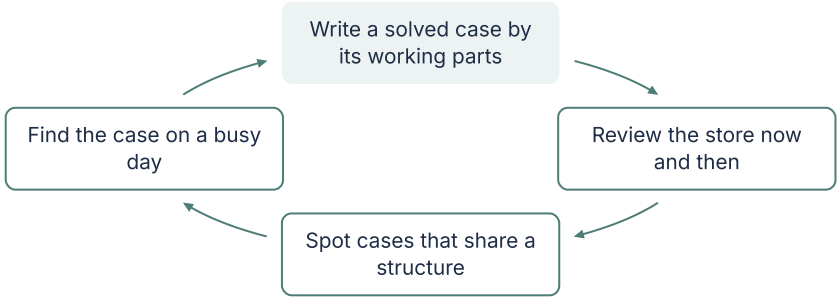
A store of solved cases



A short note of each solved problem

Review the store now and then. **Reading old cases keeps them easy to find**, and you often spot two that share a structure you had not noticed. Each match you find on a quiet day is one less search on a busy one.

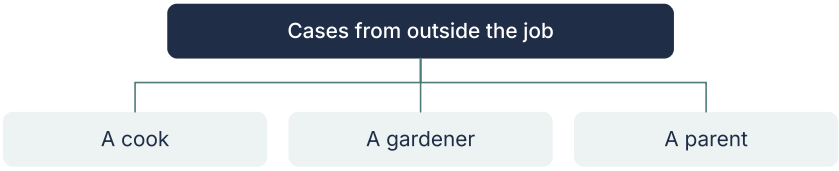
Keeping cases ready



Variety in the store helps too. **Cases from many parts of life give memory more to offer.** On this book's reading, a cook, a gardener and a parent each carry patterns that can help at work. They help most when they are stored by structure.

Groups can share their stores. In a team, **ask each person for one case from outside the job** that looks like the problem underneath. The answers will often miss, and now and then one will fit well enough to test.

More for memory to offer



Children can learn the habit early. **Ask a child what a new puzzle reminds her of**, and then whether the reminder helps. She practises the search and the check together, long before she has a word for either.

The Intellect book looks closely at patterns, rules and analogies, and the Creativity book uses distant links to build new ideas. **Here the focus is**

memory's part, which is offering the old case at the moment you need it.

Search and check together

- Ask a child what a new puzzle reminds her of
- Then ask whether the reminder helps
- Memory brings back the case when it is needed

Analogies can mislead as well as help. **A case that fits on the surface may fail underneath.** A new manager may run her team the way her last team liked to be run. The habit of checking differences protects you from the easy match.

When a match misleads, the fix is to name the difference. Suppose **her new team is larger and more experienced**, so the close checking that suited the old one now feels like distrust. Once the difference is named, she can keep what fits and drop the rest.

A new team, a different answer

Old case	Working difference	What to keep
Close checking suited the last team	The new team is larger and more experienced	Keep what fits and drop the rest

Beginners in a field have fewer cases to draw on, and that is no reason to wait. **Borrow cases from other fields you know well.** A first-time project manager who has run a school fair already knows a great deal about deadlines, helpers and last-minute changes.

A simple sign tells you a case is worth a test. **The same working parts turn up in both**, such as a limit, a queue or a missing piece. If you can

name two shared parts, try the old answer, and if you can name only a shared look, keep searching.

A case worth a test

- [x] Name two shared working parts
- [x] A limit, a queue or a missing piece
- [x] If only the look is shared, keep searching

The exercises below come from the analogy studies above (Gick & Holyoak, 1980) and from this book's own habits. **No study has tested them as training**, so treat them as practice ideas. The underneath question trains the search, and the case log builds the store it searches.

Keep score as you go. **Note each time an old case helped and each time it misled you.** After a few weeks, the notes show which kinds of case transfer well for you, and which ones need the most checking.

The score to keep

> - Each time an old case helped
> - Each time it misled you
> - Which cases need the most checking

> **Exercise:**
> Try it. Next time you are stuck, ask "what else is this like?" and name one case from a different part of your life.

Two cases, one structure

A case from home	A problem at work

Exercise:

Find the old case.

1. Starter. Take a problem you solved this month. Describe it in terms of its working parts, then think of one other case with the same parts.
2. Middle. Start a case log. For two weeks, write each solved problem as "working parts, then the fix", in one short line.
3. Advanced. Before a real stuck problem, search your case log for a match. **List where the old case and the new problem differ**, and change the answer to fit.

An answer to test

An old case	A check of differences	A candidate answer

Key idea:

Reasoning often runs on a remembered case, so ask what else the problem is like and then check where the two differ.

Quick check:

1. What happened in the study when no hint to use the story was given? Answer: The "frequency of analogous solutions decreased markedly" (Gick & Holyoak, 1980).
2. What question gives you the hint the groups lacked? Answer: "What else is this like?"
3. Why should you check where two cases differ? Answer: An analogy offers an answer and does not prove one, so a difference in a working part can make it fail.

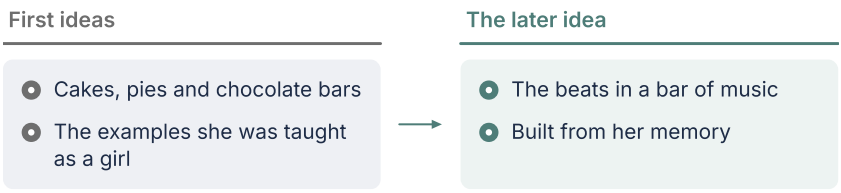
2.3 Memory and Creativity: The Raw Material and the Trap

2.3.1 Associations: How Stored Knowledge Becomes New Ideas

A maths teacher needs a fresh way to explain fractions to a class that has heard it all before. Her first three ideas are cakes, pies and chocolate bars, the same examples she was taught as a girl. **Then she thinks of the beats in a bar of music**, and the lesson suddenly has somewhere new to go.

Both kinds of idea came from her memory. **The first ones arrived ready-made, and the later one was built.** This section looks at how stored knowledge turns into new ideas, and at how to get past the ready-made ones.

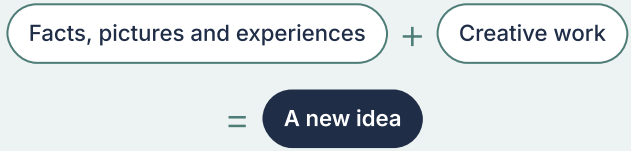
Ready-made, then built



You may have done the same at a family dinner. **Asked for a toast, you reach first for lines you have heard before**, then search for something truer to the evening. Both come from memory, and the second takes longer because it has to be put together.

This chapter pairs memory with creativity. In the Creativity book's terms, creativity is solving tasks where the variables are not identified. **Memory supplies the raw material** for that work, the facts, pictures and experiences that a new idea is made from.

The raw material



An early theory of creative thinking (Mednick, 1962) is told in 6.3, along with its test. **This section looks at what later studies add** about how memory feeds an idea.

> **Science Says:**
>
> One study asked people to come up with new uses for an object. It found that "initial responses were based on a strategy of Retrieval from long-term memory of pre-known uses" (Gilhooly et al., 2007). **The first ideas were remembered ones.** Later ideas came from other strategies, such as imagined "Disassembly of the target object into components" (Gilhooly et al., 2007).

In the new-uses study



That matches the teacher's morning. Cakes and pies were pre-known uses, already stored as fraction examples. **The music idea needed a different move**, taking a known thing apart and seeing a new part in it, the beats inside a bar.

The same study found that "Novelty of uses was particularly associated with the Disassembly strategy" (Gilhooly et al., 2007). Novelty means newness. **Taking an object apart in your mind** went with the newest ideas of all.

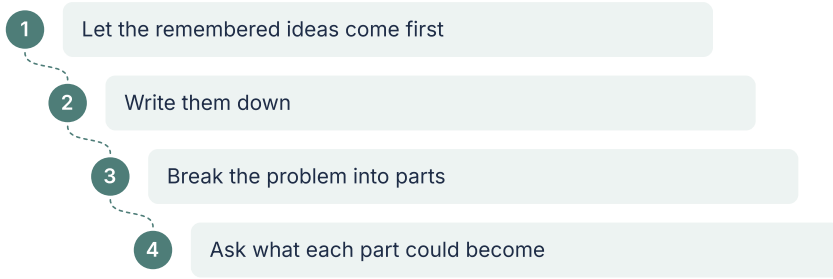
Disassembly and novelty



On this book's reading, that gives a plain plan for idea work. **Let the remembered ideas come first, and write them down.** They clear the way. Then switch to building, by breaking the problem or the object into parts and asking what each part could become.

Disassembly works on problems as well as objects. **A slow morning routine has parts**, such as waking, washing, dressing and eating. Asking what each part could become, or whether two could happen at once, gives ideas a whole-routine view would miss.

A plan for idea work



A second team looked at the shape of stored knowledge itself. They studied semantic memory, your store of facts and meanings, and **asked how its links differ between people**. The finding is about networks, a word for things joined to one another by links.

> **Science Says:**
> The team reported that "The semantic memory network of persons with low creative ability seems to be more rigid, compared to the network of persons with high creative ability" (Kenett et al., 2014). **Rigid here has a special meaning.** The low-creativity network was "more spread out and breaks apart into more sub-parts" (Kenett et al., 2014).

Two semantic memory networks

	Low creative ability	High creative ability
Network	More rigid	More flexible
Shape	Spread out, breaks apart into sub-parts	Paths run between the clumps

That needs a plain reading. In the more rigid network, ideas sat in separate clumps with few paths between them. **In the more flexible one, paths ran between the clumps**, so a thought could travel further from where it started.

Think of a town where every district has its own roads and only one bridge joins them. **Getting from one side to the other takes a long detour.** A town with many bridges lets you cross in minutes. On this book's reading, a flexible memory network is the town with many bridges.

A town with many bridges

The idea	What it is like
A rigid network	Districts joined by only one bridge
A flexible network	Many bridges: you cross in minutes

On this book's reading, a rigid network can feel safe. **Every idea stays close to home**, inside the clump it belongs to. That helps when you are checking facts, and it helps less when you need an idea nobody in your field has had.



An aerial view of a river town with several bridges, small boats moored along both banks.

These studies measured links between people, and they do not show that one causes the other. **Still, they point in a useful direction for practice.** On this book's reading, building paths between the separate parts of what you know gives future ideas more routes to travel.

A third study separated two kinds of thinking that can look alike. It addressed "the generation of genuinely new creative ideas, in contrast to the mere recollection of old ideas from memory" (Benedek, Jauk, Fink, et al., 2014). **Recalling an old idea and building a new one are different acts**, even when both feel like having an idea.

Two acts that feel alike

Recalling an old idea	Building a new one

> **Key Concept:**
> Associations. In this book's terms, associations are **the links in memory that let one stored idea lead to another**. A new idea often comes from following a link further than usual, past the first ideas that sit close to the problem.

The teacher's two kinds of idea show the difference. **Cakes were recollection**, a stored example brought back. The music beats were generation, two stored things joined in a way she had not joined them before.

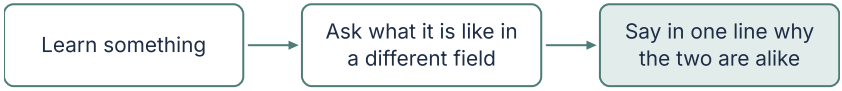
The teacher's two kinds of idea

Kind	Her example
Recollection: a stored example brought back	Cakes
Generation: two stored things joined	The music beats

You can build bridges on purpose. **Each time you learn something, ask what it is like in a different field.** A rule in cooking or a pattern in music may share a shape with your work. The link you notice becomes a path for later.

A good bridge has a reason. **Say in one line why the two things are alike**, such as "both have a rhythm" or "both run out if you rush". The reason turns a loose thought into a path you can find again.

Build a bridge



Variety in what you take in helps too. On this book's reading, a store filled from one field has fewer bridges to build. **Read, listen and look outside your own area now and then**, so your memory holds material from more than one district.

During idea work, give yourself permission to keep going. **The first ideas will feel finished**, because they are familiar. On this book's reading, that sense of being done arrives early, and the newer ideas tend to come after it.

Keep going past the first ideas

> - The first ideas will feel finished
> - The newer ideas tend to come after that feeling

Taking things apart is a skill you can practise. **Pick an everyday object and list its parts**, its materials and what each part does. Then ask what

each part could do somewhere else. The newer ideas often hide in a part nobody thinks about.

Groups can feed one another's links. **Ask each person to say one idea that came from their own field.** A nurse, a builder and a cook bring different stores, and an idea from one can open a path in another person's memory.

Take an everyday object apart



Write ideas down as they arrive. **An idea said once and never noted** can be gone by the end of the meeting, and with it the link it opened. A shared page lets everyone see the paths the group has built.

None of this means throwing away your first ideas. **Some of the best answers are remembered ones**, used well. On this book's reading, the aim is to know which kind you have in front of you. Look further when the remembered kind is not enough.

Remembered or built

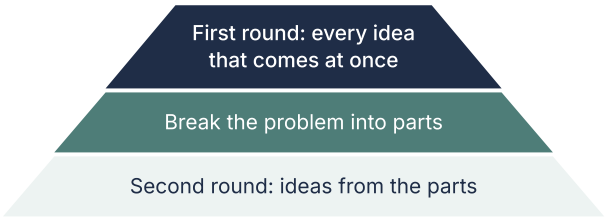
Remembered ideas	Built ideas
⊕ Some of the best answers, used well	⊖ Look further when the remembered kind is not enough

The exercises below come from the studies above (Gilhooly et al., 2007; Kenett et al., 2014). **No study has tested them as training**, so treat them as practice ideas. The two-round list follows the move from

remembered to built ideas, and the bridge log grows links between fields.

Watch your own pattern as you go. **Note which round gives you the ideas you like best.** If it is always the first, push the second round longer next time and see whether anything new turns up.

Two rounds of ideas



> **Exercise:**
>
> Try it. Write three uses for a teaspoon in one minute. Then take it apart in your mind and find one new use for one part.

Remembered, then built

Remembered first	Built second

> **Exercise:**
>
> Past the first ideas.
>
> 1. Starter. For one small problem, write down every idea that comes at once. Mark each one remembered or built.
> 2. Middle. Run a two-round list. After the first round, break the problem into parts, and write a second round from the parts.

3. Advanced. Keep a bridge log for two weeks. Each day, **link one new thing you learned to a field far from it**, in one short line.

One part, new use

A teaspoon	Take it apart in your mind	One new use for one part

Key idea:

First ideas come from memory ready-made, so **write them down and then take the problem apart** to build newer ones.

Quick check:

1. Where did people's first ideas come from in the study of new uses? Answer: "Retrieval from long-term memory of pre-known uses" (Gilhooly et al., 2007).
2. Which strategy went with the newest uses? Answer: The Disassembly strategy, taking the object apart into components (Gilhooly et al., 2007).
3. What made a memory network more rigid in the study of creative ability? Answer: It was "more spread out and breaks apart into more sub-parts" (Kenett et al., 2014).

2.3.2 Remembering to Imagine

A FRIEND IS PLANNING THE kitchen of her new flat, which is still bare walls and wires. She stands in the empty room and pictures where the cooker will go. **Every piece of that picture comes from kitchens she has known**, her mother's, her old shared flat and a café where she once worked.

The kitchen she imagines does not exist yet, but it is built from remembered parts. **This section looks at how imagination draws on memory.** It also asks why new ideas tend to keep the shape of old ones, and what that means when you set out to invent.

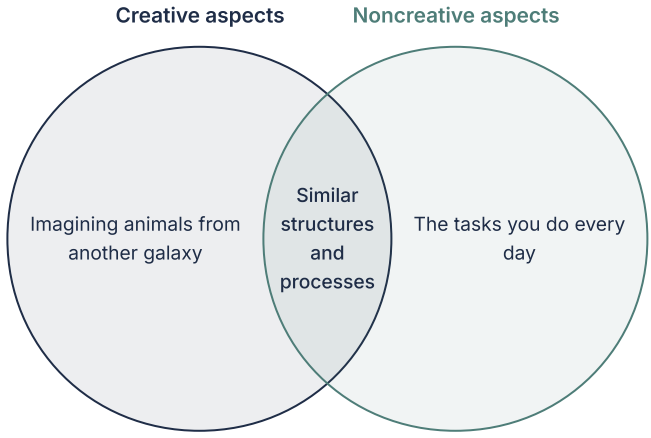


A woman in an empty room with bare plaster walls, holding a tape measure and looking at a pencil mark on the wall.

It can seem as if imagining and remembering pull in opposite directions. **One looks back and the other looks forward.** On this book's reading, they share the same store, and imagining is often remembering taken apart and put back together in a new order.

> **Science Says:**
>
> One researcher asked students to imagine animals from another galaxy. The summary reports "5 experiments involving 385 undergraduates" whose results "are consistent with the idea that similar structures and processes underlie creative and noncreative aspects of cognition" (Ward, 1994). **Cognition is a word for thinking.** The work explores "The concept of structured imagination" (Ward, 1994).

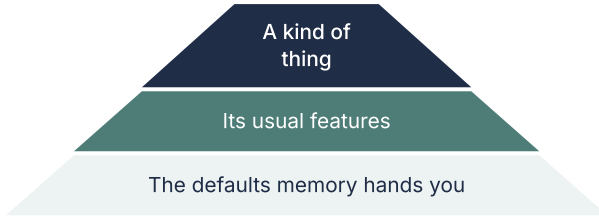
Creative and ordinary thinking



That needs a plain reading. Imagining a new creature uses the same thinking that ordinary tasks use. **Invention is not a separate gift** that switches on in special moments. It runs on the knowledge and habits you use every day.

The summary also names "the role of characteristic properties" (Ward, 1994). Characteristic properties are the usual features of a kind of thing. **On this book's reading, they are the defaults** that memory hands you when you start to imagine something of that kind.

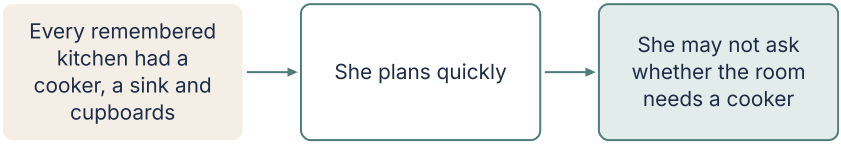
Where the defaults come from



> **Key Concept:**
> Structured imagination. In Ward's term, structured imagination describes how **new ideas keep the structure of known kinds of thing**. When you invent, memory supplies a frame, and the new idea grows inside that frame unless you change it on purpose.

The kitchen shows the frame at work. **Your friend pictures a cooker, a sink and cupboards** because every kitchen she remembers had them. That frame helps her plan quickly, and it may also keep her from asking whether the room needs a cooker at all.

The frame at work



The frame also shapes what feels possible. On this book's reading, **an idea outside the frame can look wrong at first**, because nothing like it is in memory. That feeling is worth noticing, since it may mark the newest idea on the page.

A model from the same field puts the steps in order. It describes "how preinventive structures such as creative mental images are generated and interpreted" (Finke, 1996), and it is called the geneplore model. **Preinventive structures are rough first forms**, pictures or sketches that come before a finished idea.

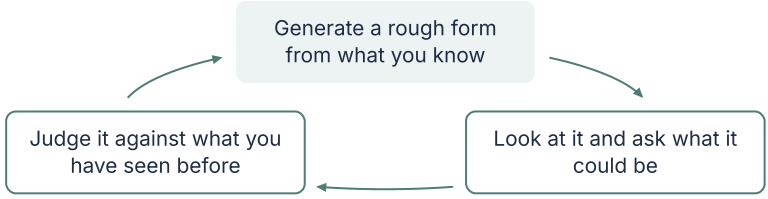
Inside and outside the frame

> - The frame helps you plan quickly
> - An idea outside it can look wrong at first
> - That feeling may mark the newest idea

On this book's reading, memory feeds both steps of that model. **You generate a rough form from what you know**, then look at it and ask what it could be. The looking also uses memory, because you judge the rough form against everything you have seen before.

The same paper contrasts "The intentional, structured qualities of creative thinking" with "its spontaneous, unstructured qualities" (Finke, 1996). **Some idea work is planned and some simply arrives.** On this book's reading, memory plays a part in both, steering the planned work and supplying the sudden pictures.

Memory feeds both steps



You can use the two steps on purpose. **Sketch a rough shape without deciding what it is for**, such as a doodle, a box or a few lines. Then look at it and ask what it could become. The looking pulls in memories you would not have searched for.

> **Science Says:**
>
> Another team gave people "brief training in recollecting details of a recent event" and reported that "an episodic-specificity induction also enhances divergent creative thinking" (Madore et al., 2015). **A later pooled review was more cautious.** It found "a small increase in fluency (number of ideas)... that became weaker or null after correction for publication bias" (Tomás et al., 2026).

Recalling events before idea work



Several words need plain meanings. Episodic memory is your memory of events you lived through. **Divergent thinking means producing many different ideas** for one problem. An induction is a short task given to people before the main test.

Publication bias is the habit of journals printing positive results more often than empty ones. **A pooled review can correct for it** and see whether an effect survives. Here the small gain in number of ideas shrank or vanished. For the quality of ideas, the review reported "no significant effect of ESI" (Tomás et al., 2026), ESI being the induction.

Words that need plain meanings

Term	Plain meaning
Episodic memory	Your memory of events you lived through
Divergent thinking	Producing many different ideas for one problem
Induction	A short task given before the main test
Publication bias	Journals printing positive results more often

Recalling a recent event in detail is therefore not a proven way to boost ideas. **I would not lean on it as a method.** The study tested only a recall exercise done beforehand. On this book's reading, remembering and imagining still share their material, as the kitchen at the start shows.

Rich memories give imagination more to work with. On this book's reading, **someone who has seen many kinds of kitchen** has more parts to build from than someone who has seen one. Travel, reading and curiosity all add to the store that imagination will later use.

Recall as a method

What still holds	Not proven
⊕ Remembering and imagining share their material	⊖ A proven way to boost ideas

Detail matters too. A vague memory gives a vague picture. **Notice the small features of things you like**, such as the height of a worktop or the way a door swings. They will be there when you next imagine something new.

Now turn to the frame itself. If every new idea keeps the shape of old ones, the most useful step is to **name the frame before you start**.

Write down the usual features of the thing you are inventing, then ask which of them you could drop.

Name the frame

1 What are the usual features of the thing you are inventing?

2 Which of them could you drop?

Answers

1 Write them down

2 Each dropped feature opens a different direction

Take a birthday card. Its usual features are folded card, a picture on the front and a message inside. **Dropping one feature at a time** gives you a card that does not fold, or one with the message on the front. Each dropped feature opens a different direction.

At work the frame often hides in a document. **A new report tends to copy the shape of the last one**, with the same headings in the same order. Ask whether a reader needs those headings, and the report may become shorter and more useful.

A birthday card's usual features



In a group, a frame can be shared without anyone noticing. **Ask the group to list the usual features out loud** before you begin. Once the frame is spoken, people can question it together instead of building inside it in silence.

You can also borrow a frame from a different kind of thing. **Picture the card as a puzzle, a map or a recipe.** On this book's reading, a borrowed frame from another field brings its own parts with it and moves the idea further from the usual shape.

Picture the card as

A puzzle	A map	A recipe

Mixing two frames goes a step further. **A card that is also a puzzle** keeps parts of both, and the join is where the surprise lives. Try pairing your object with something from a field you know well, such as cooking or sport.

Be patient with first pictures. **The first version you imagine will look like things you know**, because that is how the store hands ideas out. On this book's reading, the rough form is a starting point to look at and change.

Mixing two frames



Keep the stakes low while you imagine. **A rough form does not need to work yet**, and judging it too early sends you back to the familiar shape. Give yourself a few minutes of pure making before you start to sort.

Keep the rough forms you throw out. **A picture that did not suit today's task** may suit a later one, and a notebook of half-ideas becomes

part of your store. On this book's reading, imagination grows richer as that store fills.

While you imagine

- [x] Keep the stakes low
- [x] A few minutes of pure making before you sort
- [x] Keep the rough forms you throw out

The exercises below use the ideas above (Ward, 1994; Finke, 1996). **No study has tested them as training**, so treat them as practice ideas. The feature list names the frame, and the dropped feature and borrowed frame step outside it.

Three practice moves

- The feature list names the frame
- The dropped feature steps outside it
- The borrowed frame moves further

Exercise:

Try it. Imagine a chair for a world without gravity. List three usual chair features you kept, then drop one.

Exercise:

Change the frame.

1. Starter. Pick an everyday object and list its five usual features.

2. Middle. Drop one feature at a time and sketch what the object becomes each time.
3. Advanced. Borrow the frame of a different kind of thing, such as a game or a garden, and **redesign your object inside it**.

Change the frame

An ordinary chair	A world without gravity	Features to drop

Key idea:

Imagination is built from memory, so **name the frame you inherit** and change it on purpose when you want something new.

Quick check:

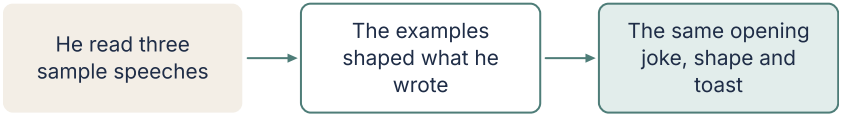
1. What did students imagine in Ward's experiments? Answer: Animals from another galaxy (Ward, 1994).
2. What are preinventive structures? Answer: Rough first forms, such as creative mental images, that come before a finished idea (Finke, 1996).
3. What happened to the fluency gain after correction for publication bias? Answer: It "became weaker or null" (Tomás et al., 2026).

2.3.3 When Memory Gets in the Way: Examples, Habits and Expertise

My nephew had a best man's speech to write, so he read three sample speeches online for ideas. **His finished speech had the same opening joke as one of them**, the same three-part shape and nearly the same toast. He had meant to write something of his own, and he was surprised when I pointed it out.

Memory had done its job too well. **The examples he had just read shaped what he wrote**, without his choosing it. This section looks at how examples, habits and expertise can narrow new ideas, and at what helps you step outside them.

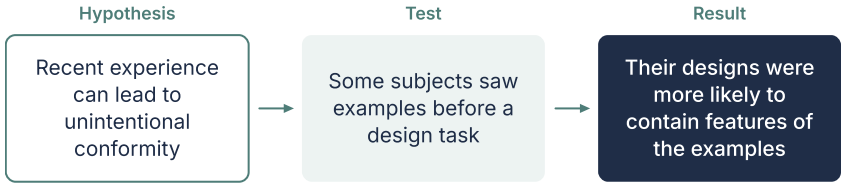
Three sample speeches



The last two sections showed memory feeding new ideas. **Here the same store works against you.** On this book's reading, the material that gives imagination its parts can also hold it in place, and the most recent material holds hardest.

> **Science Says:**
>
> In design tasks, one team found that "the designs of subjects who had seen the examples were more likely to contain features of the examples" (Smith et al., 1993). They concluded that "recent experience can lead to unintentional conformity, constraining the generation of creative ideas" (Smith et al., 1993). **Conformity here means copying without meaning to.**

Seeing examples first



The word unintentional is the heart of it. **People did not set out to copy**, and many would not have noticed. The examples simply came to mind first, because they were fresh, and new designs were built around them.

Recent is the other word to watch. On this book's reading, **what you saw this morning sits nearest the surface** of memory, so it is the first thing a search finds. An example from last year has less pull than one from ten minutes ago.

Two words to watch

Unintentional:
people did not set out to copy

Recent:
what you saw this morning sits nearest the surface

The same team tested a simple fix. They reported that "explicitly instructing subjects to create ideas that were very different from the examples did not decrease conformity to the examples" (Smith et al., 1993). **Telling people to be different was not enough.**

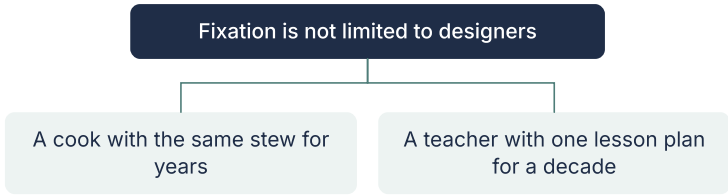


A designer's desk covered in pencil sketches of bicycles that all share the same curved frame.

> **Key Concept:**
>
> Design fixation. In Jansson and Smith's term, design fixation is "a blind adherence to a set of ideas or concepts limiting the output of conceptual design" (Jansson & Smith, 1991). **Blind is the key word**, since the person does not see the ideas they are stuck to.

Fixation is not limited to designers. **A cook who has made the same stew for years** may struggle to picture it with different spices. A teacher who has used one lesson plan for a decade may find that every new plan comes out the same shape.

Fixation outside design



On this book's reading, fixation feels like having no other ideas. **The mind returns to the same answer** because it is the easiest one to find, and the easiest answer feels like the only answer. That is why fixation is hard to spot from the inside.

You can test for it with one plain step. **Ask whether your new idea shares its main parts with something you saw lately.** If it does, the overlap may be fine, but you will at least know it is there.

Why fixation is hard to spot

> *The mind returns to the same answer because it is the easiest one to find*

Habit narrows ideas in a similar way. Every time you solve a problem one way, that way becomes easier to bring back next time. **On this book's reading, a well-worn answer becomes a groove** that new thinking slides into, even when the problem has changed.

Workplaces build grooves into their tools. **A meeting agenda copied from last week** will steer the meeting toward last week's topics. A blank agenda, or one with a single open question at the top, gives new subjects a way in.

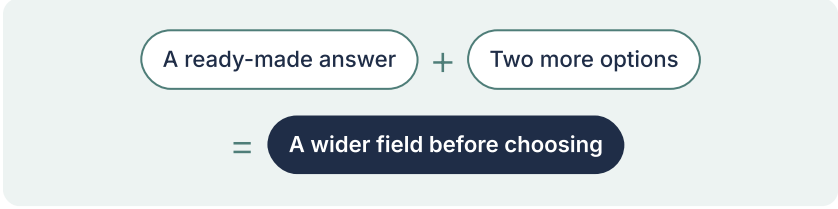
Two agendas

	Copied from last week	Blank, or one open question
Steers the meeting toward	Last week's topics	New subjects

Expertise and flexibility have a study of their own (Dane, 2010). **This section adds one point for idea work**, that every ready-made answer you know is one you may need to step past on purpose.

Experts can still use their store well. On this book's reading, **treat a ready-made answer as one option on the table**, then ask for two more before choosing. The expert's store then widens the field instead of closing it.

A wider field



Some instructions do help. Another team found that "the fixation effects can be diminished with the use of defixating instructions" (Chrysikou & Weisberg, 2005). **Defixating means loosening a fixed idea.** The question is what kind of instruction does it.

> **Science Says:**
>
> The helpful condition was the "inclusion of a problematic example, with instructions to avoid using problematic elements" (Chrysikou & Weisberg, 2005). **The instruction pointed at the faults in the example.** On this book's reading, that is a different act from simply asking people to be different.

Instructions and fixation

Did not help	Diminished fixation
⊕ Telling people to be very different from the examples	⊖ A problematic example, with instructions to avoid its problematic elements

My nephew could have used this. **Before writing, he might have listed what was weak in each sample.** One joke only works for strangers, and one toast could fit any couple. With those faults named, he would have known what to leave out.

Teams can do the same. **Give each person a different fault to look for**, such as dull wording, a costly part or a step that confuses people. The list of faults then becomes a shared brief for the new design.

Faults in the samples

Sample	Its fault
One joke	Only works for strangers
One toast	Could fit any couple

The order in which you meet examples matters too. On this book's reading, **try your own ideas before you look at anyone else's.** Your first rough version then comes from your wider store, and the examples arrive as something to compare against.

When you must look first, look widely. **One example pulls hard, and five very different ones pull in different directions.** On this book's reading, a spread of examples weakens the grip of any single one and shows how much room the task allows.

The order of examples

When	What to do
Before you start	Try your own ideas first
When you must look first	Look widely: five very different ones

Keep a note of where each idea came from. **A small mark beside an idea that echoes an example** lets you return to it later and ask whether you still want it. Some echoes are worth keeping, once you have chosen them.

The same works with recipes. **When your dish comes out just like the photo in the cookbook**, ask which part you would change if the book had never existed. Often it is only the garnish, and now and then it is the whole sauce.

Mark the echoes

- [x] A small mark beside an idea that echoes an example
- [x] Return to it later
- [x] Keep it once you have chosen it

Habits need a different tool. **Ask how you would solve the problem if your usual answer were not allowed.** Ruling out the groove forces the mind to search elsewhere, and what it finds may be better or simply useful to compare.

Fresh eyes help with expertise. **Ask someone from outside your field** to say what they would try. They do not share your ready-made answers, so their ideas can show you where your own knowledge has been setting the limits.

Tools for habits and expertise

> - Rule out your usual answer
> - Ask someone from outside your field

Children can be that outside voice at home. **Ask a child how she would fix a problem in the house**, and her answer will not come from your store. Even when her idea will not work, it may point at a part you had stopped seeing.

A new colleague can do the same at work. **In her first weeks she has not yet learned your grooves**, so her questions can sound naive. On this book's reading, those questions are worth writing down before she learns the usual answers.

A new colleague

AN

A new colleague in her first weeks

- She has not yet learned your grooves
- Her questions can sound naive
- Worth writing down

Notice when an idea comes too easily. On this book's reading, **speed is a small warning sign in idea work**, since the fastest answer is often the one memory has served before. A quick check of where it came from can save a lot of copying.

Time can loosen a fixed idea as well. On this book's reading, **a short break between reading examples and starting your own** lets the freshest ones fade a little. Other material then has a chance to come up first.

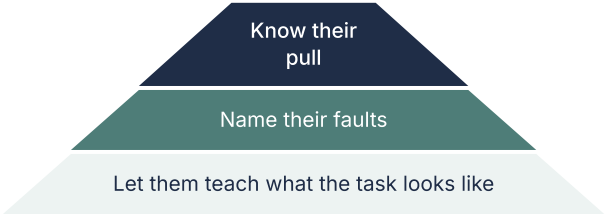
Two small checks

Speed is a small warning sign	A short break lets the freshest examples fade

None of this means avoiding examples. **Examples teach you what a task looks like**, and beginners need them. The aim is to use them with open eyes, knowing their pull, and naming their faults before they shape your work.

The exercises below come from the studies above (Smith et al., 1993; Chrysikou & Weisberg, 2005). **No study has tested them as training**, so treat them as practice ideas. Naming faults follows the helpful condition, and the other two steps work on habits and on order.

Examples with open eyes



> **Exercise:**
>
> Try it. Before your next piece of work, write two faults in a familiar example of it. Then start, avoiding both.

> **Exercise:**
>
> Break the pull.

1. Starter. Pick one example you rely on and write three things that are weak in it.
2. Middle. Sketch your own version first, then look at examples, then revise.
3. Advanced. Solve a regular problem **with your usual answer ruled out**, and compare the two results.

Leave the faults out

A familiar example	Its faults named	Something to leave out

Key idea:

Recent examples steer new work without your knowing, so **name what is wrong with them** before you start.

Quick check:

1. What did designs contain more often after people saw examples? Answer: Features of the examples (Smith et al., 1993).
2. Did telling people to be very different from the examples reduce conformity? Answer: No, it "did not decrease conformity to the examples" (Smith et al., 1993).
3. Which instruction diminished fixation? Answer: A problematic example, "with instructions to avoid using problematic elements" (Chrysikou & Weisberg, 2005).

2.3.4 When You Need Which: Memory's Part at Each Step

A FRIEND RUNS A SMALL bakery, and each week she chooses one new special for the window. Some weeks the choice is easy. **Other weeks she stands at the counter with nothing new in her head**, and the same three cakes come back to mind every time.

Her memory is full of baking. What she needs is to know **when to lean on memory and when to put it aside**. This last section of the module walks through one real task, step by step, and asks what memory should be doing at each one.



A baker leaning on a wooden counter with a notepad, a tray of plain buns cooling on a rack behind her.

Memory plays three roles in this kind of work. **It feeds attention, it supports reasoning, and it supplies new ideas** while also holding them in place. On this book's reading, a single task can call on all three roles in turn. The skill is to change role as the task moves.

> **Science Says:**
>
> One study looked at three mental skills alongside creativity. It found that inhibition helped to predict creativity, while one skill did not, since creativity was predicted "but not by shifting" (Benedek, Jauk, Sommer, et al., 2014). **Inhibition means holding back an unwanted response.** Shifting, in its general sense, is moving between tasks or ways of working.

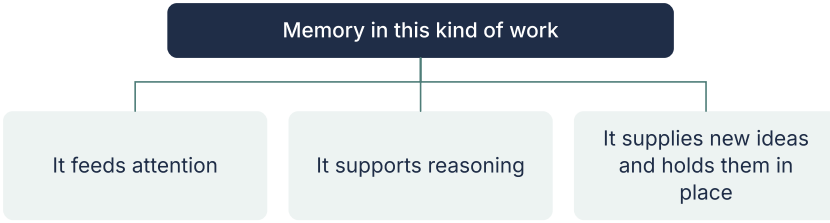
Three mental skills

Skill	Meaning
Inhibition	Holding back an unwanted response
Shifting	Moving between tasks or ways of working
Updating	Refreshing what you hold in working memory

The study's third skill was updating, which means refreshing what you hold in working memory. **The new point here is inhibition.** On this book's reading, it lets you set aside the ready answer that memory offers. A newer one then has room to form.

That gives the bakery task a shape. **Some steps want memory up front**, bringing back facts and cases. Other steps want memory held back, so the first remembered answer does not take over. Here is how the steps fall for her.

Memory's three roles



Step one is gathering. **Memory leads here.** She brings back what sold well, what customers asked for and which ingredients are in season. This is recall in its plainest form, and the more she took in during the year, the more she has to work with.

Gathering works better with notes. **A small book of what sold and what was asked for** is memory she does not have to carry. On this book's reading, written records make this step quicker and less shaped by the week she remembers best.

The bakery task, step by step



Step two is recalling cases. **Memory still leads**, now as a store of past solutions. She thinks of a special that worked last spring and of a café she visited that sold small tarts. On this book's reading, these cases are the raw material for the next step.

She can widen the case store on purpose. **Cases from outside baking count too**, such as a flower stall's seasonal buckets or a sandwich bar's names. On this book's reading, a case from far outside her trade may add the most at the making step.

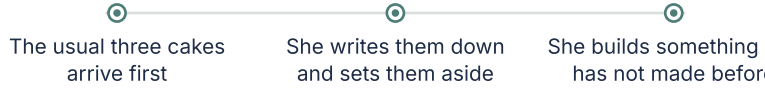
Cases from outside baking

A flower stall's seasonal buckets	A sandwich bar's names	A café that sold small tarts

Step three is generating new options. **Here memory should step back.** Her usual three cakes will arrive first, and she can write them down and set them aside. Then she takes a case apart, asks what each part could become, and builds something she has not made before.

Holding back can feel uncomfortable. **The familiar cakes keep tapping on the door**, and each one seems sensible. Writing them down gives them somewhere to go, so she can let them wait while she builds.

Holding back the familiar cakes



Step four is judging. **Memory comes back, but on a short lead.** She checks each option against what she knows about cost, time and her customers. On this book's reading, the risk is favouring an option only because it is familiar, so she checks each against this week's facts.

Judging also needs the right facts in reach. **A rough cost for each option** and a guess at baking time let her compare like with like. On

this book's reading, these are small acts of recall in service of a fair choice.

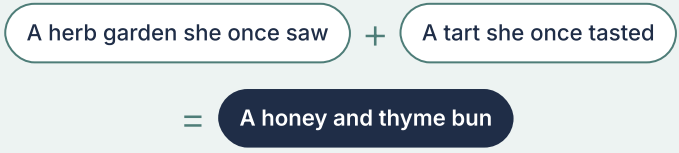
Judging each option

- [x] A rough cost
- [x] A guess at baking time
- [x] This week's facts

> **Key Concept:**
> When memory leads. In this book's terms, this is **the habit of asking, at each step of a task, whether memory should be in front or held back**. Gathering and recalling cases want it in front. Generating new options wants it held back.

She settles on a honey and thyme bun, built from a herb garden she once saw and a tart she once tasted. **Neither part was new**, and the pairing was. That is memory doing its full job, supplying parts and then stepping aside while they are joined.

A honey and thyme bun



This matches the Creativity book, which treats creativity as solving tasks where the variables are not identified. **Memory helps you find**

the variables, and inhibition keeps the old answers from naming them too soon. The Intellect book covers the judging step from its own side.

You can run the same four steps on any task. Planning a holiday or writing a report has **a gathering step, a case step, a making step and a judging step**. On this book's reading, the steps often blur, and naming them helps you see where you are.

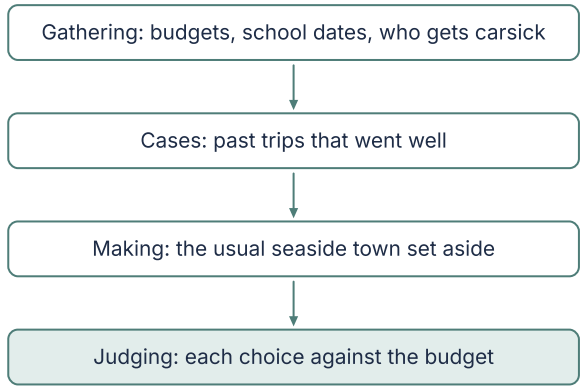
In front or held back

Step	Memory
Gathering	In front
Recalling cases	In front
Generating new options	Held back
Judging	Back, on a short lead

Take a family holiday. Gathering brings back budgets, school dates and who gets carsick. **Cases bring back past trips that went well.** Making new options means setting the usual seaside town aside for a moment, and judging weighs each choice against the budget again.

A short card can help. Write the four steps down the side with a mark beside each, **in front or held back**. Glance at it when you feel stuck. Being stuck often means memory is in front at a step where it should be held back.

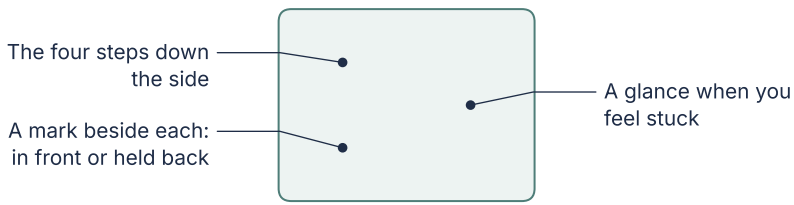
A family holiday



The inside of a kitchen cupboard door is a good place for one. **Picture it catching you at the making step** of planning a birthday party, as you list the same three venues as every year. Moving that step to held back sends you looking for a venue you have never tried.

The opposite mistake happens too. **Some people skip the gathering step** and leap straight to new ideas. Without facts and cases, the ideas float free of the task. On this book's reading, a new idea is only as good as the knowledge it was built from.

A card on the cupboard door



The four-step card

Knowledge also sets the limits of judging. **She cannot weigh an option she knows nothing about**, such as a flour she has never used. On this book's reading, a quick test bake adds to the store, and the next judging step is better for it.

Watch for the step where you rush. **Note where you spend the least time** across three tasks. If the gathering step is always short, slow it down. If the making step is always short, that may be where your best ideas have been waiting.

Where you rush

If this step is always short	What to do
Gathering	Slow it down
Making	That may be where your best ideas have been waiting

Children can learn the steps through play. **Ask a child to plan a picnic** by first listing what the family liked last time, then inventing one new thing to bring. She practises leading with memory and then holding it back, in a task she enjoys.

Groups can split the steps between people. **One person gathers, another recalls cases**, and the whole group makes new options together. Judging then goes to someone who did not make the options, so familiarity with an idea weighs less.

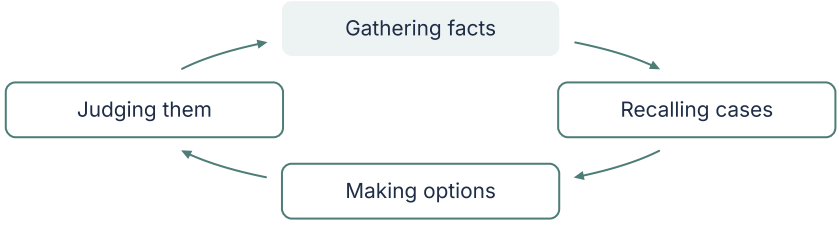
The steps split between people

- One person gathers
- Another recalls cases
- The group makes new options together
- Someone who did not make them judges

Rotate the roles over time. **A person who always judges** may lose practice at making, and one who always makes may rarely test ideas. On this book's reading, changing seats keeps each person able to work at every step.

This section ties back to the integration exercises in 6.5, which bring all four of my pillars together. **The four steps here are a small version of that work**, sized for a single task you can do this week.

Rotate the roles



Most of this section is a suggested way of working. **Only the link between creativity and inhibition is a tested finding** (Benedek, Jauk, Sommer, et al., 2014). The exercises below rest on it and on the four steps.

No study has tested these exercises as training, so treat them as practice. **The four-step card turns the module into a routine**, and the timing log shows you which step you tend to skip.

Tested or suggested

A tested finding	A suggested way of working
⊕ The link between creativity and inhibition	⊖ Most of this section ⊖ The four steps and the exercises

> **Exercise:**
>
> Try it. For tonight's dinner, name one step where memory led and one where you held it back.

> **Exercise:**
>
> Four steps, one task.
>
> 1. Starter. Pick one real task and write the four steps beside it.
> 2. Middle. Run the task with a card that marks each step in front or held back.
> 3. Advanced. Across three tasks, **log how long you spend on each step**, then lengthen the shortest.

Lead, then hold back

Lead with memory	Then hold it back	Room for a new option

Key idea:

Let memory lead when you gather and recall, then **hold it back while you make new options**, and bring it in again to judge.

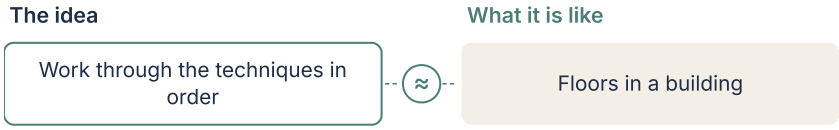
Quick check:

1. Which skill did not predict creativity in the study of three mental skills? Answer: Shifting, since creativity was predicted "but not by shifting" (Benedek, Jauk, Sommer, et al., 2014).
2. What does inhibition mean? Answer: Holding back an unwanted response, such as the ready answer memory offers.
3. At which step should memory be held back? Answer: Generating new options, so the first remembered answer does not take over.

Module 3: Techniques for Memory Improvement

Here, **theory becomes practice**. Every technique ahead is built on the brain science of how memory works. The research behind them **ranges from strong to thin**. Work through them in order. Each one builds on the last, like floors in a building.

Each technique builds on the last



The research behind them ranges from strong to thin.

> **Key Concept:**
>
> Module 3 Overview
>
> This is where what you know turns into power. You now know how memory works. Next you will pick up **the main tools that memory pros train with**. They are chunking, which is grouping small bits into bigger pieces that mean something, and visualisation, which is making pictures in your head. The others are association, which is linking things together, and mnemonics, which are memory tricks. The best memory athletes use some of them. One is the Memory Palace (Maguire et al., 2003). They work because they go along with the way the brain is built. They never fight it.

Key idea:

Every technique ahead rests on the brain science of how memory works.

The main tools memory pros train with



The best memory athletes use some of them.

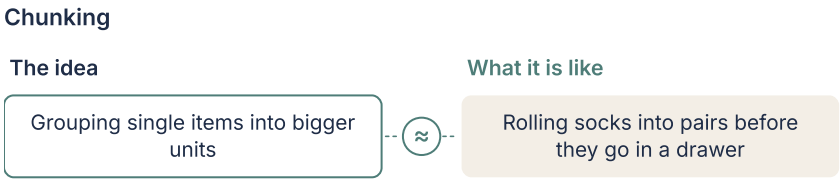
Module 3 has **five goals**, and you will work toward each one.

- Get good at chunking, so you can handle hard, many-part information
- Use mental pictures and the Method of Loci to improve recall a lot. In this method, you link each thing to remember to a place on a route you know well, and the set of places is a Memory Palace
- Build rich webs of links that make pulling memories back easy
- Learn six families of memory tricks and when to use each
- Make your own strong memory aids for anything you need to learn

3.1 Chunking and Organisation

3.1.1 The Power of Chunking

We can group single items into **bigger units that mean something**. This is called chunking. It works like rolling socks into pairs before they go in a drawer. There are fewer things to hold, though nothing is lost.



It works like rolling socks into pairs before they go in a drawer.

The science of chunking makes a claim that is both alarming and freeing.

How much your mind can juggle at once **can grow**. It grows with the richness of the knowledge you build, as three findings show.

Three findings on chunking



Three findings show that how much your mind can juggle can grow.

> **Science Says:**
>
> The first finding is The original discovery (Miller, 1956, *Psychological Review*). George Miller wrote a paper, 'The Magical Number Seven, Plus or Minus Two'.

It proposed that short-term memory, the memory that keeps a few items in mind at once, holds **about 7 ± 2 items**, as a rough limit. Miller also showed something key. What counts as one 'item' is entirely set by **what we already know**.

Take the letter string B-B-C-I-B-M. As raw letters, it takes 6 slots. But it takes **only 2 slots** if the person recognises BBC and IBM as chunks.

Chunking is more than a memory trick. It is **the main way memory training grows** how much your mind can juggle. So **group what you learn** into units that mean something.

Key idea:

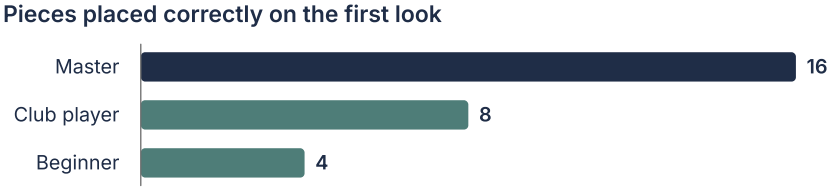
Richer knowledge gives you bigger chunks, and bigger chunks let your mind juggle more.

The second finding is Expert chunking in chess (Chase & Simon, 1973, *Cognitive Psychology*). It was the classic study of expert memory. A master, a club player and a beginner saw chess positions **for 5 seconds**.



A master, a club player and a beginner study a chess board for five seconds.

On the first look, the master placed **about 16 pieces** correctly. The club player placed about 8, and the beginner about 4. Then the same pieces were placed at random, in positions no real game would make. The master's lead then **mostly disappeared**.



On real game positions the master placed about 16 pieces (Chase & Simon, 1973).

This confirmed that expert memory works **only in a field the expert knows richly**. It is chunking driven by stored patterns, and it does not carry over to everything.

The master did not hold 16 single pieces. He held **a few larger patterns**, or chunks. These came from years of stored game experience.

The third finding is about chunking across many fields (Gobet et al., 2001, *Trends in Cognitive Sciences*). Later research carried Chase and Simon's findings over to **music, sports, medicine and programming**.

In many fields, the experts' edge **shrank sharply** when the materials were shuffled. Strong chess players still keep **a small edge** on random boards (Gobet & Simon, 1996).

The shared conclusion is that how much human memory can hold **can grow past 7 items**. It grows with how deeply knowledge is organised in long-term memory. Training that organisation directly trains how much you can hold.

Three findings in short

- Miller: about 7 ± 2 items, set by what we already know
- Chase & Simon: experts hold patterns from their own field
- Gobet et al.: the same holds in music, sports, medicine and programming
- Memory can grow past 7 items

Training how knowledge is organised trains how much you can hold.

In 1956, the psychologist George Miller published a paper. It became **one of the most cited papers** in all of psychology. Its title was 'The Magical Number Seven, Plus or Minus Two.'

He suggested the mind can hold **about 7 (±2) units** at once. Later work puts the limit nearer 4 chunks (Cowan, 2001). Beyond that, items are dropped.

This limit sounds like a problem. But Miller also named **the solution, which is chunking**. We group single items into units that mean

something, called chunks. That greatly increases the amount of information we can handle.

A beginner at chess sees 32 single pieces. A master sees **a handful of meaningful groups**. It is the same board, but a very different experience for the mind.

Same board, different minds

	Beginner	Master
What they see	32 single pieces	A handful of meaningful groups

That greatly increases the amount of information we can handle.

> **Key Concept:**
> What Is a Chunk? A chunk is any **unit of information that means something**. It has been bound together because it is familiar or because it makes sense. The key word is 'meaningful'.

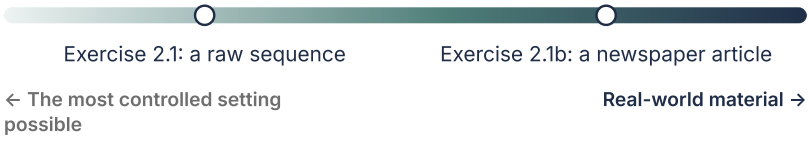
> **Definition:**
> **CHUNK:** any unit of information that means something.

Chunks form when single items are **joined together**. A pattern, a story, a relationship or what you already know can join them. This is why experts in any field can handle information so much faster than beginners. They have **more chunks ready**.

This is also why the Memory Palace works. It turns any list into **a series of chunks**. Each one is tied to a place that your memory for pictures brings back on its own.

Knowing what chunking is points straight to **how to practise it**. The exercises build the habit of reshaping new information on purpose. They start with the most controlled setting possible and move on to real-world material.

How the exercises move on



They build the habit of reshaping new information on purpose.

Practical Chunking Techniques

- Number grouping breaks long strings into groups of 3–4. For example, 192168001001 becomes 192 · 168 · 001 · 001. Phone numbers, account numbers and PIN codes all use this by instinct.
- Acronyms squash a list into a single word you can remember, using the first letters. HOMES stands for the Great Lakes (Huron, Ontario, Michigan, Erie, Superior).
- Hierarchical organisation sets information out like a tree, where main groups branch into smaller ones. This mirrors how the brain stores general knowledge in linked webs.
- Rhymes and rhythmic patterns help too. Take ‘Thirty days hath September, April, June and November’. It stores the calendar through the rise and fall of the words. The rhythm itself becomes a cue that brings the memory back.
- Concept linking finds the one idea that ties different items together. You then store that one idea in place of all the items. Understand why a list is the way it is, and the list almost remembers itself.

HOMES: the Great Lakes

HOMES

- **H** Huron
- **O** Ontario
- **M** Michigan
- **E** Erie
- **S** Superior

An acronym squashes a list into one word from the first letters.

There is **only one way** to make chunking your own, which is direct practice. Exercise 3.1 begins with a raw sequence that is hard on purpose.

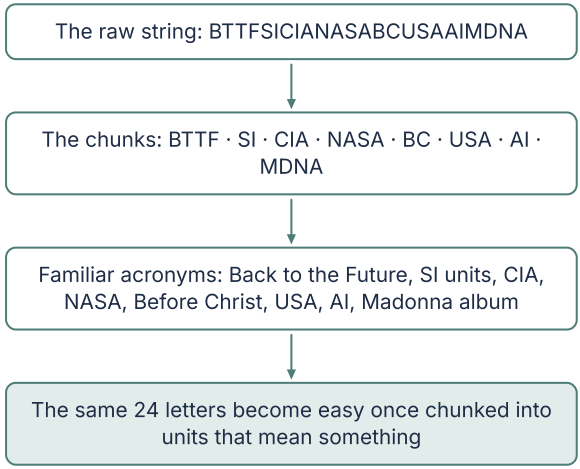
It then walks you through chunking **step by step**. That way you feel the difference in your own working memory, and you go beyond reading about it. Working memory is the part of memory that holds and works on things right now.

> **Exercise:**
>
> 3.1, Master Chunker. Follow these five steps.

1. Memorise this raw string: BTTFSICIANASABCUSAAIMDNA
2. Now try again with these chunks: BTTF · SI · CIA · NASA · BC · USA · AI · MDNA

3. Now try seeing them as familiar acronyms. They are BTTF (Back to the Future), SI (as in SI units), CIA and NASA. Then come BC (Before Christ), USA, AI and MDNA (Madonna album).
4. Notice how the same 24 letters become easy once chunked into units that mean something. This is chunking, and it works for all kinds of information.
5. Now take any 20-digit number and practise chunking it into groups. Can you recall it perfectly after 2 minutes?

Same letters, now easy



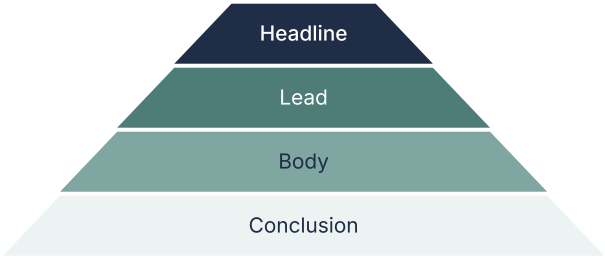
This is chunking, and it works for all kinds of information.

That first drill sets **your starting chunking skill**. Once you can squeeze raw sequences every time, use the skill on real-world material. That means the kind of dense, unbroken text you meet every day, like the text in a newspaper.

> **Exercise:**
> 3.1b, The Newspaper Chunker. Follow these five steps.

1. Find any newspaper article or dense paragraph of text you have not read before.
2. Read it once at normal speed.
3. Put it away. Now write down everything you remember. But sort what you recall into themes or groups, and skip listing random facts.
4. Compare the structure you recalled to the original. How well did chunking by theme catch the content?
5. Repeat with a different article. This time, give each sentence a group label on purpose as you read. Notice the big improvement in recall.

How journalists chunk an article



Journalists and editors think in chunks without trying.

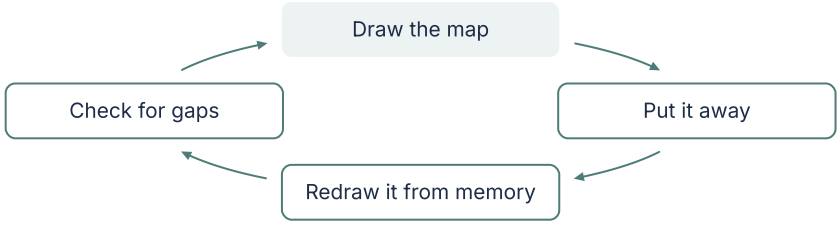
Journalists and editors **think in chunks** without trying. These are headline, lead, body and conclusion. Borrowing their way of thinking instantly improves how well you remember any article.

Newspaper chunking squashes information **sideways**, within one level. The strongest chunking, however, works **upwards**. It squashes across levels, from raw details up to the core argument. Think of a family tree read from the children up to the grandparents.

> Exercise:
> 3.1c, The Hierarchical Mastermap. Follow these six steps.

1. Take any complex topic you are studying now or need to understand. It could be a project, a subject or a technical system.
2. On a blank sheet of paper, write the topic name in the centre.
3. Draw 3–5 major "branches". These are the main sub-themes or groups.
4. From each branch, draw 3–4 "twigs". These are the specific facts, names or details that belong under that branch.
5. Now put the map away and redraw it from memory on a new sheet. Check for gaps.
6. The map you drew from memory is your actual mental model. Everything on the original that is missing from your recall still needs encoding. It still needs to be properly taken in.

Check your mental model



Everything missing from your recall still needs encoding.

Tony Buzan made **mind maps** popular. These maps branch out from a centre. In one study, medical students using them knew **about 10% more facts** a week later (Farrand et al., 2002). The study was small, and the gain was uncertain.

Centre, branches, twigs



These are the main sub-themes or groups.

Chunking is now **built in as a reflex**. It is the base for the Memory Palace, taught later. Speakers, scholars and memory champions have used that method for **over two thousand years**.

Quick check:

1. Why did the master's lead mostly disappear on random boards? Answer: His edge came from chunks, larger patterns stored from years of real games. Random positions do not fit those patterns.
2. How many slots does B-B-C-I-B-M take if you know BBC and IBM? Answer: 2 slots, against 6 as raw letters.
3. Where does later work put the limit on what the mind holds at once? Answer: Nearer 4 chunks (Cowan, 2001).

3.1.2 Organising Information for Better Retention

Organisation is to memory **what design is to a building**. Well-organised information has structure, order and clear paths between ideas. That makes both storing and finding things **far more reliable**.

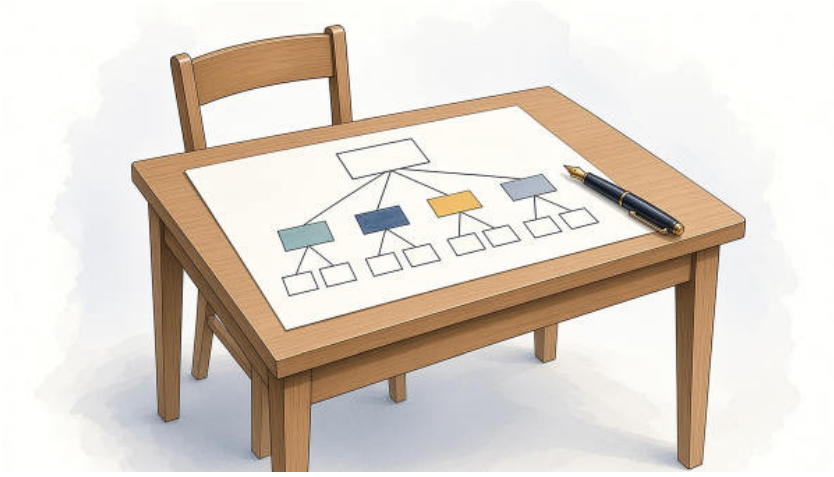


Clear paths between ideas make storing and finding far more reliable.

Bower et al. (1969) tested this. Word lists set out as a clear tree were recalled **two to three times better**. The comparison was the same words in random order.

Key idea:

With a clear tree structure, word lists were recalled two to three times better.



A word list drawn as a tree, with a branch for each group.

Technique	How It Works	Research Evidence	Best Used For
Categorisation	Group items by what they share, to make the load on your mind lighter and build paths between ideas	Mandler (1967): recall rose with the number of groups people used	Vocabulary, shopping lists, study material with clear themes
Mind Mapping	Spread ideas out from a central idea, showing how they connect in a picture	Farrand et al. (2002): about 10% more facts at one week than usual study methods; small study, uncertain gain	Complex topics with many linked ideas
Outlining	Build a tree of main ideas with supporting details under them	Katayama & Robinson (2000): no gain on facts; graphic organisers (diagrams that sort ideas) helped on applying ideas	Essay planning, exam revision, lecture notes
Spaced Review	Review material at gaps that grow longer over time	Cepeda et al. (2006): spacing beat cramming across 317 experiments	Any material that must be kept long-term
Active Retrieval	Practise recalling, and skip just rereading	Roediger & Karpicke (2006): 56% vs 42% recall after a week	All subjects; works especially well for facts

> Definition:
>
> **GRAPHIC ORGANISERS:** diagrams that sort ideas.

All these methods **link new material to what you know**, and pictures make links stronger. Think of chunking as **the skeleton of good memory**. Then visualisation, making pictures in your head, is the flesh that makes it hold.

Skeleton and flesh

The idea		What it is like
Chunking	≈	The skeleton of good memory
Visualisation	≈	The flesh that makes it hold

All these methods link new material to what you know.

Quick check:

1. How much better were word lists recalled when set out as a clear tree? Answer: Two to three times better than the same words in random order.
2. Which method in the table gave no gain on facts? Answer: Outlining (Katayama & Robinson, 2000), though graphic organisers helped with applying ideas.

3.2 Visualisation and Association

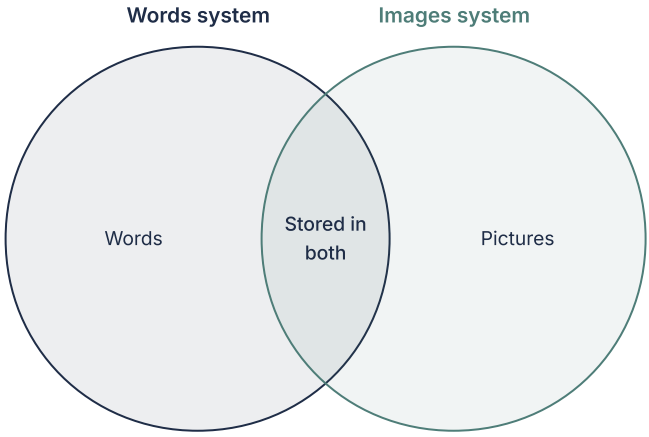
If chunking is the frame of memory, **pictures in your head are its bricks**. Scientists call making those pictures visualisation. The brain handles pictures in a very different way from words for ideas.

Using that difference is **the single biggest upgrade** to how we take things in. That taking in is called encoding.

> Science Says:
>
> The first finding is Dual Coding Theory (Paivio, 1971, 1986; *Mental Representations: A Dual Coding Approach*). Allan Paivio's founding theory showed that we encode in **two linked systems**. One is for words, and one is for images.

> Definition:
>
> **DUAL CODING:** storing something in two linked systems, one for words and one for images.

Dual coding



We encode in two linked systems (Paivio, 1971, 1986).

Some things are encoded in both systems, as words AND as solid mental pictures. They have **two routes back** to the memory, where other things have one.

They also **tend to be recalled better** than things stored only as words. This is the base of every picture trick for memory in this training.

Key idea:

Words + pictures = two routes back to a memory.

The second finding is Concreteness and memorability (Paivio, Yuille & Madigan, 1968, *Journal of Experimental Psychology Monograph Supplement*). It rated **925 English nouns** for how concrete and easy to picture they are.

Some words stand for **things you can touch**. In other studies, such solid words were remembered better than words for ideas.

Concreteness and memorability

925

English nouns rated for how concrete they are (Paivio, Yuille & Madigan, 1968)

In other studies, words for things you can touch were remembered better.

Will a word be remembered? One strong clue is **how easily it brings up a solid picture**. This explains why Memory Palace images should be bright and physical. They should be full of action, with nothing vague or abstract about them.

The third finding is The Von Restorff Effect and distinctiveness (Von Restorff, 1933; replicated by Hunt, 1995, *Psychonomic Bulletin & Review*). Things that **stand out, look odd or stir up strong feelings** are remembered clearly better. Plain, everyday things fade.

This is called the isolation effect. It works best for **one odd item in a list of similar items** (Hunt, 1995). Think of a red apple in a bowl of green ones.

The Memory Palace technique tells us to make images **strange and larger than life**. That advice is a direct use of the Von Restorff Effect.

But oddness alone **may not help** when the parts of an image already act on each other (Wollen et al., 1972).

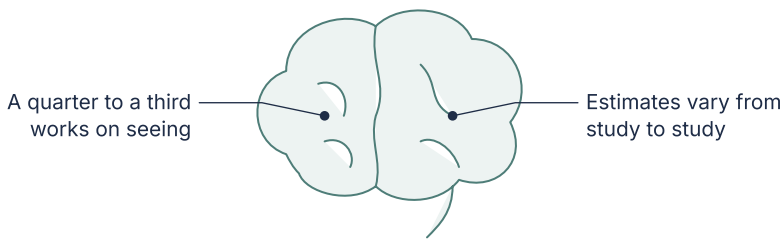
Quick check:

1. Why do words stored as pictures too tend to be recalled better? Answer: They have two routes back to the memory, where other things have one.
2. Which word is easier to remember, one for a thing you can touch or one for an idea? Answer: Usually the word for a thing you can touch, because it brings up a solid picture more easily.
3. When does the **isolation effect** work best? Answer: For one odd item in a list of similar items (Hunt, 1995).

3.2.1 Mental Imagery: The Brain's Native Language

DEEP DOWN, THE HUMAN brain is **a picture machine**. A quarter to a third of the cortex, the brain's outer layer, **works on seeing**. Estimates vary from study to study.

A picture machine



The cortex: the brain's outer layer

Deep down, the human brain is a picture machine.

Make a bright picture in your head, and you **add a picture to the words**. It works like saving a file in two folders. If one copy is hard to

find, the other may still turn up. That extra form often helps a memory last.

Allan Paivio studied how words and pictures work together in memory (Paivio, 1971). He found that pictures often give memory **an extra hold**.

His ideas became a theory that could be tested, called **dual coding**. It has held up well in many studies.

> Science Says:
>
> Paivio's Dual Coding Theory (1971) makes a key point. Facts stored in both words and pictures **tend to be remembered better**. The comparison is with facts stored in only one form.

Kosslyn et al. (2001) found that picturing uses **many of the brain areas for seeing**, though not all of them.

These findings help explain why the Memory Palace is **more than a clever trick**. Trials show it helps by **a medium amount** over usual study (Twomey & Kroneisen, 2021).

It is a system that uses **three things at once**. They are dual coding, memory for places, and encoding through feelings.

So **add a picture to the words** whenever you store a fact you need.

Key idea:

When you add pictures to words, facts tend to be remembered better.

The theory tells you that storing things as pictures works. The four principles show you **how to make it work, in detail**. They are the

design rules that separate pictures you remember from pictures you forget.

Pictures you forget and pictures you remember



The four principles are the design rules that separate them.

The Four Principles of Effective Visualisation

- Make it VIVID. More colour, texture, sound, smell and motion make for stronger encoding. A grey, still picture is easily forgotten, while a bright, moving scene stays.
- Make it BIZARRE. The brain is a machine for spotting what is new. It spends effort on the unexpected. Picture an elephant in a tutu riding a bike. It may stand out more than an elephant in a field. But oddness alone helps less than parts that act on each other (Wollen et al., 1972).
- Make it INTERACTIVE. Some pictures have parts that act on each other. These are easier to remember than parts that just sit side by side. Show the link between two ideas through action, a crash or a relationship.
- Make it EMOTIONAL. Fear, humour, awe, desire and disgust can all make a picture stick. A picture that stirs a feeling tends to last longer.



An elephant in a tutu rides a bike.

Quick check:

1. Does picturing something use the same brain areas as seeing it? Answer: It uses many of the brain areas for seeing, though not all of them (Kosslyn et al., 2001).
2. What are the four principles of visualisation? Answer: Make it vivid, bizarre, interactive and emotional.

3.2.2 The Method of Loci: Building Your Memory Palace

THE METHOD OF LOCI is **one of the oldest memory techniques** we know of. It is credited to the Greek poet Simonides of Ceos (c. 556–468 BCE).

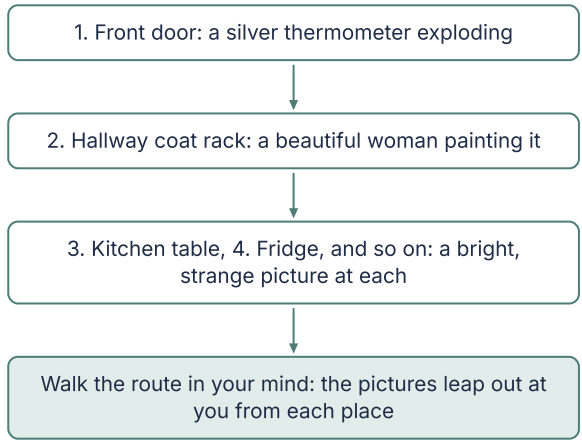
Roman speakers, Renaissance scholars and modern memory champions have all used it. With it, they did **feats of recall that seem superhuman** to ordinary people.

The method is **simple in principle and flexible in use**. You link each thing you need to remember to a bright, clear place. Each place sits

along a route you know well in your mind. It works like dropping letters into the mailboxes along a street, then walking the same street to collect them.

When you need to recall it, you **walk the route in your mind**. The thing you planted at each place comes back to you.

Plant a picture at each place, then walk the route



Always move through your stations in the same fixed order.

Key idea:

A route you know well + a bright picture at each place = a Memory Palace.

Who has used it



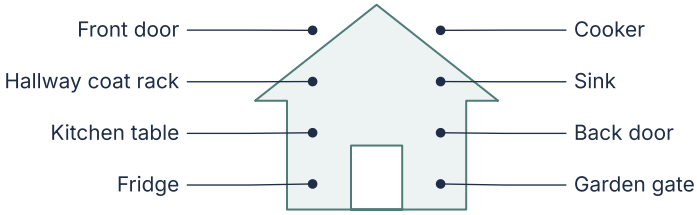
With it, they did feats of recall that seem superhuman.

> 🗝 **Key Concept:**
> How to Build Your First Memory Palace, Step by Step. The ideas are simple, and **the skill grows with practice**. Follow these six steps.

1. Choose a place you know very well. It could be your home, your school or a route you walk daily.
2. Pick out 10–20 separate stations in that place. Examples are the front door, hallway coat rack, kitchen table, fridge and cooker. Others are the sink, back door, garden gate...
3. Always move through your stations in the same fixed order. This builds the path back to each memory, one of the hooks and paths back to a memory.
4. For each item, make a bright, strange picture where the parts act on each other. Then 'place' it at its station.
5. To recall, simply walk your route in your mind. The pictures will leap out at you from each place.
6. Start with 10 stations and a simple list. Add more palaces as your skill grows.

Exercise 3.2 takes you through **the whole process**. It uses your own home as the palace. Your home is the most familiar space you have. That makes it **the best place to start**.

Stations in a home palace



Always move through your stations in the same fixed order.

Spend **at least 20 minutes** on this before moving on. The first palace takes effort, and that effort is the investment.

> **Exercise:**
>
> 3.2, Your First Memory Palace. Follow these six steps.

1. Choose your home as your Memory Palace. Pick out 10 stations on a fixed route, no more and no fewer.
2. Use your palace to memorise the 10 planets and dwarf planets in order. They are Mercury, Venus, Earth, Mars, Ceres, Jupiter, Saturn, Uranus, Neptune, Pluto.
3. For each, make a silly picture you will remember. Mercury = a silver thermometer exploding at your front door. Venus = a beautiful woman painting your coat rack. And so on.
4. Walk the route in your mind three times, ‘seeing’ each picture clearly.

5. Look away from the page. Write the 10 bodies from memory. Aim for 100%. Repeat daily for a week.
6. After one week, add a second palace for 10 historical dates. Notice how your speed improves.



A silver thermometer bursts at a front door, the first station of a home palace.

Exercise 2.2: repeat daily for a week

Day	1	2	3	4	5	6	7
Walk the route in your mind	☐	☐	☐	☐	☐	☐	☐
Write the 10 bodies from memory	☐	☐	☐	☐	☐	☐	☐

Aim for 100%, every day for a week.

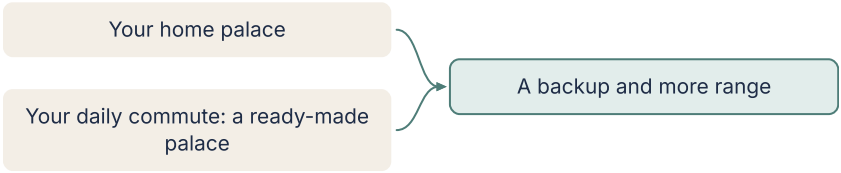
Your home palace is now **stored and ready to use**. The technique becomes more useful as you build more palaces. Each can suit different kinds of content, different fields and different moods of information.

Your daily commute is **a ready-made palace**. Most people walk past it every day without seeing it.

Two palaces give you a backup and more range. But **the real power** of palace-based memory comes from speed.

You learn to **build new palaces on demand**. Any familiar place can become a memory store. Exercise 3.2b starts with your commute, and a timed sprint follows.

Two palaces



Any familiar place can become a memory store.

> **Exercise:**
> 3.2b, The Route Method, Your Commute as a Palace. Follow these five steps.

1. Choose a trip you make often. It could be your morning commute, a familiar walk or a drive you know well.
2. Pick out 15 separate, fixed landmarks along the route. These are your stations. Write them down in order.
3. Use this route palace to memorise 15 key dates in history. These are the 15 most important dates you've always meant to know, such as these.

- 776 BCE: first Olympic Games
- 44 BCE: Julius Caesar assassinated
- 1066: Battle of Hastings
- c. 1440: Gutenberg printing press
- 1492: Columbus

- 1687: Newton's Principia
- 1776: American Declaration
- 1859: Darwin's Origin of Species
- 1903: Wright Brothers
- 1928: Penicillin
- 1945: end of WWII
- 1953: DNA structure
- 1969: Moon landing
- 1989: Berlin Wall
- 1991: World Wide Web

4. For each date, make a bright scene that uses the number itself as a picture. For 1066, picture a giant "1066" carved into a stone door. Arrows are battering it.

5. Walk the route in your mind three times. Test yourself without looking.

Exercise 2.2b: 15 key dates

776 BCE	first Olympic Games
44 BCE	Julius Caesar assassinated
1066	Battle of Hastings
c. 1440	Gutenberg printing press
1492	Columbus
1687	Newton's Principia
1776	American Declaration
1859	Darwin's Origin of Species
1903	Wright Brothers
1928	Penicillin
1945	end of WWII
1953	DNA structure
1969	Moon landing
1989	Berlin Wall
1991	World Wide Web

For each date, make a bright scene that uses the number itself as a picture.

The Route Method is **the Method of Loci**. The only change is that a route takes the place of a building. Routes often work even better. They carry strong links to places and feelings from real experience.

> **Exercise:**
>
> 3.2c, The Expanding Palace Sprint. Follow these six steps.

1. Set a timer for 5 minutes.
2. Use a palace of your home. Memorise as many items from the list as you can, in order. The list starts with umbrella, theorem, saxophone, parliament, whisky and cathedral. Next come nitrogen, avalanche, manuscript, telescope, tortoise and lighthouse. It ends with

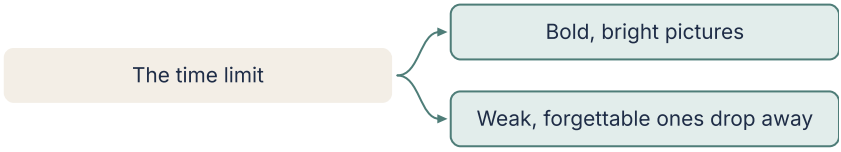
equations, chandelier, labyrinth, democracy, expedition and hibernate.

3. When the timer sounds, close the list. At once, write down every item in order.
4. Score yourself. Anything below 14/18 means your pictures need to be stranger, with parts that act on each other more. They should be doing something big and wild in the rooms they are placed in.
5. Repeat the exercise tomorrow with a different list. Track whether your score improves each day.
6. Advanced challenge: try the same list backwards, walking your palace in reverse.

Speed is the point of this drill. The time limit pushes you to make bold, bright pictures, and the weak, forgettable ones drop away.

Your palaces are **growing in number and richness**. Now it is time to add another layer of techniques.

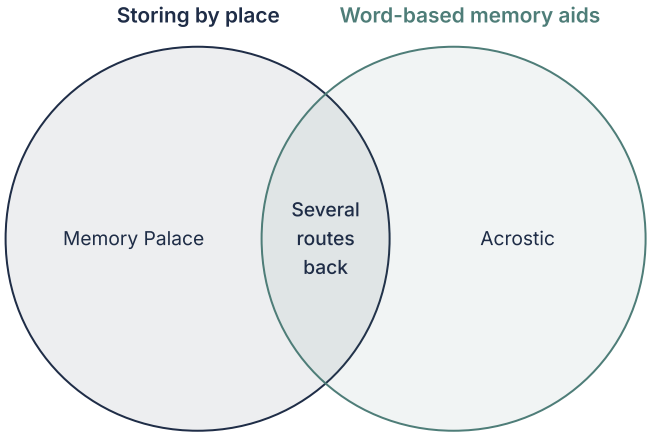
Why speed is the point



Speed is the point of this drill.

These are **word-based memory aids**. They work alongside storing by place, to give every piece of information several routes back. The first is the acrostic, a sentence whose words start with the first letters of the items. It is simple and neat.

Storing by place and word-based aids



Word-based aids work alongside storing by place.

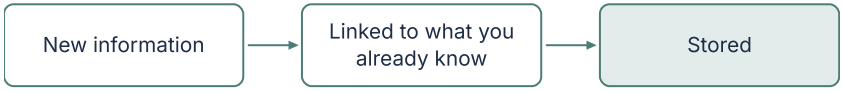
Quick check:

1. Why should you always walk your stations in the same fixed order? Answer: The fixed order builds the path back to each memory.
2. How many stations should your first palace have? Answer: Start with 10 stations and a simple list.

3.2.3 Associative Memory Techniques

MEMORY **works by links**. New information is stored by linking it to what you already know.

Memory works by links



The richer your web of links, **the easier it is to pull a memory back**. That is because more paths lead to any given memory. More roads into a

town work the same way, giving you more ways in. Each link is one of the hooks and paths back to a memory.

More roads in



Key idea:

More links give you more paths, and more paths make recall easier.

Technique	Principle	Example	Research Impact
Keyword Method	Link a new word or idea to a familiar word that sounds or looks like it, then join them with a bright picture	To learn Spanish ‘pato’ (duck): imagine a duck sitting in a pot (pato ≈ ‘pot’). A duck IN a pot.	Atkinson & Raugh (1975): 72% of Russian words recalled vs 46% without it; rated low for usefulness by the same big review (Dunlosky et al., 2013)
Peg System	Learn a list of ‘pegs’ by heart first (1=bun, 2=shoe, 3=tree…), then hang new information on each peg	To remember your 3rd task is ‘call dentist’: imagine a giant tooth growing from a tree, screaming for help	Bower (1970) studied it; the major review of study methods did not rate it (Dunlosky et al., 2013)
Link Method	Make a chain of strange pictures where each item turns into the next or acts on it	To remember book, phone, apple, car: a book calls a phone, which grows into an apple, which drives a car	Not rated separately; easy to learn, best for short lists
Story Method	Weave all the items into one bright, silly story	Grocery list of bread, milk, eggs, cheese, bananas: a loaf of bread swimming in milk, slipping on eggs…	Bower & Clark (1969): 93% of words recalled with stories vs 13% without
Mind Palace Network	Build several linked palaces, each kept for one subject	A ‘Science Palace,’ a ‘History Palace,’ a ‘Language Palace’, linked by a central ‘Grand Hall’, a palace whose stations are the doors to each subject palace	Top memorisers in one brain study used place methods (Maguire et al., 2003); loci helps by a medium amount (Twomey & Kroneisen, 2021)



A duck sits in a pot, to help recall the Spanish word ‘pato’.

These linking techniques give each piece of information **several routes back**. Come at something from more angles, and **you can find it more surely**.

Several routes back



These linking techniques give each piece of information several routes back.

The picture and place layers are now firmly set. Next comes a word-based layer, **the neat packing of mnemonics** (memory tools built from words).

Quick check:

1. Why do more links make recall easier? Answer: More links mean more paths lead to any given memory.
2. How many words did people recall with stories in Bower and Clark's study? Answer: 93%, against 13% without stories.

3.3 Mnemonics: The Full Toolkit

Some tools use **links, pictures, rhyme or structure** to make things easier to remember. These are the encoding principles. They are the rules for storing memories.

Any such tool is called **a mnemonic**. The word comes from the Greek mnemonikos, ‘of memory’. A mnemonic works like a handle on a heavy box. It gives your mind something to grab. Professionals use a full toolkit of them.

A mnemonic



From the Greek mnemonikos, ‘of memory’.

Key idea:

Links, pictures, rhyme or structure make things easier to remember.

3.3.1 The Six Essential Mnemonic Families

1. Acronyms and Acrostics

Take the first letter of each item and make **a new word** from them. This is called an acronym, like HOMES for the Great Lakes. An acronym works like a keyring, holding many keys together on one ring.

You can also start each word of **a sentence you can remember** with those letters. This is called an acrostic. For music notes E, G, B, D and F, use Every Good Boy Deserves Fruit. Each kind is **fast to make and easy to recall**.

Personal acrostics are **most useful** when they hold material you truly need to carry long-term. The same holds for acronyms.

Music notes E, G, B, D and F

E G B D F

- **E** Every
- **G** Good
- **B** Boy
- **D** Deserves
- **F** Fruit

An acrostic: each word starts with one of the letters.

Exercise 3.3 builds your first acrostic **from scratch**. It starts with content you care about, and leaves general examples aside.

> **Exercise:**
>
> 3.3, Acrostic Creator. Follow these four steps.

1. Make an **acrostic** for the planets in order. They are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune.
2. A classic example is My Very Educated Mother Just Served Us Noodles. Can you make one that is more personal, and so easier for you to remember?
3. Now make an **acronym** for any 5 things you need to remember this week.
4. Test a friend. Can they work out your acronym without help?

The planets in an acrostic

Planet	Acrostic word
Mercury	My
Venus	Very
Earth	Educated
Mars	Mother
Jupiter	Just
Saturn	Served
Uranus	Us
Neptune	Noodles

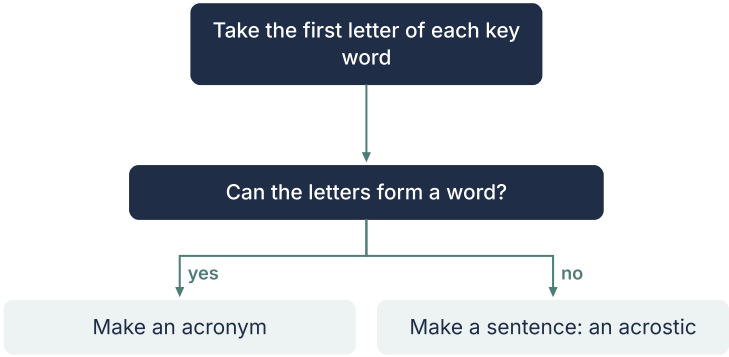
Can you make one that is more personal, and so easier for you to remember?

Exercise 3.3b takes the same idea to **any field you are building now**. It turns your own learning goals into shapes you remember, which travel with you.

> **Exercise:**
> 3.3b, The Personal Acronym System. Follow these six steps.

1. Choose 7 facts you need to remember for an upcoming task, talk or examination.
2. Take the first letter of the key word in each fact.
3. Arrange these letters to form a real word (acronym). Or form a non-word you can say that is still easy to remember.
4. If no word is possible, make a sentence you can remember. Each word should start with one of your letters (acrostic).
5. Test yourself without looking at your list. Bring the acronym to mind and rebuild all 7 facts.
6. Bonus round: make acronyms for three different lists this week. One week later, compare how easily each comes back to you.

Acronym or acrostic?

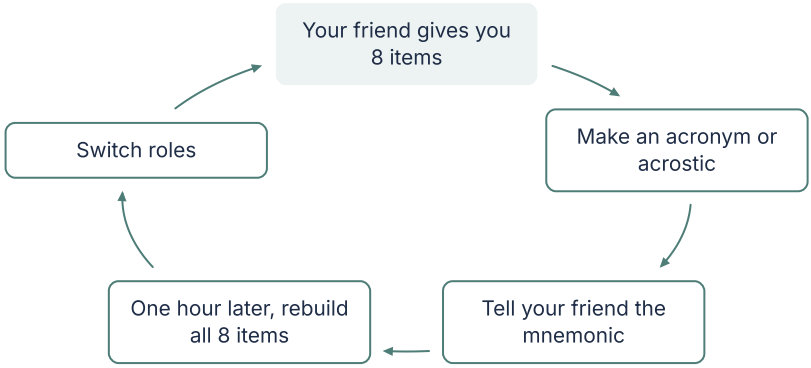


Working alone builds the mnemonic, and **a partner tests it**. Exercise 3.3c adds a light game with a friend.

> **Exercise:**
> 3.3c, Competitive Decoding. Follow these six steps.

1. Ask a friend, workmate or family member for help. They give you 8 random facts, names or pieces of information.
2. Do not write them down. At once, make an acronym or acrostic for all 8 items.
3. Tell your friend the mnemonic sentence or word.
4. One hour later, rebuild all 8 items from the mnemonic alone.
5. Switch roles, so you give them 8 items. Compare how well each of you recalled.
6. This exercise adds a little pressure. It is like recalling in front of others.

Competitive Decoding



Compare how well each of you recalled.

Practising with a partner **makes the drill more fun**. This is a tip, and nobody has tested it as a finding.

Acronyms and acrostics use the structure of language. The next technique uses something even deeper, **the bond between rhythm, tune and memory**.

Going deeper



This is a tip, and nobody has tested it as a finding.

2. Rhymes and Songs

Set information to rhythm and tune, and it uses **the brain's hearing centres**. It also uses its systems for memories tied to feelings. That builds several paths back. Each path is one of the hooks and paths back to a memory.

Wallace (1994) found that a tune helped people recall a text. It helped **only when the tune was simple and repeated**. Many children learn the alphabet through a song. A simple tune carries words the way a train carries its carriages, each one pulled along by the one in front.

The idea is simple, but **the change happens in practice**. Exercise 3.4 walks you through turning plain text into a rhythm you can remember. It starts with the simplest version. It builds to a full memory song in a single sitting.

> **Exercise:**
> 3.4, The Memory Songwriter. Follow these four steps.

1. Choose 5 facts you need to remember for work or study.
2. Set them to a tune you know (Happy Birthday, Twinkle Twinkle, or any pop song).
3. Sing it to yourself three times. Come back 24 hours later. Notice how much you kept.
4. For an advanced step, write a full song that covers a whole topic. It could be a process, a timeline or a list of key terms.

Sing, then check



For an advanced step, write a full song that covers a whole topic.

Once you feel **how easily rhythm carries content**, the next step is clear. You use it on material with built-in structure. These are rules, sequences and steps where the order counts as much as the content.

> **Exercise:**
> 3.4b, Rhyme Architecture for Rules and Sequences. Follow these five steps.

1. Choose any rule, law, formula or step-by-step process that you always find hard to remember. Think of a grammar rule, a maths formula, a legal principle or a cooking method.
2. Rewrite it as a rhyming pair of lines (a couplet) or four lines (a quatrain). The rhyme does not need to be perfect. Close rhymes ('near-rhymes') are fine.
3. Read your rhyme aloud three times. Set it to any simple tune.
4. Test yourself 24 hours later, then 1 week later.
5. Classic model: "I before E, except after C" is a 6-word rhyming rule. It has many exceptions, but its sound and beat make it stick. Your rhyme can do the same for any rule.

When to test your rhyme

Day	1	2	3	4	5	6	7
Test yourself 24 hours later	☐	☐	☐	☐	☐	☐	☐
Then 1 week later	☐	☐	☐	☐	☐	☐	☐

Close rhymes are fine.

Single memory songs **work well for set content**. A chosen memory playlist takes this further. It builds your own library of stored material to review without effort. That turns time that would be wasted into automatic retrieval practice, pulling facts back out of memory.

> **Exercise:**
> 3.4c, The Memory Playlist. Follow these six steps.

1. Pick a topic you are studying. In it, you must memorise 10–20 facts or ideas in a set order.
2. Choose 3–5 songs with tunes you know well.
3. Give each song a block of facts. Fit the facts into the tune as lyrics. You do not need a perfect match of syllables. A loose fit works.
4. Record yourself singing the songs (even a voice memo on your phone). Play it back twice.
5. One week later, play just the tune in your head. The facts should come up with the tune.
6. The order of the tune becomes the frame for finding everything stored in it.

Keep the tune **simple and repeated**, as in Wallace (1994). You can also add movement, such as tapping a rhythm or walking in time.

Storing with music does best with **content that has a natural rhythm**. Ordered sequences, especially numbered lists, need a different structure. It gives a lasting identity you can remember to each position in the sequence. The peg system gives just this.

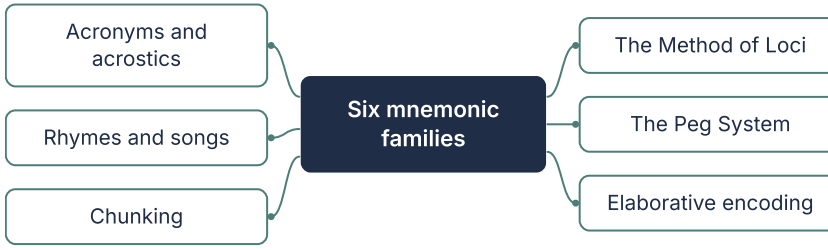
3. Chunking

You have already met chunking in detail. It is **itself a mnemonic strategy**. It is a basic step that helps many other techniques. Use it everywhere.

4. The Method of Loci / Memory Palace

You have already met it in detail. It is **a strong choice for long lists in order**. Top memorisers in one brain study used place methods (Maguire et al., 2003).

The six mnemonic families



You have already met chunking and the Method of Loci in detail.

5. The Peg System

The Peg System needs **a one-time investment**. You memorise a fixed list of peg words.

- one = bun, two = shoe, three = tree, four = door, five = hive
- six = sticks, seven = heaven, eight = gate, nine = vine, ten = hen

Once your pegs are secure, you can **hang any information on them**. It takes only seconds. The pegs work like hooks fixed to a wall. The hooks stay put, and you hang something new on them each time.

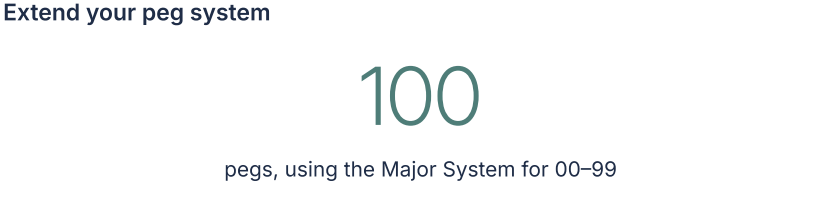
Building a peg system takes effort at the start, but **it pays off for years**. This drill sets up your own peg pictures for 1–10. It then tests them at once on real ordered content. That shows whether the pictures are bright enough to hold memories firmly in place.

> **Exercise:**
> 3.5, Peg System Drill. Follow these four steps.

1. Memorise your 10 peg words.

- 1=bun, 2=shoe, 3=tree, 4=door, 5=hive
- 6=sticks, 7=heaven, 8=gate, 9=vine, 10=hen

2. Use them to memorise today's top 10 news headlines. Put one on each peg, using a bright picture.
3. Test yourself tomorrow morning. How many headlines can you recall?
4. For an advanced step, extend your peg system to 100. Search 'Major System' online. It turns numbers into consonant sounds, which gives you pegs for 00–99.



Extend your peg system to 100 as an advanced step.

The peg system handles lists and ordered sequences **with great care for order**. But one kind of sequence shows up everywhere in modern life. In the past, it has been hard to memorise. That kind is **numbers**.

The Major System solves this problem. It turns number sequences into **language, which the brain handles easily**. It works like a secret code that swaps each digit for a sound.

> **Exercise:**
> 3.5b, The Major System, Encoding Numbers as Words. Follow these five steps.

1. Learn how the Major System matches consonants to digits.

- 0=s/z, 1=t/d, 2=n, 3=m, 4=r
- 5=l, 6=sh/ch/j, 7=k/g, 8=f/v, 9=p/b

Vowels are free. They add no number.

2. Practise storing single digits first.

- 1 = 'tie' (t=1), 2 = 'Noah' (n=2), 3 = 'Ma' (m=3)
- 4 = 'rye' (r=4), 5 = 'law' (l=5)

3. Now store a 4-digit number, such as 3141, the first 4 digits of pi. 'Mature' gives m-t-r, or 314, and 'tie' gives t, or 1. So 3141 becomes 'mature tie'.

4. Practise on numbers that are not secret. Do not store PINs or passport numbers this way.

5. The goal is to turn a number into a picture that 'means' something.

3141 as words



So 3141 becomes 'mature tie'.

Many memory competitors use **digit systems built on similar sound codes**. With practice, a long number becomes a few bright pictures. Then you place them in your Memory Palace.

Try the code

1 In the Major System, which digit do ‘t’ and ‘d’ stand for?

2 Which digit does ‘n’ stand for?

Answers

1 ‘t’ and ‘d’ stand for 1

2 ‘n’ stands for 2

Then practise storing single digits.

You now have a system for turning any number into **a word or phrase you can remember**. Its most useful first use is your weekly schedule. That is an endless stream of meetings, tasks and promises.

Most people manage it with outside tools. They skip **the most reliable organiser they have**, which is their own memory.

Two ways to manage a schedule

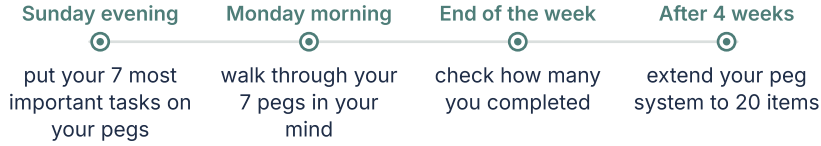
Outside tools	Your own memory
How most people manage it	The most reliable organiser you have

Exercise 2.5c uses your 10-peg system.

> **Exercise:**
>
> 3.5c, Peg System, Weekly Agenda Lock. Follow these five steps.

1. Every Sunday evening, use your 10-peg system on the coming week. Memorise your 7 most important tasks or events. Put one on each peg, in order of priority.
2. Make a bright, strange picture for each task acting on its peg word. The sillier and busier the picture, the better.
3. On Monday morning, walk through your 7 pegs in your mind. Do this before you look at any calendar or phone.
4. At the end of the week, check how many you completed. Did you miss any? Missed items almost always match weak, vague pictures. Change how you make your pictures to fix this.
5. After 4 weeks of this practice, extend your peg system to 20 items. Use the Major System peg words for 11–20.

Weekly Agenda Lock



Missed items almost always match weak, vague pictures.

Peg systems and mnemonics deal with information that can be stored as lists or sequences. The deepest form of encoding, however, is **understanding**. The Feynman Protocol makes teaching the way to build it. Teaching tests it and finally makes it safe in long-term memory.

6. Elaborative Encoding and Self-Explanation

Perhaps **the most underrated mnemonic** of all is simple. In elaborative encoding, you store something deeply by explaining what you have learned in your own words. You can explain it to yourself or someone else.

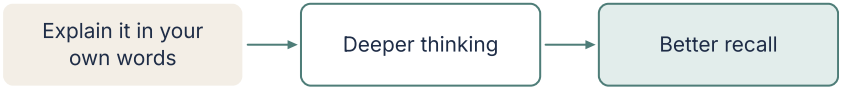
Craik & Tulving (1975) studied deep, meaningful thinking. That means making links, coming up with examples and explaining what follows. It leads to **better recall than shallow thinking**. If you cannot explain it, you may not have stored it well.

Key idea:

Explaining it in your own words makes you think more deeply, and deeper thinking leads to better recall.

The Feynman Protocol sounds simple. You explain what you know **until you find the gaps**. But most people have never used it carefully on their own learning.

Explain it in your own words



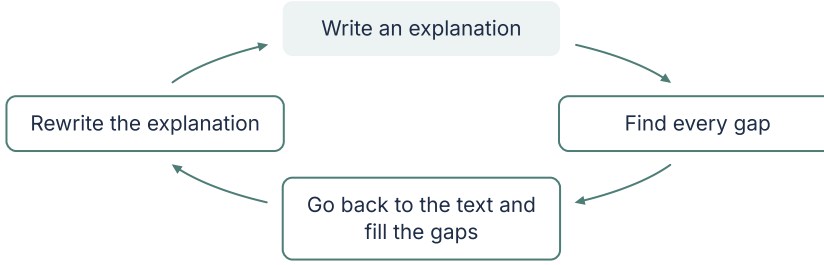
You explain what you know until you find the gaps.

Exercise 3.6 gives **the structure**. It has a real audience, a time limit and a clear method. The method turns gaps back into focused storing sessions.

> **Exercise:**
> 3.6, The Feynman Memory Protocol. Follow these six steps.

1. Choose any idea from Module 1 that felt hard.
2. Write an explanation of it as if you are teaching a bright 12-year-old. No jargon allowed.
3. Find every gap. A gap is where your explanation breaks down or needs a term you cannot explain.
4. Go back to the text and fill those gaps.
5. Rewrite the explanation. Repeat until you can explain it smoothly, start to finish, from memory.
6. This is elaborative encoding in its purest form.

The Feynman Protocol



Repeat until you can explain it smoothly, from memory.

The Feynman Protocol needs **a real audience and a full explanation**. Sometimes you need something faster. You test the limits of your understanding with only yourself as the audience. The Rubber Duck Protocol strips the technique down to its core.

> **Exercise:**
> 3.6b, The Rubber Duck Protocol. Follow these six steps.

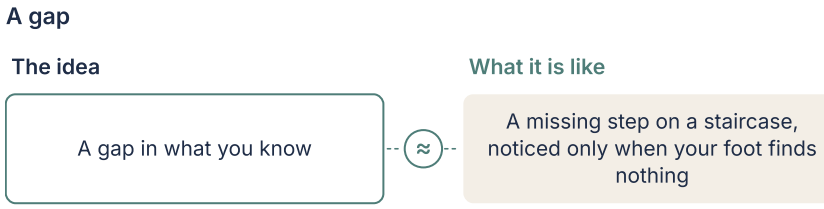
1. Place any object in front of you, like a cup, pen or phone. This is your ‘rubber duck.’
2. Explain aloud, to the object, everything you know about a topic you are learning now. Speak without stopping for at least 5 minutes.
3. Notice every moment you pause or use vague words (“something like”, “kind of”). Also notice when you reach for a term you cannot define. These are your encoding gaps. They are the very points where your memory is storing a label with no knowledge behind it.
4. Go back to your source material and fill each gap.
5. Return to your rubber duck and repeat the explanation. Keep going until you can speak smoothly for 5 minutes without pausing.
6. Record yourself in the final pass. Play it back 24 hours later and see how naturally the knowledge returns. Your own voice is a strong cue for bringing memories back.



A student explains a topic aloud to a cup on the table.

Software engineers have used **the rubber duck debugging technique** for decades. Explaining code to an object that cannot hear shows errors. A silent check in your head misses them.

The same idea applies to memory. **Saying things out loud exposes gaps** that silent rereading hides. A gap works like a missing step on a staircase, which you only notice when your foot finds nothing there.



Saying things out loud exposes gaps that silent rereading hides.

Explaining to an imaginary listener tests whether you know the material. The 3-Level Explanation Ladder goes further. It tests whether you understand it **at several depths at once**. That is the real measure of mastery.

> Exercise:
>
> 3.6c, The 3-Level Explanation Ladder. Follow these six steps.

1. Choose any idea from Modules 1 or 3 that you feel sure about.
2. Level 1 is Expert. Write a careful explanation with the right technical terms (as if for a colleague in the field). Aim for 3 paragraphs.
3. Level 2 is Student. Rewrite it for a keen 16-year-old. Replace all jargon with comparisons in plain language. Keep every key idea.

4. Level 3 is Child. Rewrite again for a curious 8-year-old. Use a story or compare it to everyday objects. Nothing abstract allowed.
5. If any level breaks down, you have found a weak spot in your encoding. Return to the source and shore it up.
6. This exercise builds three separate paths back to the same information. They are expert language, plain language and story. Under pressure, that gives you more ways back to it.

How strong is the evidence for each family? A major review rated **ten common study methods** (Dunlosky et al., 2013). It did not rate most mnemonic families, so the table adds other studies.

Family	What the research found	Evidence grade
Acronyms and acrostics	Not rated in the major review	Not rated
Rhymes and songs	A tune helped people recall a text when it was simple and repeated (Wallace, 1994)	Not rated; some support
Chunking	Experts recall far more in their own field (Chase & Simon, 1973; Gobet & Simon, 1996)	Not rated; strong support in experts
Method of Loci	A medium benefit over usual study across trials (Twomey & Kroneisen, 2021)	Not rated; medium effect
Peg System	Not rated in the major review	Not rated
Keyword method (a close cousin of pegs)	Helps with some word lists, but gains may fade (Dunlosky et al., 2013)	Low
Picturing whole texts	Helps only some readers and texts (Dunlosky et al., 2013)	Low
Elaborative encoding and self-explanation	Asking 'why?' and explaining in your own words both help (Dunlosky et al., 2013)	Moderate
For comparison: self-testing and spaced review	Strong results across many studies (Dunlosky et al., 2013)	High

Every technique so far deals with **the *encoding* phase**. That is how you get information in. But encoding is only half the job.

Encoding and review



Every technique so far deals with the encoding phase.

How you review matters as much as how you store. Spaced review and self-testing are among **the best-rated study methods** (Dunlosky et al., 2013).

Quick check:

1. In the Major System, which digit does the sound ‘m’ stand for? Answer: 3, as in ‘Ma’.
2. Which two study methods did the major review rate high? Answer: Self-testing and spaced review (Dunlosky et al., 2013).
3. Which family in the table is rated moderate? Answer: Elaborative encoding and self-explanation (Dunlosky et al., 2013).

3.4 Advanced Techniques for Expert-Level Memory

SEVEN TECHNIQUES LIE AHEAD. They are **the top shelf** of the professional memory toolkit. The earlier sections gave you the basics, like the ground floor of a house.

World memory champions use **some of these tools**, such as the Memory Palace. Anyone who must learn a lot can try them too. Each technique **builds on the foundations** you have already laid.

Seven techniques ahead

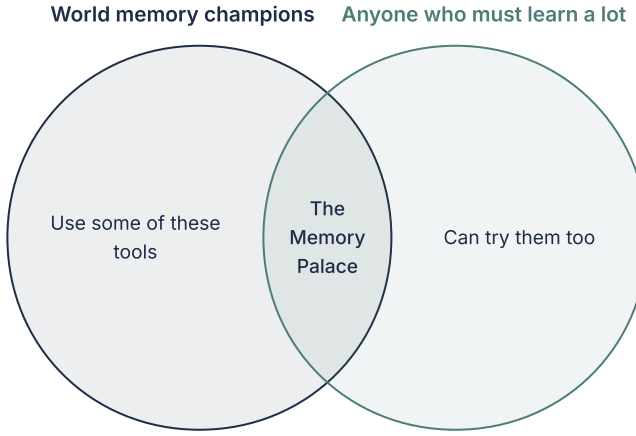
Name-Face Association	Spaced Repetition	The Story Chain
Active Reading	**The Memory Palace:** advanced	The SAVI Framework
	Planned Interleaving	

They are the top shelf of the professional memory toolkit.

Key idea:

Lay the foundations first and add advanced tools on top, and you have the full memory toolkit.

Who can use these tools



Each technique builds on the foundations you have already laid.

3.4.1 The Name-Face Association System

FORGETTING NAMES IS **a common and annoying memory failure**. It can hurt at work and in social life.

The reason lies in the brain. A name is **a random label with no built-in meaning**. It has no picture to hold on to, like a coat with no hook to hang it on.

Cohen (1990) studied why names are so hard. They were **harder to recall than facts with meaning**, such as a person's job.

One lab study used labels that can be either a surname or a job, such as **Baker and baker** (McWeeny et al., 1987). It was much harder to recall that a person's surname is Baker than that a person is a baker.

Take Sarah. A sari draped over her strong jaw **turns her name into a picture**.

The answer is to **make a picture** for each name. That made-up picture becomes one of the hooks and paths back to a memory.

Key idea:

Turn a name into a made-up picture and place it on the face, and you get a name you can find again.

Why names are so hard

	A name	A person's job
What it is	A random label with no built-in meaning	A fact with meaning

Names were harder to recall than facts with meaning (Cohen, 1990).

> **Key Concept:**
> The Five-Step Name-Face System. Follow these five steps.

1. Focus. When you are introduced, give the name your full attention. Silently repeat it once: "Sarah. Sarah." Most names are 'forgotten' because they were never properly stored. Nobody stored them and then lost them; they never got in.
2. Feature. Find one feature of the face that stands out. Pick the one that stands out most, whether or not it is the most beautiful. It might be the strong jaw, the deep-set eyes or an unusual eyebrow shape. This feature becomes your memory anchor.

3. Transform. Turn the name into a bright picture. Sarah becomes a sari (the garment). Michael becomes a microphone. David becomes a dove. For unusual names, find a sound-alike. Tadeusz becomes "tad of fuzz."
4. Link. Place your name-picture ON the feature. Sarah has a colourful sari draped over her strong jaw. Michael has a microphone for a nose. Make the picture as silly as possible.
5. Use. Say the person's name a few times, with growing gaps between. Recalling names at growing gaps helped people at a real party (Morris et al., 2005). In that test, name pictures alone did no better than no method.



Sarah, with a colourful sari draped over her strong jaw, to recall her name.



These five steps change name learning from **taking it in passively to storing it actively**. That is the difference between hoping a name sticks and making sure it does. The drill drives this system in through **repetition on purpose**.

Passive or active

Passive	Active
Taking a name in passively	Storing it actively
Hoping a name sticks	Making sure it does

The five steps turn passive into active.

At a real party (Morris et al., 2005)

	Result
Recalling at growing gaps	Helped
Name pictures alone	No better than no method

> **Exercise:**
> 3.7, Name-Face Rapid Drill. Follow these six steps.

1. Go to any online source with photos of public figures you don't know. Try a list of historical figures. A team photo of a sports club you don't follow also works. So does a cast list from a foreign film.
2. Study 10 names and faces. For each, use the 5-Step Name-Face System. Find a feature that stands out, turn the name into a picture and link them.

3. Close the source. From memory, write all 10 names next to descriptions of their faces.
4. Check your score. Then wait 24 hours and test again without any preparation.
5. As a training target, aim for 9–10 at once. A day later, aim for 8–9. These targets come from training practice, and no study measured them.
6. For an advanced step, meet 5 new people this week. Use the system in real time. No practice works better than using it live.

Name-Face Rapid Drill

Try this now

1. Study 10 names and faces with the 5-Step System
2. Close the source and write all 10 names from memory
3. Wait 24 hours and test again

Use the system in real time.

Quick check:

1. Why are most names 'forgotten'? Answer: They were never properly stored.
2. In the real party test, what helped people recall names? Answer: Recalling the names at growing gaps. Name pictures alone did no better than no method.

3.4.2 Spaced Repetition: The Science of Never Forgetting

Hermann Ebbinghaus was a German psychologist. In 1885, he carried out **the first careful scientific study of memory**. He timed how fast he could relearn lists he had learned before. After 20 minutes, he saved about 58% of the work; after a day, about 34%.

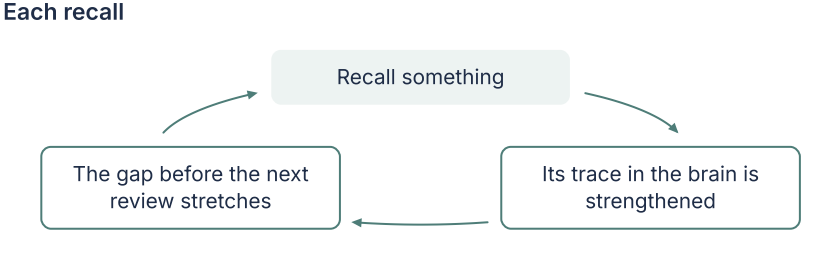
The longer the wait, **the less of the memory was left**. He called this drop the Forgetting Curve. Memory for new information drops fast at first, then more slowly. He also found that spreading out reviews helped.

Review material **at growing gaps**. This is called spaced repetition, and it slows forgetting. It works a bit like watering a plant. A little water every few days keeps it going better than one big flood.

> Definition:
>
> **Spaced repetition:** reviewing after longer and longer gaps.

Each time you recall something, you **strengthen its trace in the brain**. A trace is the mark a memory leaves there. Each recall also stretches the gap before you need the next review.

With each spaced review, **the memory tends to last longer**. No study sets a fixed number of reviews for this.



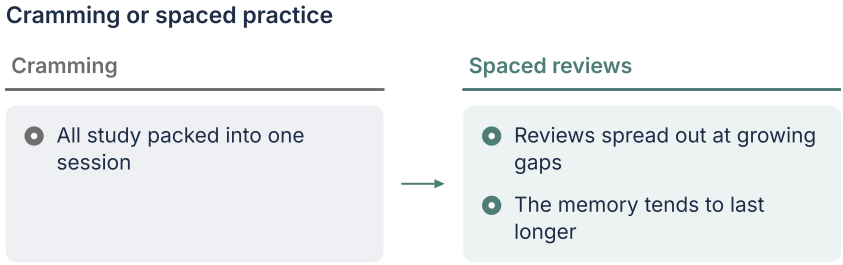
With each spaced review, the memory tends to last longer.

Cepeda et al. (2006) ran a large study that combined many spacing studies. They compared spaced practice with massed practice (cramming). **Spaced practice beat cramming** for long-term memory.

So **spread your reviews out** at growing gaps, and skip the cram.

Key idea:

With spaced reviews, the memory tends to last longer.



Spaced practice beat cramming for long-term memory.

> **Science Says:**
>
> The best spacing gap follows **a pattern**. Pimsleur (1967) proposed a set of growing gaps called 'graduated interval recall'.

In his paper, **each gap is about 5 times longer than the one before**: 5 seconds, 25 seconds, about 2 minutes, and so on. The tidy list that runs from 5 seconds to 2 years came later, from other writers.

Modern spaced repetition software **comes close to these** using an algorithm, a fixed set of rules a computer follows, like a recipe.

Anki is **a popular spaced repetition app**. Studies of flashcard spacing back the idea behind it. One such study used a flashcard program other

than Anki (Kornell, 2009). Spacing helped **90% of learners**, yet 72% thought cramming worked better.

The spacing effect is among **the most replicable findings** in all of memory science. Replicable means other scientists get the same result when they repeat the study.

What learners thought



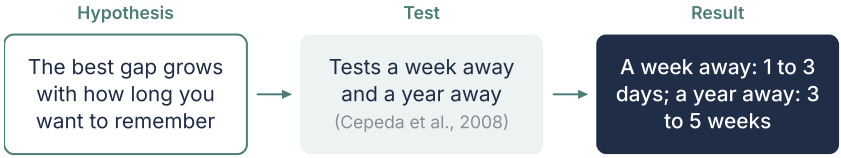
Kornell, 2009.

> **Science Says:**
> The study is Distributed practice vs. massed practice (Cepeda et al., 2006, *Psychological Bulletin*). It pooled **839 tests from 317 experiments in 184 articles**.

Distributed practice means studying in sessions **with gaps between them**. Massed practice means the same total study time packed into one session. Spaced study gave better long-term memory across the board.

The best gap grows with how long you want to remember. A later study tested this (Cepeda et al., 2008).

Does the best gap grow?

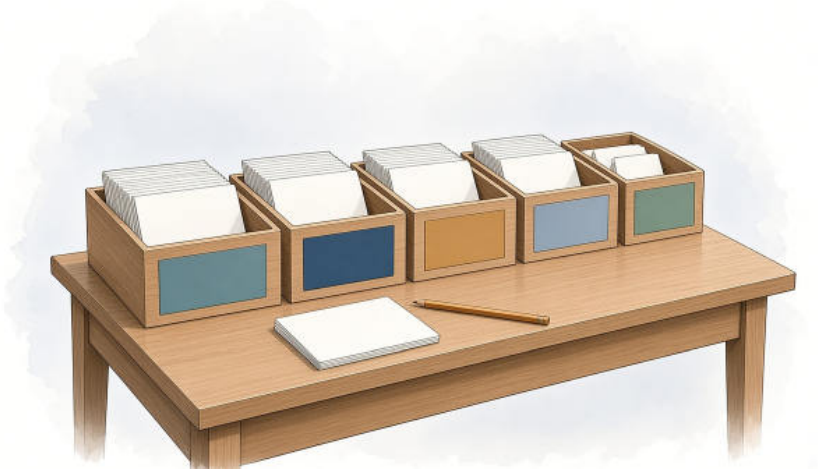


These gaps come from tests of what worked best.

For a test a week away, the best gap was 1 to 3 days. For a test a year away, it was about 3 to 5 weeks. These gaps come from tests of what worked best.

> **Science Says:**
> The Leitner Box System (Leitner, 1972, *So lernt man lernen*). Sebastian Leitner made **a paper flashcard system**. Before digital tools, it was one of the most used spaced repetition methods.

It splits cards into **5 boxes**. They are reviewed at growing gaps (daily, every 2 days, weekly, fortnightly, monthly). Cards answered correctly move up to the next box. Cards answered wrongly go back to Box 1.

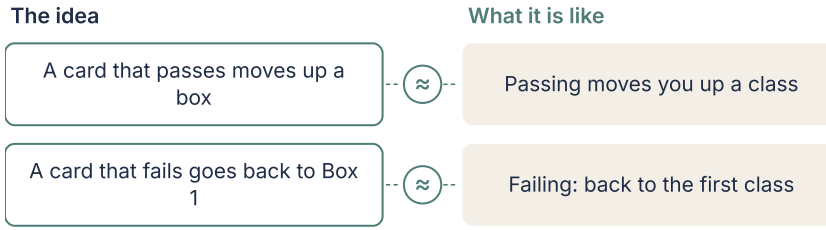


Flashcards sorted into five labelled boxes on a desk.

The system **corrects itself**. It gives more practice time to hard material on its own. That way it builds in the best spacing without the learner doing any sums.

The boxes work like classes in a school. A card that passes moves up a class, and a card that fails goes back to the first one.

Boxes like classes



The system corrects itself.

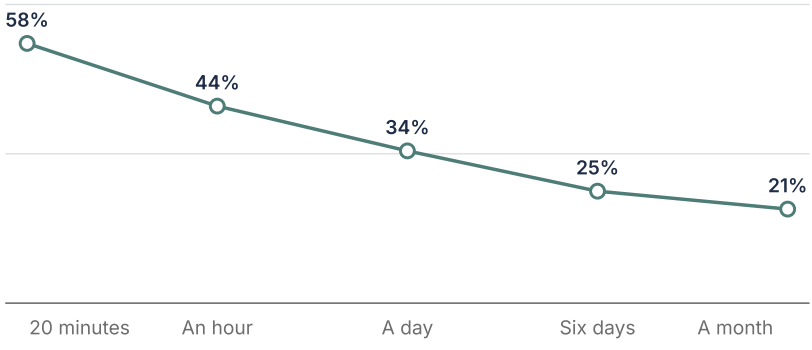
> **Science Says:**
> The Forgetting Curve and spacing (Ebbinghaus, 1885; replicated by Murre & Dros, 2015, *PLOS ONE*). Hermann Ebbinghaus was **the first scientist to study his own memory** in a planned, step-by-step way.

Over years of experiments, he memorised **thousands of nonsense syllables**. These are made-up sounds with no meaning.

His savings fell from **about 58% after 20 minutes** to 44% after an hour. They were about 34% after a day and 25% after six days. After a month, they were about 21%. His method has been repeated in modern times.

Murre and Dros's 2015 exact replication, a repeat of the original study as close as possible, **confirmed that the curve holds**.

Ebbinghaus's savings over time



His method has been repeated in modern times.

Ebbinghaus also found **the spacing effect**. He found that spreading repetitions over several days worked better than packing them together. In his own tests, **38 repetitions spread over 3 days** worked as well as 68 made in one day. He warned that his numbers rested on very few tests (Ebbinghaus, 1885). Modern spaced repetition systems build on this finding.

Exercise 3.8 builds **your own spaced repetition system** on these same principles. Its review plan keeps your knowledge fresh with little time.

> ✎ **Exercise:**
>
> 3.8, Your Spaced Repetition System. Digital spaced repetition systems work out the gaps for you.

Digital or paper

Digital (Anki)	Physical cards (Leitner Box)
Works out the gaps for you	You sort the cards and make real keep-or-review choices

No study shows that cards beat digital review, so choose what suits you.

Some people prefer **physical cards**. You sort the cards and make real keep-or-review choices. No study shows that cards beat digital review, so choose what suits you. The Leitner Box, invented in 1972 and still used by many people, is a paper option.

1. Download Anki (free), or make a set of physical index card flashcards. Put one fact on each card.
2. Choose 20 items you need to learn long-term (vocabulary, formulas, key facts, names, dates, processes).
3. Make a card for each. Put the question on the front and the answer on the back. Keep questions specific and testable.
4. Review the full set today. Grade each card. Use Easy (remembered at once), Good (remembered with effort), Hard (barely remembered) or Again (forgot).
5. Review again tomorrow. Anki will handle the timing of the gaps. With paper cards, split them into 5 boxes. Label them Today, Tomorrow, This Week, This Month and Archive.

6. Commit to 10 minutes of Anki review every single day for 30 days. At the end of the month, track how much you remember.

7. Set a training target for the 20 items after 30 days. Aim to remember 80–90% of them. It takes about 5–10 minutes of daily review, where cramming would take hours.

Grade each card

Grade	What it means
Easy	Remembered at once
Good	Remembered with effort
Hard	Barely remembered
Again	Forgot

Review the full set today, then again tomorrow.

The most important rule of spaced repetition is simple. Review when the app tells you to. Do not wait until you feel like it.

The scheduling algorithm is **tuned to the forgetting curve**. Skipping sessions weakens it.

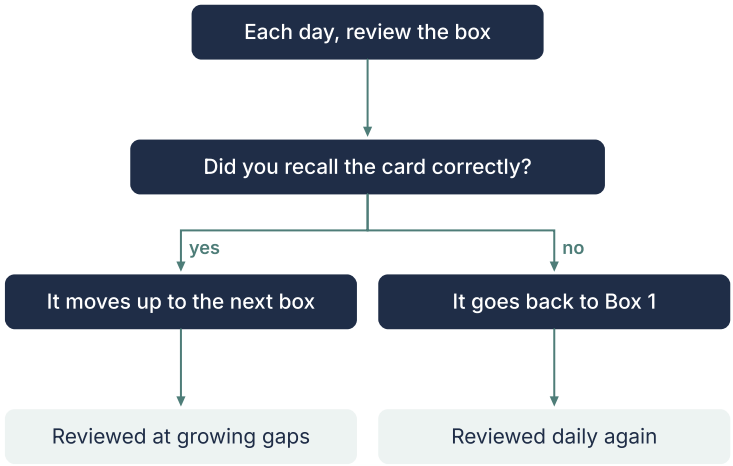
> **Exercise:**
> 3.8b, Paper Spaced Repetition, The Leitner Box. Follow these six steps.

1. Make 5 physical compartments (boxes, folders or sections of a binder). Label them Box 1 (Daily), Box 2 (Every 2 days) and Box 3 (Weekly). Then label Box 4 (Fortnightly) and Box 5 (Monthly).

2. Write 15 flashcards on material you are studying now. Place all new cards in Box 1.

3. Each day, review Box 1. Cards you recall correctly move to Box 2. Cards you fail stay in Box 1.
4. Review Box 2 every 2 days. Cards you recall correctly move to Box 3. Cards you fail go back to Box 1.
5. Use the same logic through all the boxes. Take a card that reaches Box 5 and is recalled correctly. It has been reviewed at growing gaps.
6. Sebastian Leitner invented this system in the 1970s, and it is still widely used. It needs no technology. Once set up, it takes less than 10 minutes a day.

Move up, or back to Box 1



Box 1 is daily; Box 5 is monthly.

Spaced repetition decides **when you review**. The Story Chain decides how you store a list of unrelated items. It turns any list into **a single**

story you can remember. The brain can then recall it whole, as one piece, and skip juggling a set of separate facts.

Quick check:

1. In the flashcard study, how many learners did spacing help? Answer: 90%, yet 72% thought cramming worked better.
2. For a test a year away, what was the best gap? Answer: About 3 to 5 weeks (Cepeda et al., 2008).
3. In the Leitner Box, where does a card you answer wrongly go? Answer: Back to Box 1.

3.4.3 The Story Chain: Narrative Memory for Long Lists

People told stories **long before they could write**. Before writing, much knowledge was passed on by word of mouth, often as stories.

The psychologist Roger Schank argued that **memory itself is basically a story-telling process**. We remember events by building and recalling chains of story. Separate facts are not how we keep them. The Story Chain technique uses this idea.

The principle. Say you need to memorise **a list of unconnected items**. Spin them into a bright, silly, action-packed story. In it, each item turns into or causes the next.

The story becomes **the frame you recall from**. Follow the story, and every item comes back in order on its own. It works like a row of dominoes, where each one knocks over the next.

The Story Chain

The idea	What it is like
Each item turns into or causes the next	A row of dominoes, where each one knocks over the next

Follow the story, and every item comes back in order on its own.

> **Key Concept:**
> Rules for an Effective Story Chain. Here are the four rules.

- Make it ridiculous. The more surreal, funny or impossible the actions, the more they may stand out. Picture a coffee cup that turns into a lighthouse. It is easier to remember than one that 'leads to' a lighthouse.
- Make each item turn into the next. Simply being near it is not enough. Each item should grow from the one before or explode out of it. It could even be eaten by it. The link between items must be active and physical.
- Keep it moving. The story should have speed. Each scene lasts two or three seconds before it changes. Slow, thoughtful stories are harder to recall than fast, busy ones.
- Involve your senses. The best story chains use touch, sound, smell and taste as well as sight. Picture a story with the smell of burning rubber and the sound of breaking glass. It is stored across several sense systems.

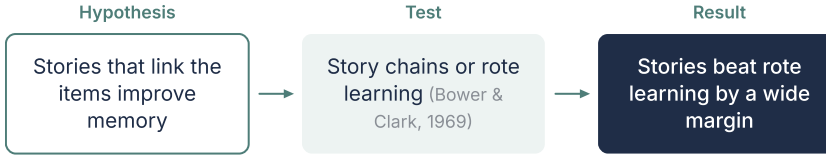
Harder and easier to recall

Harder to recall	Easier to recall
A coffee cup that 'leads to' a lighthouse	A coffee cup that turns into a lighthouse
Slow, thoughtful stories	Fast, busy ones
Items that are simply near	Each item grows from the one before

The link between items must be active and physical.

The rules for a good story chain look simple, yet **they count for a lot**. Stories that link the items beat rote learning, which is learning by plain repetition, **by a wide margin** (Bower & Clark, 1969).

Stories or rote learning?



The rules for a good story chain count for a lot.

Key idea:

Make each item turn into the next, add a bright, silly story, and every item comes back in order.

With these rules in mind, Exercise 3.9 puts the principle **to work at once**. It gives you a controlled space to tune the technique. Then you can use it on real learning material.

> **Exercise:**
> 3.9, The Story Chain Challenge. Follow these six steps.

1. Use a Story Chain to memorise the 15-item list below. The list starts with Volcano, Ambassador, Saxophone, Diesel engine and Butterfly. Next come Theorem, Avalanche, Senator, Microscope and Champagne. It ends with Labyrinth, Oxygen, Telegram, Carousel, Thunderstorm.
2. Build your story aloud, speaking it as you build it. Use physical actions that change one item into the next.
3. Tell the story to yourself twice, with full detail for every sense.
4. Wait 20 minutes. Without looking, write all 15 items in order.
5. Count how many you got right. For a first try, 12–15 correct is a good target. Below 10 means your pictures are not ridiculous enough, so add more physical change.
6. For an advanced step, try the list in reverse order. Run your story 'backwards'. This tests whether your chain truly runs in one direction.

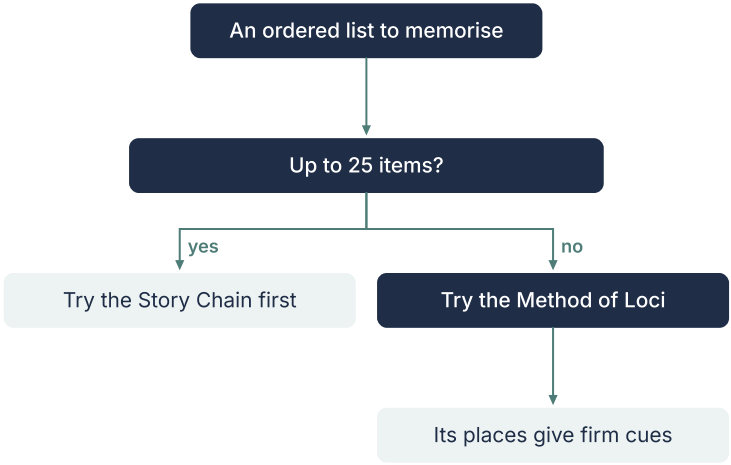


For a first try, 12–15 correct is a good target.

For ordered lists of **up to 25 items**, try the Story Chain first. Beyond that, try the Method of Loci, whose places give firm cues. The 25-item line is a rule of thumb, and no study set it.

Abstract lists and random sequences respond at once to the Story Chain. The technique is **even more useful for *procedural* knowledge**, the knowledge of step-by-step processes, routines and workflows. In such knowledge, order is essential and a missed step has consequences.

Story Chain or Method of Loci?



The 25-item line is a rule of thumb, and no study set it.

> **Exercise:**
> 3.9b, Story Chain for Procedural Knowledge. Follow these five steps.

1. Choose a process with many steps that you need to remember. Try a procedure at work, a recipe, a scientific method or a legal process.
2. List the steps in order.

3. Build a Story Chain where each step is a character or object. Each character acts on the next one. That action should show how one step causes the next.
4. Take an example. Say step 1 is ‘collect a blood sample’ and step 2 is ‘centrifuge it’. A centrifuge spins a sample very fast to split it. Your story might show a vampire collecting blood. At once, the vampire is spun like a record player until the blood separates. The silly picture stores both the content and the order.
5. Write out your story. Then, from the story alone, rebuild the full procedure.



A vampire collects blood, then spins like a record player until it separates.

From steps to story

	The step	The story
1	Collect a blood sample	A vampire collects blood
2	Centrifuge it	The vampire is spun like a record player

At once, the vampire is spun like a record player until the blood separates.

Your storing toolkit is **now complete**. It is time to look at where most structured learning happens, which is **reading**. The aim is to turn reading from something passive into an active storing session. Then the material settles into long-term memory and does not fade on the page.

Quick check:

1. In a Story Chain, how should each item link to the next? Answer: It should turn into the next or cause it, through an active, physical link.
2. Up to how many items should you try the Story Chain first? Answer: Up to 25, as a rule of thumb.

3.4.4 Active Reading and the SQ4R System

Most people **read to recognise information**. They read until something 'feels familiar' and then move on, believing they have learned it. This is one of **the most costly tricks of the mind** in education.

Recognising is **different from recalling**. You may spot a fact in a multiple-choice question. Yet you may still be unable to bring it back in any other setting. It is like knowing a friend's face in a crowd, yet being unable to draw it from memory.

Recognising and recalling

	Recognising	Recalling
What it looks like	Spotting a fact in a multiple-choice question	Bringing it back in any other setting

You may recognise a fact and still be unable to recall it.

Active reading systems turn reading from something passive into **active memory storing**. One of them uses six steps, which are Survey, Question, Read, Recite, Record and Review. This is called **the SQ4R system**.

> Definition:
>
> **SQ4R:** an active reading system of six steps, Survey, Question, Read, Recite, Record and Review.

It grew out of **Francis Robinson's SQ3R method** (Robinson, 1946). Later writers added a Record step to make it SQ4R.

It suits **anyone who must learn from written material**. That includes students and people training for work.

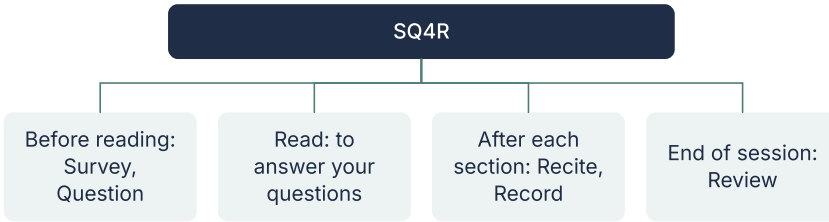
> Key Concept:
>
> The SQ4R Active Reading Protocol. Follow these six steps.

1. Survey (2 min). Before reading, scan the whole text. Read all headings, subheadings, bold terms and the first sentence of each paragraph. Build a mental map of the ground ahead.
2. Question (1 min). Turn each heading into a question. For example, take the heading 'Memory Disorders'. Ask what the main memory disorders are. Also ask what they tell us about healthy memory.

These questions switch on your brain's search mode for the reading that follows.

3. Read (active). Read to answer your questions. Underline or make notes only sparingly. The goal is understanding, and colouring in lines does not give you that.
4. Recite (after each section). Close your book. Say aloud everything you just read, in your own words, without looking. Reciting is self-testing, one of the best-rated study methods (Dunlosky et al., 2013).
5. Record (brief notes). Write a 3–5 sentence summary of each section in your own words. Do not copy. Pull the ideas together yourself.
6. Review (end of session). Reread only your summaries. Then close them and recite the key points from each section from memory.

SQ4R by timing



You do not need to memorise the list itself.

The SQ4R protocol above is **a workflow to carry out**. You do not need to memorise the list itself.

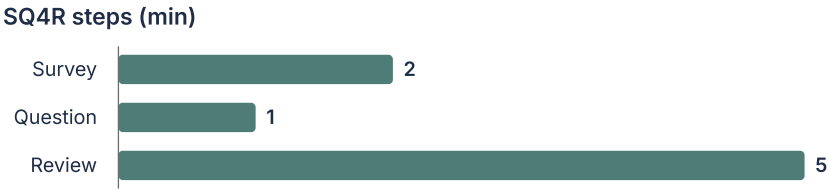
The first time through, each phase will feel **slow and careful**. By the third time, it becomes automatic. Exercise 3.10 runs the full SQ4R cycle on your own current material.

Key idea:

Reading, reciting and reviewing beat rereading and note-taking in one study.

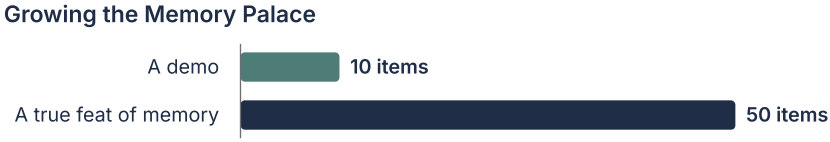
> Exercise:
>
> 3.10, SQ4R Live Application. Follow these five steps.

1. Choose any non-fiction chapter or article you need to take in this week.
2. Apply each step of SQ4R strictly, and time yourself. Do Survey (2 min) and Question (1 min). Read at your normal pace. Recite after each section (2–3 min per section). Then Record (brief summary) and Review (5 min).
3. Compare the time taken with your usual time. That is how long you spend reading the same material passively.
4. Wait 48 hours, and do not review your notes. Then write down everything you can recall from the chapter. In one study, read-recite-review beat rereading and note-taking (McDaniel et al., 2009).
5. This test lets you see the difference for yourself.



Recite after each section (2–3 min per section).

The SQ4R reading system is **now in your toolkit**. Next, the focus returns to the Memory Palace. The next step is to grow it from **a 10-item demo** into a true 50-item feat of memory.



Next, the focus returns to the Memory Palace.

Quick check:

1. How is recognising different from recalling? Answer: Recognising is spotting a fact, as in a multiple-choice question. Recalling is bringing it back in any other setting.
2. What are the six SQ4R steps? Answer: Survey, Question, Read, Recite, Record and Review.

3.4.5 The Memory Palace: Advanced Techniques

YOU HAVE ALREADY BUILT **your first Memory Palace**. Now you are ready for the advanced uses. They take a useful beginner tool much further.

To outsiders, some recall **looks superhuman**. Grand Master of Memory Ed Cooke credits the Memory Palace with his own. Eight-time World Memory Champion Dominic O'Brien does too.

Your first palace showed the principle. The next stage sets casual palace users apart from **true memory athletes**. It means building **a network of palaces** on careful design principles.

A memory champion

DO

Dominic O'Brien

- Eight-time World Memory Champion
- Credits the Memory Palace with his recall

Grand Master of Memory Ed Cooke credits the Memory Palace too.

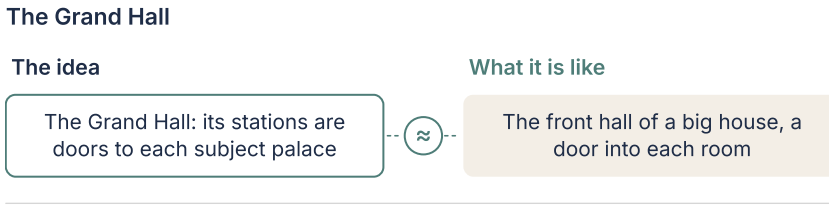
The guide below maps the design choices that improve two things. One is **how much each palace holds**. The other is how reliably it lasts.

> **Key Concept:**
> Advanced Palace Architecture. Here are the four design ideas.

- Multiple Palaces. As your knowledge grows, build a palace for each major subject area. You might have a History Palace, a Science Palace and a Languages Palace. Connect them through a 'Grand Hall'. That is a central palace whose stations are the doors to each subject palace. It works like the front hall of a big house, with a door into each room.
- Layered Encoding. At each station, store a whole scene of linked facts in place of one fact. Think of a frozen scene where several parts act on each other. Make the scene well built and bright. Then a single station can hold several pieces of information.
- Revision Walks. Take regular 'maintenance walks' through your palaces. In your mind, revisit each station to check that the pictures

are still bright. Refresh any faded picture with new detail for the senses.

- The Super-Memo Palace. Combine your Memory Palace with spaced repetition. Keep a log of which stations you have visited and when. Revisit palaces on the spaced repetition schedule, and skip random visits. This helps you remember for longer.



Build a palace for each major subject area.

Key idea:

Walk your Memory Palace on a spaced repetition schedule, and you remember for longer.

> Exercise:
>
> 3.11, The 50-Item Palace Master Test. Follow these six steps.

1. Choose a place you know extremely well. A large building is best. It could be your school, a workplace or a hotel you have stayed in. It needs at least 50 separate rooms, doorways or objects.
2. Map out 50 stations in a fixed route and write them down.
3. Use your palace to memorise the 50-item list. (Use the list of 50 random words at the end of this exercise box below.)

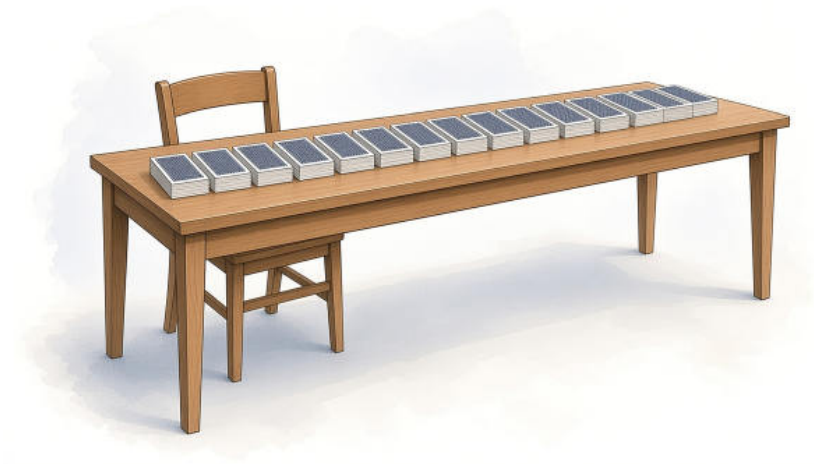
4. Spend 15 minutes placing pictures. Then walk the palace in your mind twice.
5. Look away from the list. Write out all 50 items in order. Score 40–50 for master level and 30–40 for advanced. Below 30 means your pictures need to be stranger and to act on each other more.
6. Memorise this list, in order.

- architect, compass, serpent, ballot, mercury, curtain, glacier, oboe, covenant, hurricane
- pendulum, saffron, manifesto, telescope, lantern, octopus, sovereign, archipelago, theorem, velvet
- turbine, labyrinth, embassy, oxygen, caravan, locket, parliament, avalanche, sextant, mosaic
- chancellor, prism, filibuster, cormorant, calculus, citadel, nocturne, harness, equinox, solstice
- verdict, dynasty, carbon, mirage, scalpel, tributary, algorithm, eclipse, cavalry, tundra



Write out all 50 items in order.

Memory champion Dominic O'Brien set **a Guinness world record in 2002**. He memorised 2,808 playing cards (54 packs) in one session, seeing each card once. He used a linked network of Memory Palaces.



Many packs of playing cards laid out in a long row.

Quantity is one side of memory mastery, and *depth* is **the other side**. Each stored item should be a picture and also a richly linked point in your memory web. The Dual-Encoding Palace deals with this.

Two sides of memory mastery

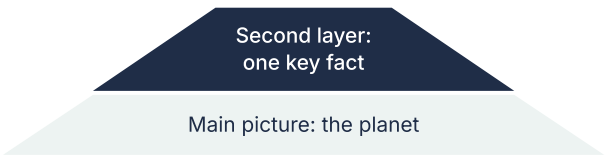
Quantity	Depth
How much you store	Each item a richly linked point in your memory web

The Dual-Encoding Palace deals with depth.

> **Exercise:**
> 3.11b, The Dual-Encoding Palace. Follow these five steps.

1. Return to the Memory Palace you built for the 10 planets and dwarf planets.
2. At each station, add a second layer of information to the picture you already have. Make it one key fact about each body. Take Station 1, Mercury. Add the fact that it has the most extreme temperature swings in the solar system. Give your exploding thermometer a dial that swings wildly from fire to ice.
3. Walk the palace three times. Notice both the main picture (the planet) and the extra detail (the fact).
4. Test yourself. Write out the planet name AND the linked fact for each station.
5. This exercise shows what a single Memory Palace station can do. It can hold more than one piece of information at once.

Two layers at one station

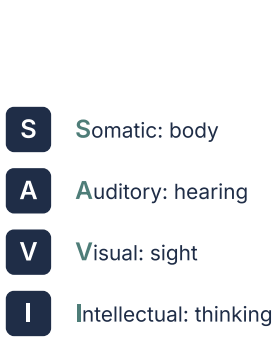


Mercury: an exploding thermometer, plus its most extreme temperature swings.

Storing by place alone **reaches its limit when the content moves**. Some things are best understood through movement, feeling or physical action. SAVI is learning through four channels, which are body (Somatic), hearing (Auditory), sight (Visual) and thinking

(Intellectual). SAVI encoding stretches the palace across **the full range of the senses**.

SAVI



Quick check:

1. What does the Super-Memo Palace add to a Memory Palace? Answer: Spaced repetition. You revisit your palaces on the spaced repetition schedule.
2. How many cards did Dominic O'Brien memorise in one session in 2002? Answer: 2,808 cards (54 packs), seeing each card once.

3.4.6 The SAVI Framework: Multimodal Learning for Maximum Retention

Learning can use **four channels**. They are body (Somatic), hearing (Auditory), sight (Visual) and thinking (Intellectual). This is called **the SAVI framework**.

The trainer Dave Meier built it on research into learning through many channels. He claimed that **you keep more as you use more channels**. No study shows that memory grows in step with the number of channels. Some single effects are well supported, though.

> **Key Concept:**
> Myth check. Many people believe they learn best in **their own style**, such as 'visual'. Matching lessons to your style has not been shown to help (Pashler et al., 2008). So use SAVI as **a menu of tools**, and skip labelling yourself.

Three single effects have **good support**. Each matches one SAVI channel.

Effect	What the study found	SAVI channel
Production effect	Saying words aloud helped people remember them, mainly when mixed with silent reading (MacLeod et al., 2010)	Auditory
Drawing effect	Drawing a word helped people remember it more than writing it (Wammes et al., 2016)	Visual
Generation effect	Coming up with a word yourself helped more than reading it (Slamecka & Graf, 1978)	Intellectual

Key idea:

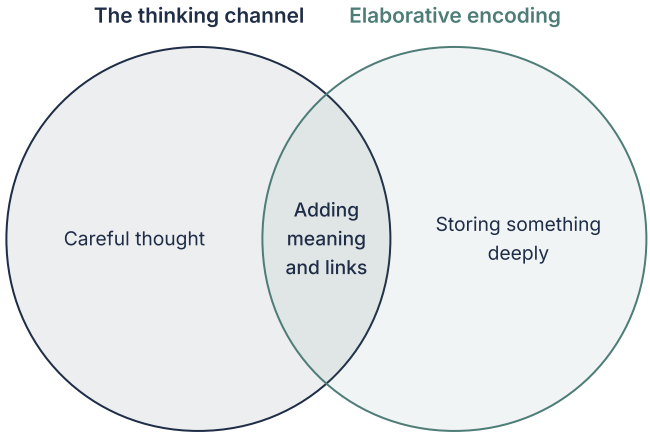
Saying it, drawing it and coming up with it yourself each helped memory in its own study.

In memory training, SAVI means **using all four on purpose** when storing new information. You move while studying, speak aloud or use music, and make bright mental pictures. You also make meaning through careful thought and links.

The thinking channel is close to what researchers call **'elaborative encoding'**. That means storing something deeply by adding meaning and links.

Exercise 3.12 uses **all four SAVI channels** on one body of material. That lets you see for yourself whether it helps you.

The thinking channel



The thinking channel is close to what researchers call 'elaborative encoding'.

> **Exercise:**
> 3.12, The SAVI Encoding Session. Follow these seven steps.

1. Choose 10 facts from Module 1 that you found hard to keep.
2. For each fact, use all four SAVI channels at once (steps 3–6).
3. Somatic. Write the fact on a card and walk around the room while reading it aloud. Or move your hands as you explain the idea to yourself.
4. Auditory. Say the fact aloud in your own words. Then exaggerate your voice. Shout it, whisper it or give it a funny accent. The change in how you say it is itself an encoding cue.

5. Visual. Make a bright mental picture for the fact. Draw a quick sketch, even a stick-figure cartoon. The act of drawing forces visual encoding.
6. Intellectual. Write one sentence linking the fact to something you already know. Try “This is similar to…”, “This contradicts my assumption that…” or “This explains why…”
7. Test yourself on all 10 facts 48 hours later. Compare the result with your score from the Module 1 Memory Baseline exercise.

When to test



Compare the result with your Module 1 baseline score.

In educational neuroscience, many-channel encoding has been found to use **more brain regions at once**. Researchers call this a ‘richer memory trace’. A memory trace is the mark a memory leaves. A richer one can be recalled **through any channel used during encoding**. It is like a house with several doors, where you can get back in through any door you used.

A richer memory trace



It can be recalled through any channel used during encoding.

Using the body while you study **may help too**. One kind is well tested. Doing the action a phrase names, such as ‘clap your hands’, gives better

memory than only reading it. This is called the enactment effect. A review of 145 studies found a large effect, g = 1.23 (Roberts, MacLeod & Fernandes, 2022). The walking lecture takes the technique outdoors to try this.

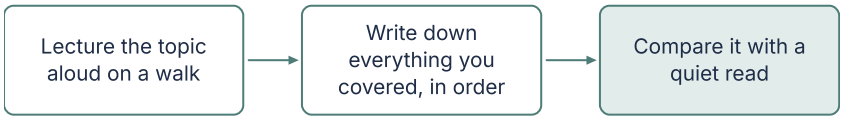
> **Exercise:**
> 3.12b, The Walking Lecture. Follow these six steps.

1. Pick a topic you are studying now or a presentation you need to prepare.
2. Go for a 20-minute walk.
3. During the walk, lecture the topic aloud to yourself, as if to an audience. Cover every key point. Explain all the links. Use your hands, change your tone of voice and pause to stress a point.
4. Return home and at once write down everything you covered, in order.
5. Notice how much you recall after moving, speaking aloud and pulling ideas together. Compare it with what a quiet read usually gives you.
6. For an advanced step, add new material to your 'walking lecture' script on later days. Give updated versions. You are building a living Memory Palace that moves with you.



A person on a walk explains a topic aloud, using their hands.

Walk, lecture, write



For an advanced step, add new material to your 'walking lecture' script on later days.

All the techniques so far have dealt with **encoding and first review**. The final technique in this module deals with a deeper question. How should you plan review *across* subjects?

The aim is better transfer, better telling ideas apart and more reliable long-term recall. This practice is called **interleaving**, which means mixing up your practice of different topics or skills.

The aim of interleaving



Quick check:

1. Does matching lessons to your own learning style help? Answer: It has not been shown to help (Pashler et al., 2008).
2. Which SAVI channel matches the drawing effect? Answer: Visual (Wammes et al., 2016).

3.4.7 Planned Interleaving: Training the Retrieval System

Mix up your practice of **different topics or skills**, without mastering each in turn. This **often gives better long-term memory**. It is like moving between three rooms in a house, where you must find the door again each time you come back. It feels harder and less productive in the moment. That makes it one of the surprising findings of memory science.

In the moment and in the long run

In the moment	Long-term
⊕ Feels harder and less productive	⊖ Often better long-term memory

This often gives better long-term memory.

This is called **the Interleaving Effect**. A review of 59 studies found **a moderate benefit** across all of them (Brunmair & Richter, 2019). The

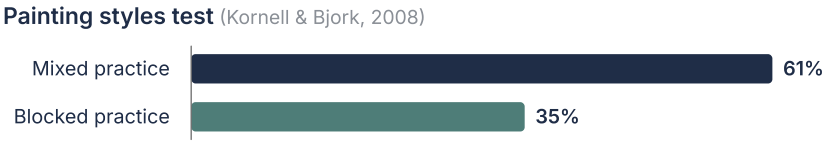
benefit was largest for paintings and other pictures, and small for maths. For word lists, one topic at a time did better.

Interleaving works because your brain must **find the way back to each topic**. It must find the content too. Say you switch from Topic A to Topic B to Topic C, then back again. Your brain must find the mental path to A again.

It cannot simply keep going **along a path that is already open**. Each re-found path is one of the hooks and paths back to a memory.

This extra effort to recall **feels frustrating**. That effort is what builds lasting, flexible memory.

Kornell and Bjork (2008) compared interleaved practice with **blocked practice**. Blocked practice means one topic at a time. On a later test of painting styles, **mixed practice scored 61% and blocked 35%**. Yet 78% of learners judged blocking as good or better.



Blocked practice means one topic at a time.

In one maths study on finding the volumes of solids, mixed practice scored **63% against 20% for blocked** a week later (Rohrer & Taylor, 2007). During practice, it was the other way round, with 89% for blocked and 60% for mixed.

Interleaving **feels harder** than blocked practice. That difficulty is part of why it can work. So **mix your topics** on purpose when you review.

Key idea:

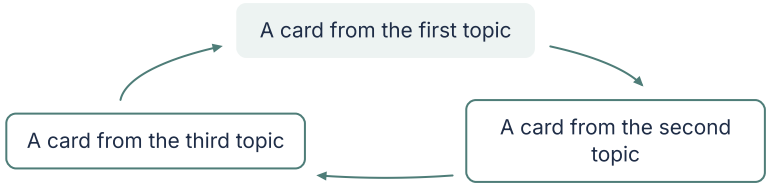
Mixed practice plus extra effort to recall often leads to better long-term memory.

Exercise 3.13 mixes **three different subject areas** on purpose, within a single 30-minute session. The benefit of telling topics apart then shows up at once in your recall scores.

> Exercise:
> 3.13, The Interleaved Review Sprint. Follow these six steps.

1. Take three topics you are studying now (or three sets of flashcards from Module 1).
2. Do not review each set fully before moving to the next. Switch between all three on every card. Take one card from each topic in turn. Go from the first to the second to the third, and repeat the cycle...
3. Note how much harder this feels than reviewing each topic in one block.
4. Complete the full interleaved session (all cards from all three topics, in turn).
5. Return to the same cards in 48 hours, in the same interleaved format.
6. At one week, test yourself on all three topics at once. Compare your performance with a friend who studied the same material in blocks. Results vary with the material, so see what you find.

One card from each topic



Switch between all three on every card.

The Sprint sets up **the principle**. The Skill Builder takes it a step further, to **switching between techniques**.

> **Exercise:**
> 3.13b, The Interleaved Skill Builder. Follow these five steps.

1. Choose three types of memory technique from this module. They are the Peg System, the Story Chain and the Method of Loci.
2. Make three separate lists of 8 items each.
3. In a single 20-minute session, use each technique on its list. Switch techniques every 2 items. Do not finish one list before starting the next.
4. This forced switching makes your brain actively recall the rules of each technique. That deepens your mastery of all three at once.
5. Test yourself on all three lists the next morning. Record your scores and the points where you switched technique.

Mix your formats **on purpose**. The effort can build a more flexible memory than topic-by-topic drilling.

Quick check:

1. In the painting-styles test, how did mixed practice compare with blocked practice? Answer: Mixed practice scored 61% and blocked 35%. Yet 78% of learners judged blocking as good or better.
2. For which material did one topic at a time do better? Answer: Word lists (Brunmair & Richter, 2019).

You now have **a complete memory toolkit**. It covers place, word, rhythm, story, sense and strategy techniques. The research behind them **ranges from strong to thin**. The exercises ahead put these tools to work in harder and more realistic settings.

Not sure which tool to use? **Match the technique** to what you need to remember.

If you need to remember...	Try	How strong is the evidence?
A short list in order	Story Chain	Strong in one classic study: 93% vs 13% (Bower & Clark, 1969)
A long list in order	Method of Loci	A medium benefit over usual study (Twomey & Kroneisen, 2021)
Numbers	Major System	Not rated in the major review of study methods
Foreign words	Keyword method	Rated low; gains may fade (Dunlosky et al., 2013)
A rule or steps with a beat	Rhymes and songs	Helped when the tune was simple and repeated (Wallace, 1994)
Names and faces	Recall the name at growing gaps	Helped at a real party (Morris et al., 2005)
A chapter or article	SQ4R (read, recite, review)	Beat rereading and note-taking (McDaniel et al., 2009)

Ideas you must understand	Explain them in your own words	Rated moderate (Dunlosky et al., 2013)
Similar topics you mix up	Interleaving	Moderate across studies; worse for word lists (Brunmair & Richter, 2019)
Anything for the long term	Spaced review and self-testing	Rated high (Dunlosky et al., 2013)

> **Key Concept:**
>
> Module 3 Key Takeaways
>
> Chunking beats working memory limits by grouping items into units with meaning. It is a key part of expert memory.
>
> Mental imagery adds a picture code to words. Bright pictures whose parts act on each other are easier to remember than words alone.
>
> The Method of Loci, or Memory Palace, is a well-tested tool for long lists in order. Anyone can learn it.
>
> Associations make paths back to a memory. The more ways you connect a new memory to old ones, the easier it is to reach.
>
> Six mnemonic families cover all information types: acronyms/acrostics, rhymes/songs, chunking, Memory Palace, Peg System, and elaborative encoding.

Use the checklist below to **track your work** through Module 3.

Exercise: Module 3 Completion Checklist. Encoding Mastery: Building Your Full Memory Technique Toolkit	
Core Ideas to Remember	
[ ]	Chunking beats working memory limits by grouping items into units with meaning
[ ]	Mental imagery adds a picture code. Make pictures bright and have their parts act on each other

[ ]	The Memory Palace is a well-tested tool for long lists in order
[ ]	Associations make paths back to a memory. The more links, the stronger the recall
[ ]	Spaced repetition makes the forgetting curve work for you
[ ]	Six mnemonic families: Acronyms/ Acrostics, Rhymes/Songs, Chunking, Memory Palace, Peg System, Elaborative Encoding
[ ]	The Feynman Protocol: if you cannot explain it simply, you have not encoded it deeply
[ ]	Name-face memory is a skill you can learn. Attention when you are introduced is the key
Foundational Exercises to Complete First	
[ ]	Exercise 3.1, Master Chunker (find your starting chunking level)
[ ]	Exercise 3.2, Your First Memory Palace (store your home as a 10-station palace)
[ ]	Exercise 3.5, Peg System Drill (build your 1–10 peg picture set)
[ ]	Exercise 3.7, Name-Face Rapid Drill (10 names in one session)
All Exercises. Work Through the Full Set	
[ ]	Ex 3.1, Master Chunker
[ ]	Ex 3.1b, The Newspaper Chunker
[ ]	Ex 3.1c, The Hierarchical Mastermap
[ ]	Ex 3.2, Your First Memory Palace
[ ]	Ex 3.2b, The Route Method
[ ]	Ex 3.2c, The Expanding Palace Sprint
[ ]	Ex 3.3, Acrostic Creator
[ ]	Ex 3.3b, The Personal Acronym System

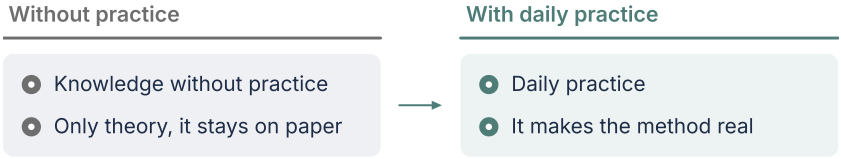
[ ]	Ex 3.3c, Competitive Decoding
[ ]	Ex 3.4, The Memory Songwriter
[ ]	Ex 3.4b, Rhyme Architecture for Rules
[ ]	Ex 3.4c, The Memory Playlist
[ ]	Ex 3.5, Peg System Drill
[ ]	Ex 3.5b, The Major System
[ ]	Ex 3.5c, Weekly Agenda Lock
[ ]	Ex 3.6, The Feynman Memory Protocol
[ ]	Ex 3.6b, The Rubber Duck Protocol
[ ]	Ex 3.6c, The 3-Level Explanation Ladder
[ ]	Ex 3.7, Name-Face Rapid Drill
[ ]	Ex 3.8, Your Spaced Repetition System
[ ]	Ex 3.9, The Story Chain Challenge
[ ]	Ex 3.9b, Story Chain for Procedural Knowledge
[ ]	Ex 3.10, SQ4R Live Application
[ ]	Ex 3.11, The 50-Item Palace Master Test
[ ]	Ex 3.11b, The Dual-Encoding Palace
[ ]	Ex 3.12, The SAVI Encoding Session
[ ]	Ex 3.12b, The Walking Lecture
[ ]	Ex 3.13, The Interleaved Review Sprint
[ ]	Ex 3.13b, The Interleaved Skill Builder
Daily Practice Habits	
[ ]	Practise one Memory Palace walk (5 min). Review a palace you have already built
[ ]	Store 3 new names using the name-face system in real social situations
[ ]	Use chunking on one piece of information you need to keep today
Actions to Take This Week	
[ ]	Build your first Memory Palace this week (your home, 10 stations minimum)

[ ]	Make your own peg picture set for numbers 1–10
[ ]	Set up a spaced repetition system (Anki or physical Leitner Box)
[ ]	Pick one subject you are studying now and make an acrostic for its key points
[ ]	Teach a Module 3 technique to someone else. Use the Ex 3.6 Feynman Protocol

Module 4: Practical Memory Exercises

Knowledge without practice is **only theory**. Each method from the techniques module stays on paper until you use it. Daily practice makes it real. You build it up, track it and make it harder bit by bit.

Knowledge and practice



Each method stays on paper until you use it.

This module is where you **build real skill**. You will use daily drills, tests that get harder, group work and practice with AI. Work through it in order. Each drill gets you ready for the next.

> **Key Concept:**
> Module 4 Overview
>
> Knowing without doing stays just an idea. Here you **build real memory skill**, and you test it. You do this with daily drills and harder training plans.
>
> By the end, you should have a full 30-day training plan. You should also be really good at ways to learn a lot at once. And you should feel sure of yourself, because you have seen your own real progress.

This module has **five goals**. You will work toward all of them.

- Set up a daily memory training routine
- Use spaced repetition (reviewing after longer and longer gaps), active recall (testing yourself from memory) and visualisation (making pictures in your head) every day
- Use stronger methods to learn large amounts of hard facts
- Train the way memory contest players do, or practise as if you were one
- Track and measure how you improve over time

Spaced repetition



I start with the drills you can do on your own, every day.

I start with **the drills you can do on your own**, every day.

Key idea:

Daily practice, tracking and making it harder bit by bit add up to real memory skill.

Solo Memory Techniques

THE BASE OF MEMORY mastery is **practice on your own**. The techniques here are built for solo training. You can do them anywhere, and most need no partner or special equipment.

They form the core of your daily practice, which you **must not skip**. Master these first. Everything else builds on them.

Key idea:

Solo practice comes first, and everything else builds on it.

Daily Memory Exercises

Simple Exercises to Practice Every Day

MEMORY, LIKE PHYSICAL FITNESS, responds to **steady training**. Twenty minutes a day adds up, and scores often rise within weeks.

Memory, like physical fitness



The key is variety. Rotate through different types of exercise. Changing the exercises keeps practice hard.

Mixing your practice up tends to help you learn as well (Bjork & Bjork, 2011). Psychologists call it a "**desirable difficulty**". It works like a hill on a bike ride, harder now and stronger legs later.

Key idea:

With variety and 20 minutes a day, scores often rise within weeks.

Daily Exercise	Duration	What It Trains	Instructions
Number Memorisation	3 min	Chunking; number encoding; spatial encoding	Each day, try to memorise a number that is a little longer than the day before. Start at 10 digits. Aim for 20+ by week 4. Use your peg system or chunking.
Word List Recall	4 min	Episodic memory; vocabulary encoding; association	Write 15 random words. Study for 2 minutes using bright images. Recall after 10 minutes. Track your score daily.
Name & Face Practice	3 min	Memory for people; making links; reading faces	Look up 5 new historical figures online. Learn their name and one key fact by making a strong picture that links them.
Backwards Review	2 min	Getting memories back; self-testing; finding gaps	At day's end, tell yourself your day in reverse order in your head, from now back to waking up. Notice what you cannot recall.
Spaced Flashcard Drill	5 min	Keeping things long-term; pulling facts back out	Use Anki or paper flashcards to review what you learned before. Keep to the spaced repetition gaps.
Mind Palace Maintenance	3 min	Memory for places; tidy long-term storage	Walk through a Memory Palace you already have and check that every picture is still bright and in place. Replace any that have faded.

This daily plan is built to last alongside work or study. Next, a 30-day programme shows how these habits add up. Over a month of planned training, they become **skill you can measure**.

How the habits add up



Over a month of planned training, the habits become skill you can measure.

Quick check:

1. How long does the daily plan in the table take? Answer: 20 minutes, made of six short drills.
2. What do psychologists call practice that is mixed up so it feels harder? Answer: A "desirable difficulty" (Bjork & Bjork, 2011).
3. In Number Memorisation, where do you start, and what do you aim for by week 4? Answer: Start at 10 digits, and aim for 20+ by week 4.

The 30-Day Memory Training Programme

THIS PROGRAMME **starts from where you are now**. In 30 days, it aims to make your memory better in a way you can measure. It gets harder slowly, so you are not swamped. Yet it keeps stretching your growing skill.

Week	Daily Focus	Target Skills	Milestone by Week's End
Week 1 (Days 1–7)	Visualisation + Basic Memory Palace (10 stations)	Bright pictures; strange links; memory for places	Memorise a 20-item list perfectly using your Memory Palace, the places you walk through in your head, each one holding something to remember. Record your baseline on the 30-word list.
Week 2 (Days 8–14)	Peg System + Number Memorisation	Memory for order; storing digits; chunking	Memorise a 30-digit number using chunking (grouping small bits into bigger pieces that mean something) and your peg system (a list of 'pegs' learned by heart first, on which you hang new information). Add a second Memory Palace (20 stations).
Week 3 (Days 15–21)	Spaced Repetition + Active Recall	Keeping things long-term; retrieval practice (pulling facts back out of your head); self-testing	Score 90%+ on a 50-word list recalled 48 hours after you learn it. Start reviewing Week 1 material with flashcards.
Week 4 (Days 22–30)	Speed + Volume	Fast storing; recalling a lot; using the techniques together	Memorise a shuffled deck of playing cards (or another list of 52 items). Complete your Module 4 self-assessment.

The milestones give the frame. You also need **an honest picture of where you start**, before any other exercise. Without that baseline, you cannot measure the gains that follow.

> Definition:
>
> **BASELINE:** your first score, which later scores are measured against.

Your baseline score is **a starting line**, and it does not judge you. It is like a pencil mark on the door frame for a child's height. The weekly tracker turns this one score into a curve of progress. That makes your improvement visible. Writing your progress down makes reaching your goal more likely as well (Harkin et al., 2016).

Your baseline score



That makes your improvement visible.

Key idea:

A baseline and a weekly tracker let you see your improvement. Writing progress down makes reaching your goal more likely.

This baseline test measures **how well you store new material now**. It counts one thing: how many of 30 words you recall. It gives every later exercise a point to measure from. Then your improvement is visible and real.

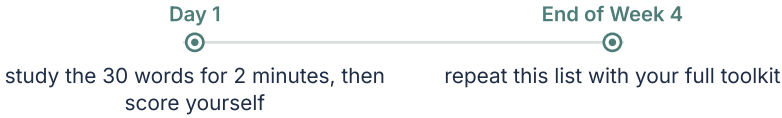
> **Exercise:**
>
> 4.1, Day 1 Baseline Assessment. Follow these four steps.

1. Set a timer for 2 minutes. Study the 30 words below.

- piano, cloud, justice, salmon, umbrella, centenary, bronze, whistle, cathedral, parliament
- asteroid, lemon, violin, democracy, eclipse, marble, hurricane, portrait, labyrinth, compass
- telegraph, cinnamon, volcano, sapphire, theorem, glacier, lantern, mosaic, pendulum, meridian

2. Look away from the list. Write every word you can recall. Score yourself out of 30.
3. Save this score. At the end of Week 4, you will repeat this list with your full toolkit.
4. Record your score, the date and any notes in your Memory Journal.

Day 1 Baseline Assessment



Save the score, the date and any notes in your Memory Journal.

> **Exercise:**
> 4.1b, The Weekly Progress Tracker. Follow these five steps.

1. In your Memory Journal, make a tracking table. Give it six columns.

- Date | Exercise | Items to Memorise | Items Recalled | Score (%) | Notes

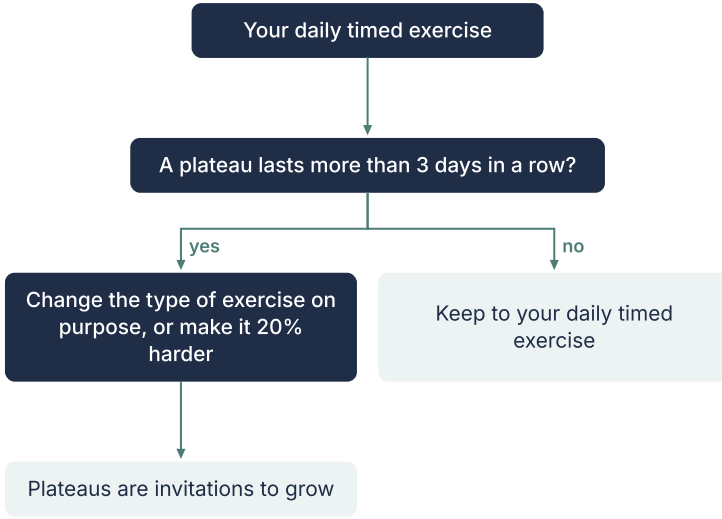
2. Every day for 30 days, record your result on at least one timed memory exercise.

3. At the end of each week, work out your average weekly score across all exercises. Plot these averages as a simple line graph.

4. The graph will show two things. One is your general direction, which is almost always upward with steady practice. The other is your ‘plateau zones’. These are times when scores stall and you need a new challenge. A plateau is like a landing on a staircase, flat for a while before the next steps.

5. Say a plateau lasts more than 3 days in a row. Then change the type of exercise on purpose, or make it 20% harder. Plateaus are invitations to grow. They are no sign of failure.

When a plateau lasts



Deliberate practice means focused practice aimed at getting better. Research on deliberate practice (Ericsson et al., 1993) shows how top performers train. They actively seek **the edge of their ability** and train there. They avoid the comfortable zone of tasks they can already do well.

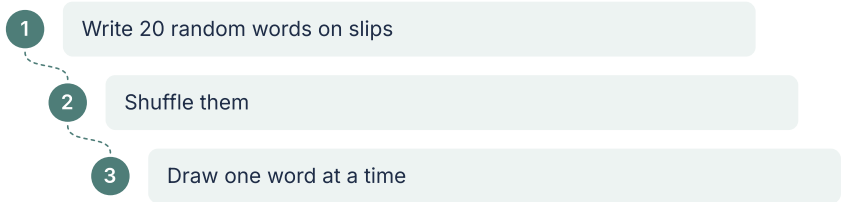
Tracking your scores **keeps the outer game honest**. The next exercise deepens the inner game. It uses all five senses to store new material. That makes each memory richer and easier to pick out from the rest.

> **Exercise:**
> 4.1c, The Sensory Encoding Sprint. Follow these six steps.

1. Write 20 random words on separate slips of paper. Shuffle them.
2. Draw one word at a time. For each, make a mental image that uses at least three senses. Choose from sight, sound, smell, touch or taste.

3. For example, take ‘LEMON’. See its yellow skin and hear the squeak as you press it. Smell the sharp citrus and feel the cold spray on your fingers. Taste the sour burst.
4. Work through all 20 words with full detail for the senses. Then set the slips aside and wait 15 minutes.
5. Recall all 20 words. Record your score.
6. Compare this score with your Day 1 baseline. Most people notice they recall more once they add sound, smell and touch. The difference is planned encoding, or getting a memory in, through many senses.

Getting ready



For each, make a mental image that uses at least three senses.



A person presses a lemon, hearing the squeak and feeling the cold spray.

Using several senses for a single memory is called **synaesthetic encoding**. It was Solomon Shereshevsky's natural ability. He experienced the senses blended together, which made his memories vivid. Top champions today mostly use trained methods, such as the memory palace (Maguire et al., 2003).

Two ways to vivid memories

	Shereshevsky	Top champions today
How	A natural ability	Trained methods, such as the memory palace

Champions mostly use trained methods (Maguire et al., 2003).

Richer encoding improves the quality of each memory. The following exercise targets **the mind's workspace** itself, called working memory. It uses the dual n-back, a working-memory task where you track two streams and spot items that match the one from N steps back.

> **Exercise:**
> 4.1d, The Dual N-Back Working Memory Builder. Follow these six steps.

1. This exercise trains working memory. It is the narrow point that limits how much you can hold in mind while learning.
2. For setup, use any free dual n-back app. Search 'dual n-back' online, as several free versions exist. Or use this simpler home version, which differs from the research task. A partner reads out letters while showing playing cards one at a time.

3. Your task is to track both streams at once. Signal when the current item matches the one from N positions ago. Start with N=2.
4. Practise for 10 minutes a day. Increase N when you reach 80%+ accuracy.
5. Jaeggi et al. (2008) published evidence in the Proceedings of the National Academy of Sciences. Its authors said dual n-back training lifted scores on reasoning tests. Bigger studies later found the gains mostly stay on n-back and tasks like it (Melby-Lervåg et al., 2016). Treat this exercise as working-memory practice. It is not a way to raise your IQ, your score on a test of how smart you are.
6. Track your highest N-value each week. Expect the gains to show mainly on this task and ones like it.

Children with a stronger working memory **tend to do better at school**. In one study, it predicted later reading and maths scores better than IQ did (Alloway & Alloway, 2010).

Working memory limits **what you can hold in mind at once**. It works like a juggler's hands, which can keep only a few balls in the air. The next section shows larger systems for storing numbers, such as the Major System.

Working memory



It works like a juggler's hands, which can keep only a few balls in the air.

Quick check:

1. What does the Day 1 baseline count? Answer: How many of 30 words you recall.
2. What should you do if a plateau lasts more than 3 days in a row? Answer: Change the type of exercise on purpose, or make it 20% harder.
3. Did dual n-back gains spread to other skills in the bigger studies? Answer: Mostly not. The gains mostly stayed on n-back and tasks like it (Melby-Lervåg et al., 2016).

Advanced Memory Techniques

Techniques for Memorising Large Amounts of Information

Once you have mastered the basic techniques, the question becomes **how to scale up**. The best memory athletes memorise a shuffled deck of cards in under 15 seconds. They can memorise a string of 500 binary digits, made only of 0s and 1s. How?

What the best memory athletes do

15	500
seconds or less for a shuffled deck	binary digits in one string

The best memory athletes memorise a shuffled deck in under 15 seconds.

The answer is structure. They build whole systems, beyond single tricks.

The Person-Action-Object (PAO) System

Many memory competitors use **the PAO system**. It gives a Person, an Action and an Object to every single playing card. It can also cover every two-digit number, 00–99.

Definition:

PAO SYSTEM: a system that gives each card or two-digit number a Person, an Action and an Object.

Two PAO cards

Card	Person	Action	Object
Ace of Hearts	Sherlock Holmes	Examining a clue	Magnifying glass
Seven of Hearts	Serena Williams	Smashing a serve	Tennis racket

Each card gets its own Person, Action and Object.

Any three cards can then be stored as **a single, vivid scene**. It works like a flip book where you mix the head, body and legs of three different people. The Person from card 1 does the Action from card 2. The Object comes from card 3. One image then covers three cards.

Key idea:

Person from card 1 + Action from card 2 + Object from card 3 = one image for three cards.

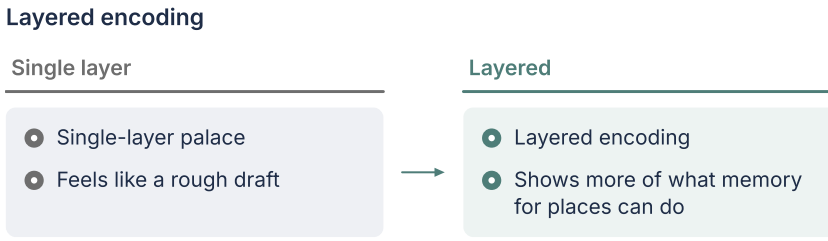
Science Says:

Journalist Joshua Foer won the 2006 USA Memory Championship. After about a year of training, he memorised a deck in 1 minute 40 seconds. He tells the story in *Moonwalking with Einstein: The Art and Science of Remembering Everything* (2011).

His conclusion was that top memory performance is **a skill you can learn**. It is no natural gift.

These advanced palace techniques stretch the basic structure a long way. **Layered encoding** is the most important of them. Once you master it,

the single-layer palace feels like a rough draft. It shows only part of what memory for places can do.



Layered encoding is the most important advanced palace technique.

Layered Memory Palaces

Some amounts of information are extremely large. Think of a whole medical course, a complete language or a whole profession's knowledge. For these, **a single Memory Palace is not enough**.

The answer is **a network of palaces**. A master 'Grand Palace' works as a directory, like a library catalogue that sends you to the right room and shelf. Its corridors lead to palaces for each subject. Each palace contains rooms, and each room contains items.

A tree of palaces keeps huge amounts of material **easy to move through**. Organised material is remembered better (Bower et al., 1969).

Number training comes next. There, the gap between trained and untrained memory shows most clearly. Numbers have **no natural meaning** to hold on to. That forces pure encoding technique.

The Major System: Numbers to Words

The Major System turns numbers **into consonant sounds**. It works a bit like a phone keypad, where each digit also stands for letters. You can then make these into words and picture them, using this mapping.

- 0=s/z, 1=t/d, 2=n, 3=m, 4=r
- 5=l, 6=j/ch, 7=k/g, 8=f/v, 9=p/b

The number 42 becomes ‘rN’, and that becomes ‘rain’ or ‘rhino’. With this system, **any number can become a memorable image**. It could be a date, a statistic or a phone number.

Using the code

Number	Sounds	Word
42	r, n	Rain or rhino
58	l, v	Lava
23	n, m	Name

Each digit pair becomes a word you can picture.

Your layered palace is now set up. It is time to test it on **a truly demanding string**. The number exercises begin with the core task. You store 30 digits with the Major System and place them along a palace route.

Most people hold about seven digits, so thirty is **far beyond them** (Miller, 1956). It is also where the palace technique shows its biggest advantage over rote repetition. Rote repetition means repeating something over and over. Keep a note of your encoding time, and compare it week to week.

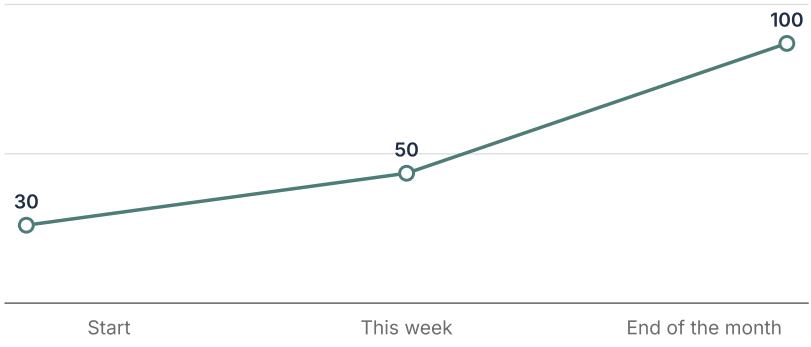
> **Exercise:**
> 4.2b, The 30-Digit Number Challenge. Follow these six steps.

1. Use the Major System to store the 30-digit number below as 15 two-digit images.

- 58 23 97 14 86 32 71 49 05 67 18 40 93 25 76

2. For each two-digit pair, use your Major System mapping. Make a vivid word or short phrase. For example, 58 becomes ‘lava’ (l=5, v=8) and 23 becomes ‘name’ (n=2, m=3).
3. Place each word-image in a Memory Palace with 15 stations.
4. Wait 10 minutes. Without looking at the number, walk your palace. Write the 30-digit string from memory.
5. Aim for 100% accuracy. Any errors show which Major System conversions need more practice.
6. Extend to 50 digits this week. Reach 100 digits by the end of the month.

The 30-Digit Number Challenge



Extend to 50 digits this week, and reach 100 by the end of the month.

The record for digits memorised in one hour **is 4,620**. Ryu Song I set it at the World Memory Championships in 2019 (Guinness World Records, as of 2026). Two groups run memory contests, and each keeps its own list of records. One is the WMSC (World Memory Sports Council), and the other is the IAM (International Association of Memory). The 4,620 record is on the WMSC list, and the record it broke there was 3,260 digits, held by Zhang Ying.

Digits memorised in one hour (WMSC list)



Two groups run memory contests, and each keeps its own list of records.

Raw digit strings are **a useful training tool**. The PAO system turns digit encoding into a full, fixed structure.

In it, every two-digit pair from 00 to 99 has **a fixed, memorable identity**. With enough practice, you can recall each one in under a second.

> **Exercise:**
> 4.2c, The PAO Speed Builder. Follow these six steps.

1. Make your own Person-Action-Object (PAO) table. Cover the 10 cards of a single suit (Ace through 10 of Hearts).
2. For each card, choose a Person you know well (real or fictional). Add an Action they are known for and an Object strongly linked with them. Write these down.
3. Use these two examples as models.

- Ace of Hearts gives Person: Sherlock Holmes, Action: examining a clue, Object: magnifying glass
- Seven of Hearts gives Person: Serena Williams, Action: smashing a serve, Object: tennis racket

4. Shuffle your 10 Hearts cards and lay them face-down. Flip them one at a time, building PAO scenes as fast as you can.
5. Practise until you can process 10 cards in under 2 minutes. Then extend to a full suit of 13.
6. For an advanced step, join three cards into a single scene. Person1 does Action2 with Object3. That packs three cards into one image. Many competitors use this technique for speed cards.



Practise until you can process 10 cards in under 2 minutes.



Sherlock Holmes examines a clue through a magnifying glass.

PAO handles ordinary digits, 0 to 9, neatly. Binary encoding is **a different kind of task**. It is highly practical for people who work in maths, computing or logic-heavy fields.

Two kinds of task

	PAO	Binary encoding
Handles	Ordinary digits, 0 to 9	Strings of 0s and 1s
Useful for	Speed cards	Maths, computing or logic-heavy fields

> Exercise:
> 4.2d, The Binary Number Sprint. Follow these six steps.

1. Binary digits are strings of 0s and 1s. They are a standard event in the World Memory Championships. They are one of the purest tests of encoding speed.
2. Group binary digits into pairs, which are 00, 01, 10 and 11. Give each a vivid image.

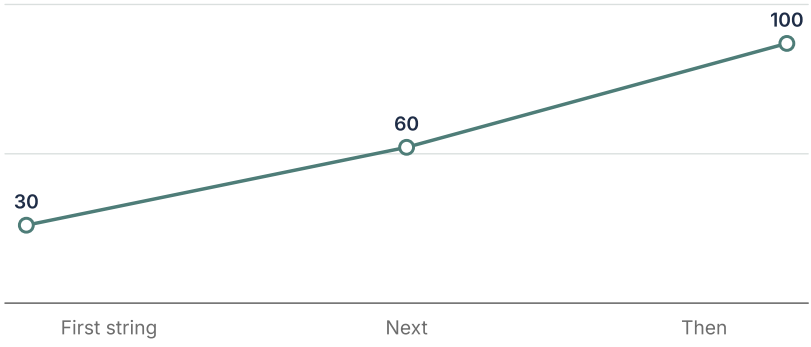
- 00 = an egg (two zeros)
- 01 = a pole with a ball on top
- 10 = a large 1 towering over a small 0
- 11 = two soldiers standing at attention

3. Start with the 30-digit binary string below.

- 0 1 1 0 0 1 1 0 1 0
- 1 1 0 0 1 0 1 1 0 1
- 0 0 1 1 0 1 0 1 1 0

4. Group the digits into pairs. Place each image in a Memory Palace of 15 stations.
5. Wait 5 minutes. Recall the full binary string.
6. Aim for 80%+ on your first try. Extend to 60, then 100 binary digits, as your palace skill grows.

Binary targets



Aim for 80%+ on your first try.

Number encoding **makes you more exact**. Word encoding builds a rich imagination. This lets you picture any word or phrase in a clear, striking way, on demand. Speed Words training is the purest form of this practice.

Binary, decimal and word encoding all deal with single items. Speed training adds **a different side**. It is the skill of storing and recalling material under competition time pressure.

A different side

So far	Speed training
Storing single items	Storing and recalling under competition time pressure

Binary, decimal and word encoding all deal with single items.

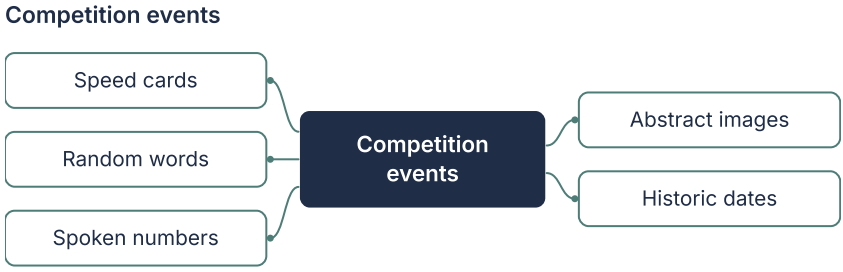
That is the most demanding condition in planned memory practice. **Time pressure** is what makes it so hard.

Quick check:

1. In the PAO system, how many cards does one image cover? Answer: Three. The Person from card 1 does the Action from card 2 with the Object from card 3.
2. In the Major System, what does 42 become? Answer: ‘rN’, as in ‘rain’ or ‘rhino’.
3. How fast could Joshua Foer memorise a deck after about a year of training? Answer: In 1 minute 40 seconds.

Competition-Style Training

Memory competitions are **more than events for experts**. Competition drills have a clock and a score, so you can see your progress. The events include speed cards, random words and spoken numbers. They also include abstract images, which are pictures that do not show any real object, and historic dates.



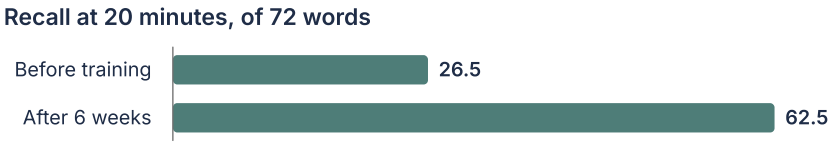
Each event tests a different kind of material.

Each event tests **a different kind of material**. You do not need to enter a competition to gain from competition-style training. Copy these events in your daily practice.

The World Memory Championships **began in 1991** and are now held every year. They have ten standard events, and each tests memory in a different way. The five most useful for everyday memory growth each come with full steps.

> **Science Says:**
>
> Research by Dresler et al. (2017) was published in Neuron. It compared the brains of **23 world-ranked memory champions** with matched controls. Controls are similar people who did not get the training.

The champions' brain networks were wired differently from the controls'. Think of roads between towns. Training changes which roads carry the most traffic. Then untrained people trained for just 6 weeks in Memory Palace techniques. That is the same method used in competition. Recall at 20 minutes **more than doubled**: 26.5 to 62.5 of 72 words.



Recall more than doubled after 6 weeks.

Their brains also showed changes you can measure in how areas link up and work together. The changes were in **visual and memory-related brain networks**. The default mode network changed too, the areas busy when your mind wanders.

Memory training lifts your scores, and it **changes how parts of the brain work together**. Speed Words practice makes your image-making faster. Session by session, you form vivid links faster. That speed helps every time you fill a memory palace.

Key idea:

Memory training lifts your scores and changes how parts of the brain work together.

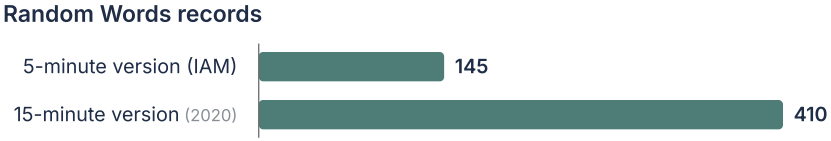
Speed Words practice makes you **faster at turning words into pictures**. You learn to picture words and ideas clearly and quickly. The steps that follow cover a full first week. The practice gets harder as you go.

Quick check:

1. How many world-ranked memory champions did Dresler et al. (2017) study? Answer: 23.
2. After 6 weeks of training, how did recall at 20 minutes change? Answer: It more than doubled, from 26.5 to 62.5 of 72 words.
3. When did the World Memory Championships begin? Answer: In 1991.

Speed Words: Rapid Vocabulary Encoding

In competition, the 5-minute version of this event is called Random Words. You memorise as many random words as you can. Then you recall them in order, and **the record is 145 words** (IAM). In the 15-minute version, the record is 410 words (Guinness World Records, 2020).

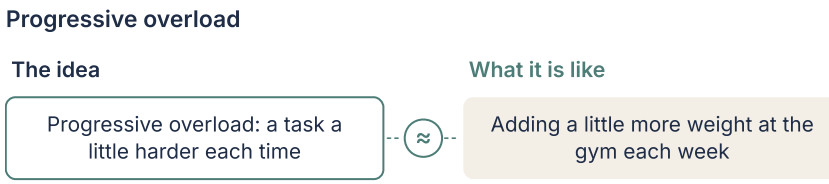


You recall the words in order.

For everyday learners, 40–60 words after one month of practice is **an excellent result**. Quick image-making also helps you learn new words with the keyword method, where you link a new word to a familiar word that sounds like it, through a bright picture.

The event is simple, and the task gets harder just as fast as your skill grows. Begin at a pace that feels slightly uncomfortable. It should be **hard but possible**. That zone of hard but doable work is where growth happens.

Week One sets up the habit and the baseline. The step-up programme makes sure training never gets comfortable enough to stop giving growth. Making a task a little harder each time is called **progressive overload**. It works like adding a little more weight at the gym each week. Here it is applied to memory.



It works like adding a little more weight at the gym each week.

Key idea:

Keep it hard but doable, make it a little harder each week, and you keep growing.

Speed Words training is **a quick drill you can do every day**. In five minutes, it builds encoding speed, image vividness and creative linking.

> **Exercise:**
> 4.3, Speed Words, Week 1 Protocol. Follow these six steps.

1. Set a timer for 5 minutes.
2. Study the 40 words below. Use any method from the techniques module, such as a Story Chain (a story that links the items to remember, one after another) or Memory Palace.

- architect, sermon, canyon, covenant, diesel, aqueduct, saffron, manifesto, metronome, solstice
- embassy, turbine, tapestry, verdict, tributary, algorithm, equinox, dynasty, mirage, scalpel
- cavalry, cormorant, citadel, nocturne, prism, harness, calculus, comet, tundra, chancellor
- filibuster, archipelago, sextant, oboe, sovereign, velvet, mercury, curtain, ballot, harpoon

3. When the timer sounds, put the list away. Wait a full 20 minutes (no peeking).
4. Write all the words you can recall, in the order they appeared. You get 1 point per word in the correct position. You get 0.5 points per word recalled but out of order.
5. Record your score. Repeat this exercise three times a week for 4 weeks, and track your progress.
6. In Week 1, aim for 15–20 points. By Week 4, aim for 40 or more.



You get 1 point per word in the correct position.



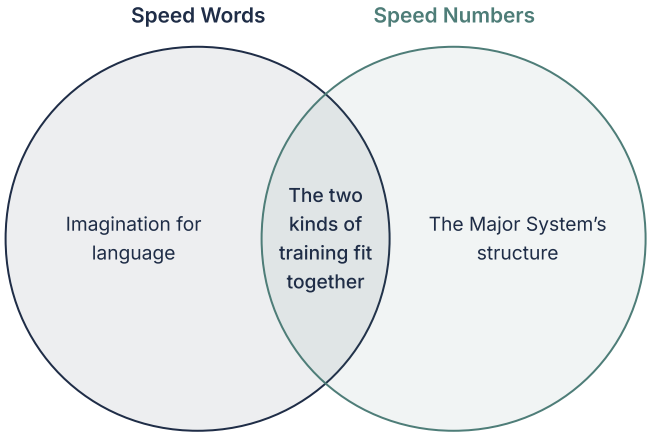
A learner studies a list of words while a five-minute timer runs.

In competition, words come in columns of 20. A perfect column scores 20, and **one mistake halves it**. Two or more mistakes score 0 (WMSC, 2019).

Champions take **about 2 seconds a word**. Learners do fine at 3–5 seconds. If you spend over 10 seconds on each image, your images are too detailed. Trust the first vivid image that comes to mind, and move on.

Words use your imagination for language, and numbers use the Major System's structure. The two kinds of training **fit together**. Switch between them often. Otherwise you narrow your skills, and that would limit your encoding range.

Words and numbers

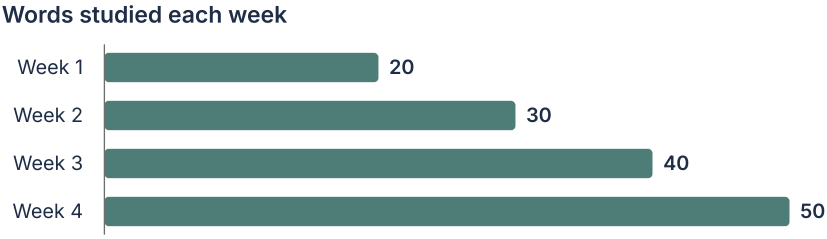


> **Exercise:**
> 4.3b, Speed Words, Progressive Difficulty Programme. Follow these six steps.

1. Week 1 uses 20 words, a 3-minute study and a 15-minute recall gap. Aim for 15+ correct.
2. Week 2 uses 30 words, a 4-minute study and a 20-minute recall gap. Aim for 20+ correct.
3. Week 3 uses 40 words, a 5-minute study and a 30-minute recall gap. Aim for 30+ correct.
4. Week 4 uses 50 words, a 5-minute study and a 45-minute recall gap. Aim for 40+ correct.

5. After each session, find the words you missed and work out why. Was the image weak? Was the palace station crowded? Did you skip encoding one item to rush to the next?

6. Write these notes on what went wrong in your Memory Journal. Studying your mistakes and fixing what caused them **is central to deliberate practice**.



Week 4 uses 50 words, a 5-minute study and a 45-minute recall gap.

Speed Words builds ease in turning words into pictures. Speed Numbers **builds the partner skill**. That is using the Major System automatically under time pressure. Competitive number memorising depends on it.

Quick check:

1. How many points do you get for a word recalled out of order? Answer: 0.5 points.
2. What is the Week 4 target in the Week 1 Protocol? Answer: 40 points or more.
3. What does it suggest if you spend over 10 seconds on each image? Answer: Your images are too detailed.

Speed Numbers: Digit Memorisation Under Pressure

In the Speed Numbers event, you have 5 minutes. You memorise as many random digits as you can. Wei Qinru holds the 5-minute record, with **616 digits in 2019** (Guinness World Records).

Recall takes 15 minutes (WMSC, 2019). The digits come in rows of 40. A perfect row scores 40, **one mistake halves it** and two or more score 0.

Scoring a row of 40

Mistakes in the row	Score
None	40
One	Half
Two or more	0

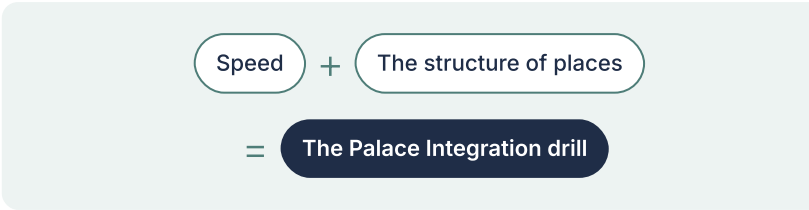
One mistake halves the row (WMSC, 2019).

In everyday life, storing 50–80 digits in one session is **very useful**. It can help with statistics, dates and phone numbers. Never store PINs, passwords or account numbers only as images, or write the images down. Use a password manager or your bank's app.

Speed Numbers and Speed Words training build **different encoding muscles**. Switching between words and numbers keeps both skills in shape. The exercises below take Speed Numbers through its full step-up structure.

Speed training on single number strings builds **raw encoding power**. The Palace Integration drill joins this speed with the structure of places. Competitive memory athletes use this mix for whole decks of cards and hundreds of digits.

Palace Integration



The Palace Integration drill joins this speed with the structure of places.

Key idea:

Digit pairs, the Major System and a palace route together give you long numbers you can recall.

Number encoding relies on method more than any other memory event. **Imagination alone is not enough**. It needs careful use of the Major System under time pressure.

This step-up drill begins at a pace most people find comfortable. It then **grows harder steadily**. That trains the speed and automatic use that make the Major System truly useful.

> **Exercise:**
> 4.4, Speed Numbers, Progressive Challenge. Follow these six steps.

1. On Day 1, memorise the 20-digit number below, using chunking and the Major System. Study it for 3 minutes, and recall it after 10 minutes.

- 7 3 8 4 1 9 2 6 5 0
- 4 7 3 1 8 5 2 9 6 4

2. On Day 3, extend to 30 digits. Add 10 new digits to your palace after the first 20.

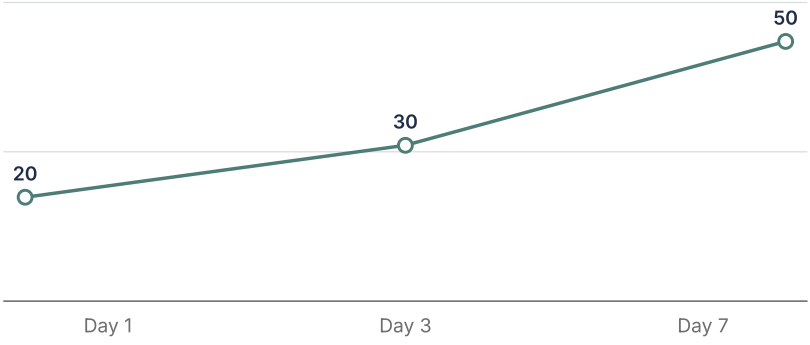
3. On Day 7, try 50 digits. Use a palace with at least 25 stations, each holding one Major System image.

4. In each session, use the Major System to turn each digit pair into a word-image. Then place the string of images in your Memory Palace.

5. Record your longest accurate string of digits each session. Chart it weekly.

6. As a guide, 20 digits after Day 1 is good. 50 digits after Week 4 is excellent. The world's best manage over 600 digits in five minutes.

Speed Numbers, Progressive Challenge



Record your longest accurate string each session.

Convert digits **two at a time**. Single digits have only 10 possible images. Pairs give you 100, with a much richer range of pictures. It is like a box of 100 crayons next to a box of 10. That usually makes encoding faster.

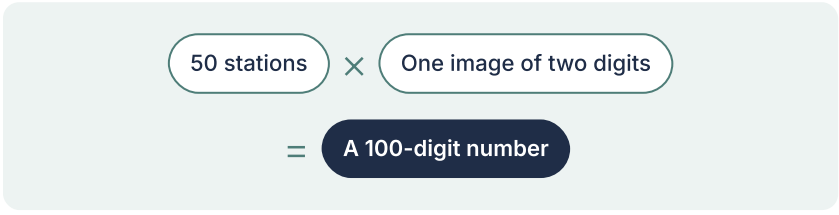
Numbers and words train encoding of things with no natural picture. The next timeline exercise adds **a third side**, which is time. You store when things happened as well as what, in an ordered memory of time. It turns single facts into real understanding of history.

> **Exercise:**
> 4.4b, The Number-Palace Integration Drill. Follow these five steps.

1. Build a 'Number Palace' **just for numbers**. Use a very familiar route of 50 stations, no more and no fewer. Try your morning commute, a school you attended or a long corridor you know well.
2. Each station will hold one Major System image (two digits). So your 50-station palace can hold **a 100-digit number**.

3. Practise loading the palace with random numbers **daily**. Make up a random 20-digit number. You could also use any news story's page number or reference codes. Turn it into Major System images, and place them.
4. For the recall test, **wait 1 hour**. Then walk the palace and rebuild the number.
5. Set a goal for the next 3 weeks. Aim to load and recall a 40-digit number with **95%+ accuracy**.

Number Palace



Set a goal for the next 3 weeks.

Quick check:

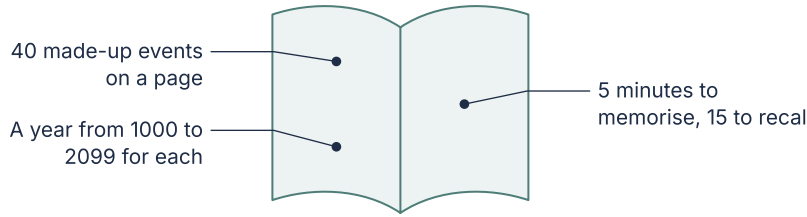
1. How long is recall in the Speed Numbers event? Answer: 15 minutes (WMSC, 2019).
2. Why convert digits two at a time? Answer: Pairs give you 100 possible images. Single digits give only 10.
3. How many digits can a 50-station Number Palace hold? Answer: 100 digits.

Historic Dates: Anchoring Facts in Time

MEMORISING LOTS OF DATES and their events is one of the **most practical memory skills**. History students, quiz champions and anyone who wants a clear timeline need it.

The official competition event is called **Historic / Future Dates**. You get 5 minutes to memorise and 15 minutes to recall (WMSC, 2019). The events are made up, such as "Peace treaty signed". Each has a year from 1000 to 2099, with 40 on a page.

A page of the event



Historic / Future Dates

The events are made up, such as "Peace treaty signed" (WMSC, 2019).

At recall, the events come back in a new order, and you write each year. Each correct year scores 1 point. Each wrong year **loses half a point**, and a blank costs nothing. The steps below work for any subject that pairs dates with facts.

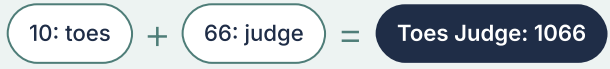
The IAM record is **148 dates in 5 minutes**. Prateek Yadav set it at the Indian Memory Championship 2019 (IAM Statistics).

To memorise an event, you store what happened. You also build **a hook and path back** from it to its exact date. This system turns dates into vivid images with the Major System. It fixes them to places in a timeline palace.

> **Key Concept:**
> The Date-Event Encoding System has four steps.

1. **Convert the year**. Use your Major System to turn the year into a word or pair of words. For 1066, split it into 10, which becomes ‘toes’ (t-s), and 66, which becomes ‘judge’ (j-j). That gives ‘Toes Judge.’
2. **Encode the event**. Turn the event into a vivid image or character. For the Battle of Hastings, picture two armies clashing on a hill. Give each army its own coloured flag.
3. **Fuse date and event**. Place both images in a single Memory Palace station. Make a scene where the date-image acts physically on the event-image. Toes plus a Judge stand over two armies on a hill. It works like stapling a ticket to a coat. When you find one, you find the other.
4. **Use a Timeline Palace**. Build a Memory Palace laid out as a timeline. Put the Ancient world in the entrance and Medieval in the hallway. Early Modern goes in the living room and Modern in the kitchen. The 20th Century takes the bedroom. This gives order in time a place in space.

Convert the year



Split 1066 into 10 and 66.



Two armies clash on a hill, a memory image for the Battle of Hastings.

Key idea:

Put the year image and the event image in one scene, and the date comes back with the event.

Historical timelines store the public record of events. Personal timelines store something just as important, which is **your own life story**. That means your experiences, choices and turning points in order. You remember them clearly and on purpose.

Two kinds of timeline

	Historical timelines	Personal timelines
What it stores	The public record of events	Your own life story

Personal timelines store something just as important.

> **Exercise:**
> 4.5, The Historical Timeline Challenge. Follow these four steps.

1. Memorise the 20 date-event pairs below. BCE means before the Common Era, the years counted back from year 1, and CE means the years from year 1 on. Use the Date-Event Encoding System and a Timeline Palace.

- 776 BCE (traditional date) = First Olympic Games
- 44 BCE = Assassination of Julius Caesar
- 476 CE = Fall of the Western Roman Empire
- 622 CE = The Hijra, which marks year 1 of the Islamic calendar
- 1066 = Battle of Hastings
- 1215 = Magna Carta sealed
- c. 1440 = Gutenberg's printing press
- 1492 = Columbus reaches the Americas
- 1543 = Copernicus publishes his theory that the Earth goes round the Sun
- 1687 = Newton's *Principia Mathematica*
- 1776 = American Declaration of Independence
- 1789 = French Revolution begins
- 1859 = Darwin's *On the Origin of Species*
- 1865 = 13th Amendment abolishes slavery in the USA
- 1903 = Wright brothers' first powered flight
- 1928 = Fleming discovers penicillin
- 1945 = End of World War II

- 1953 = Watson and Crick describe the structure of DNA
- 1969 = First Moon landing
- 1989 = Fall of the Berlin Wall

2. **Study for 15 minutes**. Walk your Timeline Palace twice in your mind.
3. **Wait 1 hour**. Without looking at the list, write all 20 date-event pairs from memory.
4. Score 1 point for the correct year and 1 point for the correct event. Aim for 30/40 at first. After a week of practice, **aim for 38/40**.

BCE and CE



BCE years count back from year 1, and CE years count on from it.

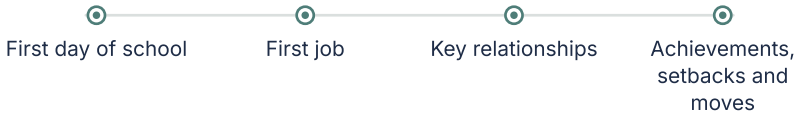
Real events and experiences are natural things for the brain to store. Symbols with no meaning are **a very different kind of task**. They do not stand out, so they need a clear plan for storing them.

> Exercise:
>
> 4.5b, Personal Timeline Palace. Follow these five steps.

1. Make a Memory Palace for **the key events of your own life**. You can walk this timeline of your life any time.
2. Pick **20 important moments**. Think of your first day of school, first job and key relationships. Add achievements, setbacks, moves and decisions.

3. For each, make a vivid scene that captures **both when and what**. Store the when with a Major System year-image. Show the what with a strong picture of the event.
4. Place these scenes in time order through a palace that feels personal to you. **Your childhood home** is ideal.
5. This exercise builds your date-encoding technique. Memory of your own life is called **autobiographical memory**. It is closely bound up with your sense of self (Conway, 2005). Walking your own timeline may help you see your life story more clearly.

Personal Timeline Palace



Place the scenes in time order through your childhood home.

Memories tied to your own life are **often well remembered**. That is especially true when they matter to you. Shaping your life story on purpose may help both your memory and your wellbeing.

Quick check:

1. In the competition, what does a wrong year cost? Answer: Half a point. A blank costs nothing.
2. What does 1066 become in the Major System example? Answer: 'Toes Judge', from 10 as 'toes' and 66 as 'judge'.
3. After a week of practice, what score should you aim for on the 20 pairs? Answer: 38/40.

Abstract Images: Encoding the Unnameable

One of the **hardest competition events** asks you to memorise strings of abstract images. These are shapes, patterns and symbols with no built-in meaning.

In the official event, you get **15 minutes to memorise and 30 minutes to recall** (WMSC, 2019). Each page has rows of 5 images. At recall, each row comes back in a new order. You write down where each image was at first.

A fully correct row scores 5 points. A row you try but get wrong loses 1 point. A blank row costs nothing.

Scoring a row

Row	Points
Fully correct	5 points
Tried but wrong	Loses 1 point
Blank	Costs nothing

You write down where each image was at first.

This event tests a simple idea. I say there is **no meaningless information**. There is only information you have not given a meaning yet. Seeing what a shape looks like can help with logos, symbols and diagrams.

A system for single symbols is the base. The Symbol Alphabet stretches this into a full code. It is **a picture language** that can store any string of symbols. You can learn to read it as fast as words.

Maths signs, circuit drawings, music symbols and foreign letters **mean nothing to an untrained eye**. That makes them hard to store.

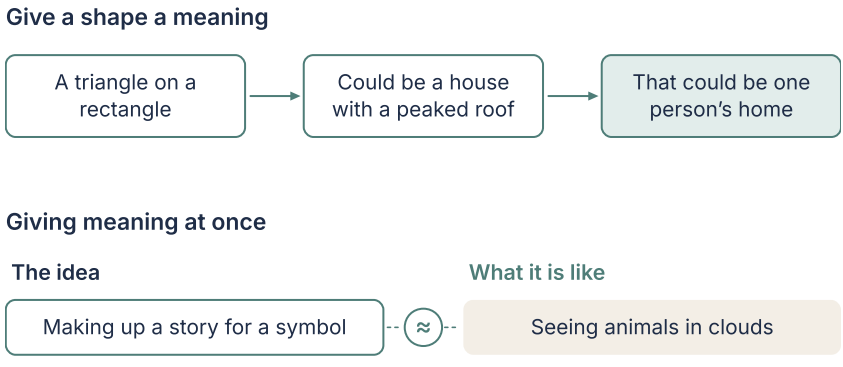
Key idea:

An odd shape plus a made-up meaning gives you an image that is easier to remember.

The next technique turns each symbol into a real, memorable image. Turning a shape with no meaning into a real picture makes it **easier to remember** (Paivio, 1986).

> Exercise:
> 4.6, Abstract Symbol Encoding. Follow these five steps.

1. Draw or print 15 simple symbols. Use shapes, letter parts, random curves and odd mixes. One mix is a circle with a line through it and a small square.
2. For each symbol, make up a story at once about what it could stand for. Think about what it looks like, and set aside what it is. It is like seeing animals in clouds. A circle crossed by a line could be a lollipop from above, and that could be a child at a fair. A triangle on a rectangle could be a house with a peaked roof, and that could be one person's home.
3. Link each meaning into a Story Chain, or place each one in a Memory Palace.
4. Shuffle the symbols and wait 20 minutes. Put them back in their first order from memory.
5. The skill you are building is giving meaning at once. Aim to give any shape a memorable meaning in under 2 seconds. That target is practice, and the skill will likely help your other techniques too.



Think about what it looks like, and set aside what it is.

This is **a training drill**, and the competition uses its own format. The section after this trains the ear, where these drills train the eye. You learn to store spoken information as you hear it, without notes. This helps in talks, meetings and presentations.

> Exercise:
> 4.6b, The Symbol Alphabet. Follow these five steps.

1. Make your own Symbol Alphabet. It is a fixed set of **26 memorable images**, one per letter. Choose images that are vivid, stand out in shape and mean something to you.
2. A is an ARROW, B a BEAR, C a CRESCENT MOON and D a DOOR. E is an EYE, and so on through Z.
3. Memorise your Symbol Alphabet, since it is a one-time job. Spend 2–3 days drilling it until every letter brings up its image at once.

4. Now use your alphabet to store information with no meaning of its own. Turn key ideas into first-letter images, and string them into scenes. You can turn any meaningless string into a vivid story.

5. Test your alphabet on 5 random 4-letter strings (like XBQM or PZLR). Store each as a Palace scene, then recall them 30 minutes later.

Your Symbol Alphabet

A B C D E

A Arrow

B Bear

C Crescent moon

D Door

E Eye

One memorable image per letter, through Z.

Quick check:

1. How many points does a fully correct row score? Answer: 5 points.
2. What does a row you try but get wrong cost? Answer: 1 point. A blank row costs nothing.
3. How fast should you aim to give a shape a memorable meaning? Answer: In under 2 seconds.

Spoken Words: Audio Memory Training

In this drill, a partner reads you a list of words, **one per second**. It is hard because you cannot reread, go back or pause. You must store each word in under one second.



A partner reads a list of words aloud, one per second.

The drill builds a very useful skill. You learn to catch information **from a single hearing**, and keep it. That helps in lectures, meetings, briefings and talks with people.

Spoken words have **no pause button**. It is like catching balls from a machine that keeps throwing. They keep coming, even if you have not finished the last one. That pressure is what makes this drill such good training.

No pause button



That pressure makes this drill such good training.

The word drill is my own training drill and not a competition event. The official championship event uses digits, and it is **called Spoken Numbers** (WMSC, 2019).

In Spoken Numbers, the digits are read out at one per second. At world level, there are **three tries**. They last 200 seconds, 300 seconds and the world record plus 20%.

You get **10, 15 and 25 minutes** to recall them. At national level, the tries last 100 and 300 seconds.

World and national level

	World level	National level
Tries	200 and 300 seconds, and the record plus 20%	100 and 300 seconds

You get 10, 15 and 25 minutes to recall them.

Scoring stops at the first mistake. You score the correct digits in a row from the start. Say you recall 127 digits, with a mistake at digit 43. Your score is 42.

Storing what one speaker says builds the core skill. The Meeting Recall Protocol takes it into **a harder setting**. There, many people talk about many topics, all pulling at your attention.

Spoken information is **easy to lose**. You cannot look at it again, mark it or reread it. The next exercise trains you to store information as you

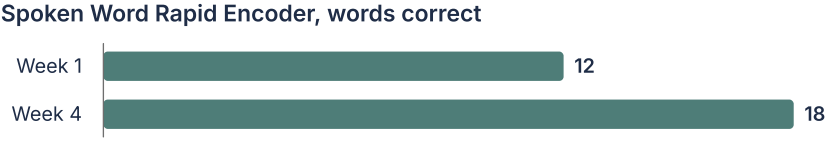
hear it. You turn each sound into a picture for your palace before it fades away.

Key idea:

One hearing plus an image made at once gives you spoken words you can keep.

> Exercise:
>
> 4.7, The Spoken Word Rapid Encoder. Follow these six steps.

1. Ask a partner to read 20 random words aloud, one per second. A text-to-speech app set to a 1-second gap works too.
2. As each word is spoken, make **a vivid image at once**. Place it at a station in a Memory Palace. You have just 1 second before the next word comes.
3. After the last word, **wait 5 minutes in silence**.
4. Write all 20 words **in order** from memory.
5. In week 1, **aim for 12+** words correct. In week 4, aim for 18+.
6. The one-second limit makes you **trust your first idea**. Stopping to think slows you down. This exercise trains quick choices as much as memory.



In week 1, aim for 12+; in week 4, aim for 18+.

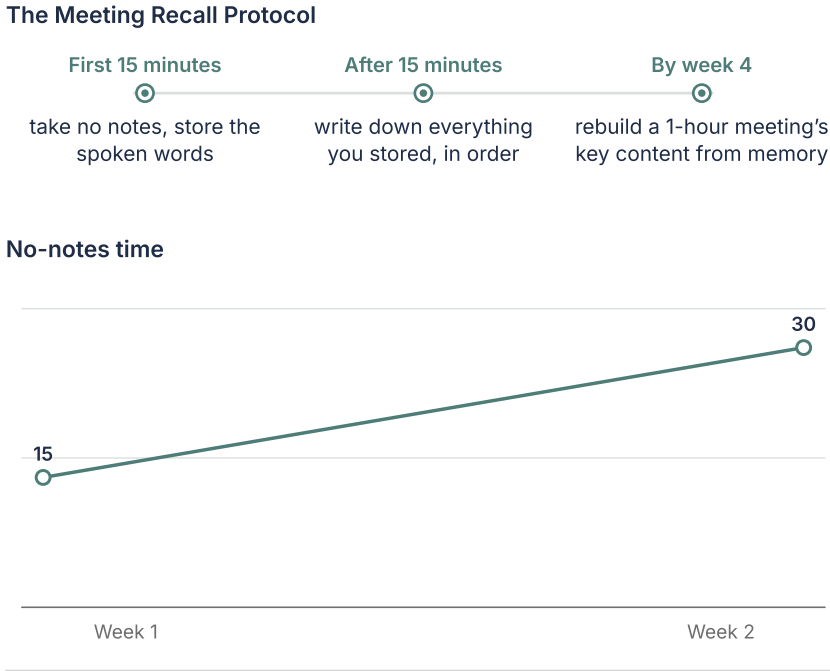
In the World Memory Championships, Spoken Numbers digits come one per second. Training at this speed may help you **stay focused when listening**.

For a harder score, borrow the digits rule for your word list. **Stop counting** at your first mistake.

Every exercise in this module up to now has been for practising alone. Memory also has **a social side** that solo training cannot reach. Sharing, teaching, competing and working with others can help you store things. The next section covers that side.

> Exercise:
>
> 4.7b, The Meeting Recall Protocol. Follow these six steps.

1. In your next meeting, lecture or talk, **take no notes** for the first 15 minutes.
2. Instead, store the spoken words as they come. Give each key point a vivid image. Place it in a Memory Palace built from **the room you are sitting in**.
3. After 15 minutes, pause and write down **everything you stored**. Write the key ideas in order. The exact words do not count here.
4. Compare your list with **any notes others took**. See how complete and well ordered your recall is.
5. Slowly **make the no-notes time longer**. Go for 15 minutes in week 1 and 30 in week 2. In week 3, go for the full meeting.
6. By week 4, aim to rebuild a 1-hour meeting's key content from memory. A personal target is **70–80%** of it.



In week 3, go for the full meeting.

Practise this in meetings where little is at risk. Numbers, decisions and deadlines matter. Write them down afterwards, or keep notes as usual. Writing things down is a **well-studied way to take load off memory**, and it works (Risko & Gilbert, 2016).

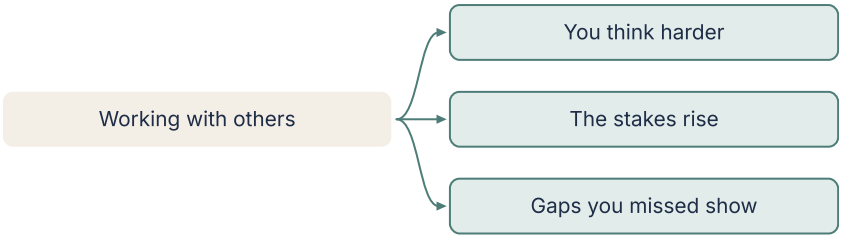
Quick check:

1. In Spoken Numbers, you recall 127 digits with a mistake at digit 43. What is your score? Answer: 42.
2. What is the week 4 target in the Spoken Word Rapid Encoder? Answer: 18 or more words correct.
3. What should you do with numbers, decisions and deadlines from a meeting? Answer: Write them down afterwards, or keep notes as usual (Risko & Gilbert, 2016).

Group Memory Training

People often think of memory training as something you do alone. But we can also store things well **with other people**. You explain, quiz, challenge and compete. That can make you think harder, raise the stakes and show gaps you missed.

Why groups help



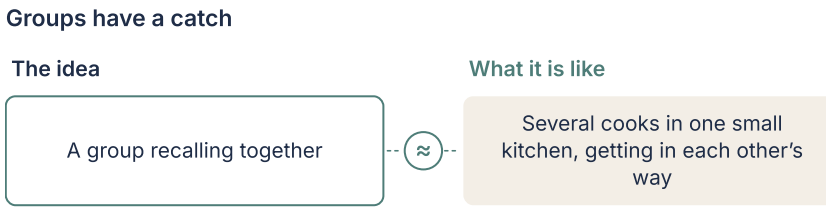
You explain, quiz, challenge and compete.

Teach what you have learned, from memory and without notes. That works **about as well as testing yourself** (Koh et al., 2018). It works much better than rereading or marking lines with a pen (Dunlosky et al., 2013). Teaching helps most when it makes you recall.

The exercises in this section need **two or more people**. Study groups, work teams, couples, families or any pair can use them. You need no extra materials.

We can think of **four ways that groups help memory**. They are teaching, competing for attention, building together and keeping each other on track. Each of the eleven exercises below uses one of them.

Groups also have a catch. A group recalling together remembers less than its members recalling alone and pooling answers (Rajaram & Pereira-Pasarin, 2010). It is like several cooks in one small kitchen, getting in each other's way. Working together can still fix mistakes and help later memory. Study and recall alone first, then compare in the group.



A group recalling together remembers less (Rajaram & Pereira-Pasarin, 2010).

Key idea:

Study and recall alone first, and then compare in the group.

> **Science Says:**
>
> Bargh and Schul (1980) studied students who expected to teach the material later. They **remembered more of it** than students who studied only for themselves. Getting your knowledge in order for someone else makes you store it more deeply.

Koh et al. (2018) tested teaching without notes. It **did as well as testing yourself**. Both beat teaching from notes, one week later.

One week later

	Result
Teaching without notes	As well as testing yourself
Testing yourself	As well as teaching without notes
Teaching from notes	Did less well

Both beat teaching from notes (Koh et al., 2018).

Partner exercises with a clear plan use these social effects best. They give you **the right kind of pressure**, feedback and teamwork.

Quick check:

1. What did Bargh and Schul (1980) find? Answer: Students who expected to teach remembered more than students who studied only for themselves.
2. Does a group recalling together remember more than its members alone? Answer: No. It remembers less than its members recalling alone and pooling answers (Rajaram & Pereira-Pasarin, 2010).
3. How did teaching without notes do one week later? Answer: As well as testing yourself, and better than teaching from notes (Koh et al., 2018).

Partner and Small Group Exercises

These exercises go in order, **from the most basic to the hardest**. The first is the Relay Palace. It tests how well an image passes from one person to another. The last is the Interference Championship, where you learn while something gets in your way.

The group exercises, from the most basic to the hardest



Work through them in order the first time.

Work through them in order the first time. Then **go back to the ones** that help your group grow the most.

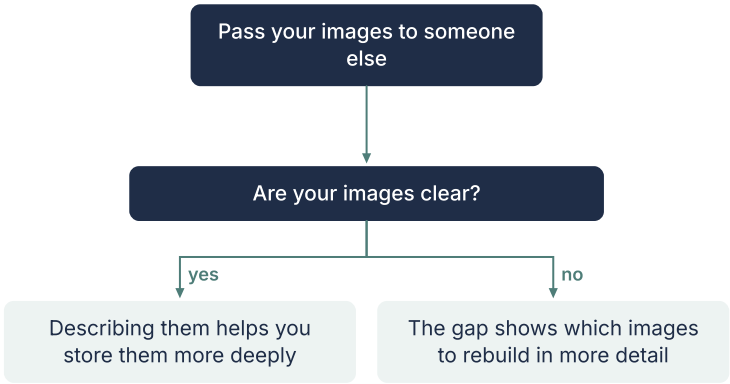
Key idea:

Teach from memory, then talk it over afterwards, for deeper learning.

The Relay Palace checks whether your images pass clearly to someone else. The Teaching Chain asks for more. Each person must know their part well enough to **teach it from memory**.

The test **works both ways**. If your images are clear, describing them helps you store them more deeply. If not, the gap shows which images to rebuild in more detail.

The test works both ways

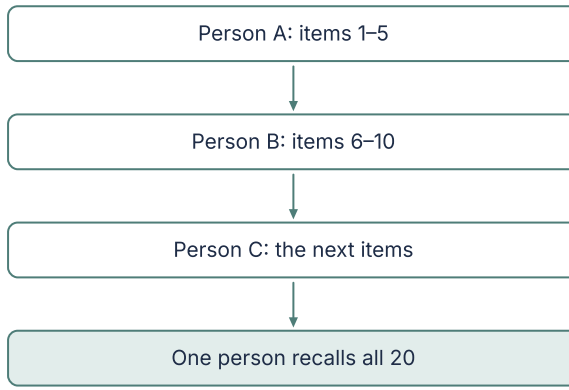


> **Exercise:**
> G-1, The Relay Palace. Follow these six steps.

1. You need 2–4 people and 20–30 minutes.
2. Choose a Memory Palace place that everyone can picture. Try a shared office, a school or a building you all know.
3. Person A stores the first 5 items from a 20-word list. They place them at stations 1–5 of the palace. Then they describe each image to Person B.

4. Person B stores and places items 6–10. They describe them to Person C, or back to the first person. Keep going until all 20 items are placed.
5. Pick one person at random. They must recall the whole list in order without help.
6. Talk it over afterwards. Where did the handovers give the weakest recall? Whose image descriptions stuck best, and why? What helped an image pass from one mind to another?

Pass the images on



Keep going until all 20 items are placed.



Friends share one Memory Palace, an office they all know well.

Putting your image into words for someone else makes you **sharpen it**. Explaining is itself a good way to learn (Fiorella & Mayer, 2013).

The Teaching Chain uses **the protégé effect**. It works like an older sister who learns a game better by teaching it to her little brother. In one study, students taught a computer character (Chase et al., 2009). They tried harder to learn than when they learned for themselves. The Speed Round Recall Duel adds the helpful pressure of comparing your results.

The Teaching Chain



You need 2–6 people and 30–45 minutes.

> **Exercise:**
> G-2, The Teaching Chain. Follow these six steps.

1. You need 2–6 people and 30–45 minutes.
2. Each person studies a different part of some material on their own for 15 minutes. That might be one chapter each, or one module each of a course.
3. Each person then teaches their part to the group from memory, with no notes. The group may ask questions.
4. After every part has been taught, test everyone on all of the material.

5. Score each person's test on its own. You will probably score best on the part you taught. That shows the teaching effect at work.
6. Swap parts in the next session. In time, everyone teaches every part.

Teaching without notes works because it makes you recall. One week later, it had helped as much as testing yourself (Koh et al., 2018). **Teaching with notes did not**. Expecting to teach also helps you recall more, in better order (Nestojko et al., 2014).

Teaching, one week later

	Without notes	With notes
Result	Helped as much as testing yourself	Did not

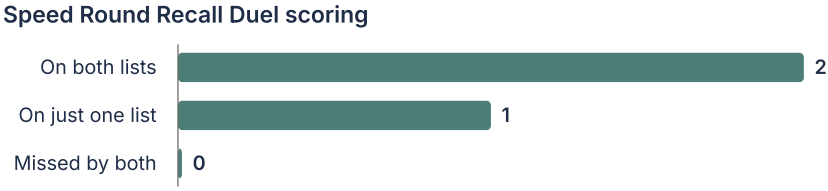
Teaching without notes works because it makes you recall (Koh et al., 2018).

Competing sharpens your attention. But the deepest learning comes in **the talk after each round**, when you compare methods. The Socratic Memory Drill makes that questioning the exercise itself, so you learn by being asked questions, with no statements given. Talking things through is the main way you store the material.

> **Exercise:**
> G-3, Speed Round Recall Duel. Follow these six steps.

1. You need 2 people and 10–15 minutes.
2. Both of you study the same 20-item list for 90 seconds. Make sure you cannot see each other's lists during recall.

3. On “go”, you both write your recall lists at the same time, on your own.
4. Compare your lists. An item on both lists scores 2 points. An item on just one list scores 1 point. An item that you both missed scores 0.
5. Add up the joint score. Items on both lists were the easiest to remember. Items on just one list show different ways of storing.
6. Afterwards, talk it through. Compare how you each stored the items.



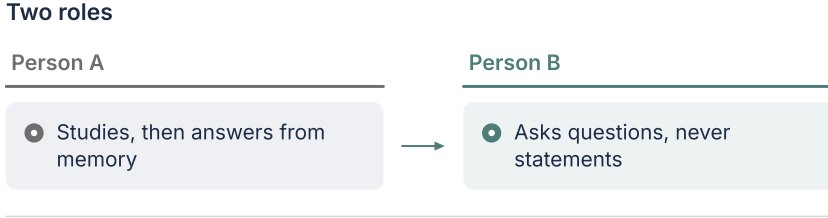
Add up the joint score.

The real value is the talk afterwards. Comparing how each of you stored the items gives you new ideas to try.

Questions find gaps that checking yourself misses. A group’s shared imagination can give richer results than one person’s ideas. The Construction Party shows this.

> **Exercise:**
> G-4, The Socratic Memory Drill. Follow these six steps.

1. You need 2 people and 20 minutes.
2. Person A studies some material for 10 minutes with any technique. It could be a chapter, a set of vocabulary or a process.
3. Person B then asks Person A questions for 10 minutes, and never makes statements. Try “What does that connect to?” or “Why does that matter?” Then try “What would happen if you removed that step?” Also ask “How does that relate to what you told me earlier?”
4. Person A must answer from memory. Person B’s job is to find the edges of what Person A knows.
5. Swap roles. The questioner learns as much as the one who answers. Good questions need deep understanding too.
6. Write down every question that caused a pause or a mistake. Those become the focus of your next solo study session.



Person A must answer from memory.

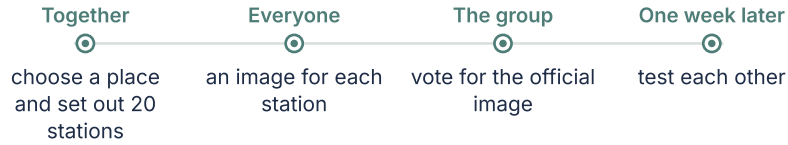
Answering “why” and “how” questions **hooks facts onto each other**. That helps you remember them. A big review rated this method as moderately useful (Dunlosky et al., 2013).

In a shared palace, each person's imagination **adds angles the others may miss**. The Error Auction uses something else the group has, which is everyone's mistakes. It turns them into chances for the whole group to learn.

> Exercise:
> G-5, Memory Palace Construction Party. Follow these six steps.

1. You need 2–4 people and 45–60 minutes.
2. Together, choose a real place you all know as the Palace. A school corridor, a shared flat or an office floor works well.
3. Together, set out 20 stations in order through the place. Everyone must agree on the order and the landmarks.
4. One person reads out the items to store. Everyone makes their own image for each item at each station.
5. Each person describes their image for each station to the group. The group votes for the best image. It becomes the "official" image for that station.
6. One week later, meet again and test each other on the palace. Compare the group's score with each person's solo score.

Memory Palace Construction Party



One week later, meet again and test each other on the palace.

Pick the image that stands out most and **acts on its station**. A strange image is not always easier to remember (McDaniel & Einstein, 1986). What helps more is images acting on each other (Wollen et al., 1972).

Strange images

A strange image	Images acting on each other
A strange image is not always easier to remember	→ Images acting on each other help more

McDaniel & Einstein, 1986; Wollen et al., 1972.

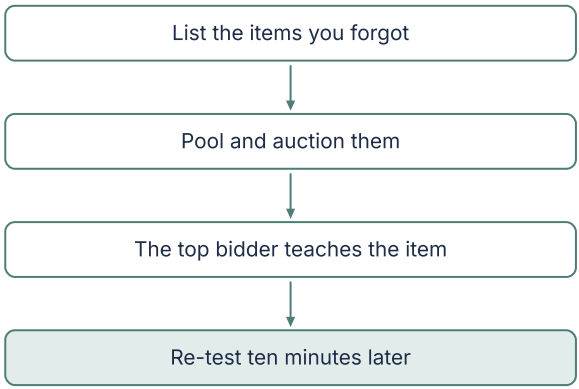
Mistakes that you look at honestly and teach to others **can become strong memories**. The Cumulative Story swaps careful study for imagination. Together, you build a shared story while the load on your memory keeps growing.

> Exercise:
> G-6, The Error Auction. Follow these six steps.

1. You need 2–6 people and 20–30 minutes.
2. After any group recall exercise, each person lists the items they forgot or got wrong.
3. Pool these "error items" and auction them. Each person bids pretend points on the items they can explain. The top bidder then teaches that item to the group. They explain why it is memorable and show the technique they will now use.
4. Ten minutes later, everyone re-tests on the auctioned items.

5. Aim for near-perfect recall of the taught items in the re-test. Aim for good recall a week later.
6. Track the auction items across sessions. Mistakes that keep coming back show weak spots in how you store things. Give them extra work.

The Error Auction



Mistakes that keep coming back show weak spots.

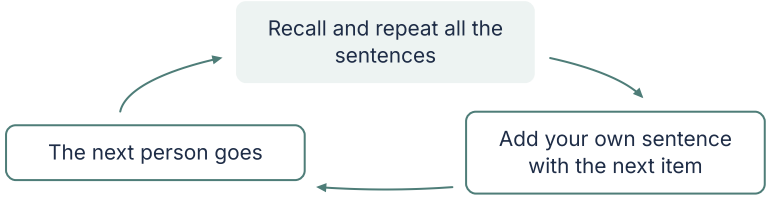
Getting it wrong, then learning the right answer, **can help you learn** (Kornell et al., 2009). In my view, groups that focus on mistakes come to see them as practice. Fear of performing becomes less of a problem.

The Cumulative Story tests short-term memory while **new items get in the way**. Blind Palace Navigation tests something just as important. It checks whether your words let someone else rebuild your mental image.

> **Exercise:**
> G-7, The Cumulative Story. Follow these six steps.

1. You need 3–8 people and 15–20 minutes.
2. One person draws a card from a shuffled deck of memory prompt cards. A random word generator works too. They say one sentence that includes that item.
3. The next person must repeat the first sentence word for word. Then they add their own sentence with the next item.
4. Keep going round the circle. Each person must recall and repeat all the sentences before adding their own.
5. When someone makes a mistake, the whole group rebuilds the correct order. Then you go on.
6. The person who adds the 20th item without a mistake wins. But the real measure is the group's total number of mistakes. Track this across sessions.

The Cumulative Story



Keep going round the circle.

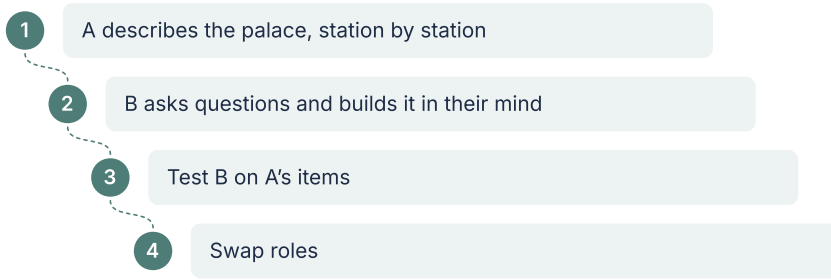
Each new sentence competes with the ones before it. That makes the game a good test of **how well you hold things in order**. It is like trying to read with a radio on.

Putting images into words shows gaps that **private review never finds**. The next exercise, run over 48 hours, looks further ahead in time. It tests how well you first stored things. It also tests how well your way of reviewing holds up against forgetting.

> Exercise:
> G-8, Blind Palace Navigation. Follow these six steps.

1. You need 2 people and 30 minutes.
2. Person A describes to Person B a Memory Palace they built on their own. They go room by room, station by station and image by image. They give as much detail as they can.
3. Person B asks questions to make things clear. They build their own version of the palace in their mind, from the description alone.
4. Then test Person B on the items in Person A's palace. Person B finds the way using only the description they heard.
5. Count how many items Person B recalled from A's description alone. This shows how clearly and richly A put the palace into words.
6. Swap roles. Compare your scores to see whose palace was easier to pass on.

Blind Palace Navigation



This shows how clearly and richly A put the palace into words.

Describing your palace in words is **a useful self-check**. Images that are hard to describe are often not vivid or specific enough. This exercise shows those weak spots before they let you down when it counts.

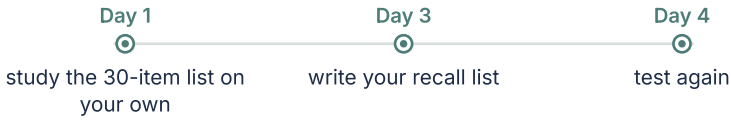
Tracking each person over 48 hours shows **which ways of storing hold** and which fade. The Collective Scoreboard turns this into a shared record. It keeps everyone on track for 30 days.

> **Exercise:**
> G-9, The 48-Hour Challenge. Follow these six steps.

1. You need 2 people, and the exercise runs over 4 days.
2. On Day 1, you both study the same 30-item list on your own. Use any techniques from Modules 3 and 4.
3. Neither of you tests yourself or reviews the list. On Day 3, at the 48-hour mark, you each write your recall list.
4. Compare your lists. For items you both recalled, talk about the ways of storing you shared. For items only one of you recalled, that person explains their technique for that item.

5. Use the borrowed techniques on the items you missed. Test again 24 hours later, on Day 4.
6. You now have three points to compare. They are Day 1 storing, Day 3 recall and the Day 4 re-test. Together, they show which of your methods work best for you.

The 48-Hour Challenge



Together, the three points show which methods work best for you.

Forgetting is fastest in the first day. A test after two days shows what has really stuck. A test after a few minutes only shows what you still have in mind.

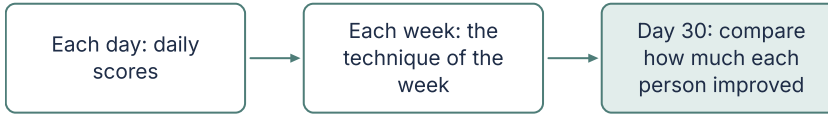
Shared targets and visible progress **keep you practising** when your drive drops. The Interference Championship ends the group exercises with the hardest task. You store items while something gets in your way. Then the winner teaches their method to the group.

> Exercise:
>
> G-10, The Collective 30-Day Scoreboard. Follow these six steps.

1. You need 2–10 people and 5 minutes a day for 30 days.
2. Each person works through the 30-Day Memory Training Programme from earlier in this module. Go at your own pace.

3. Each day, everyone reports their daily scores in a shared place. That could be a group chat, a spreadsheet or a noticeboard. Scores must include items recalled, time taken and technique used.
4. Each week, the group picks the one technique that scored best across everyone. That becomes the "technique of the week", and everyone adds it to their practice.
5. On Day 30, compare how much each person improved. The person who improved most by percentage gets a group cheer. But the group's average score is the main measure.
6. Look back together. Whoever's technique report lifted others' scores most is the group's best memory coach.

The Collective 30-Day Scoreboard



Tracking your progress helps you reach goals. It helps more when you **write it down and share it** (Harkin et al., 2016). Making a specific if–then plan also helps (Gollwitzer & Sheeran, 2006). The scoreboard turns a private plan into a public one.

Group training has now given you a range of social ways to store things. Next, training goes in **a third direction**. It uses AI to make new practice material. The practice rules you have now learned guide it.

Three directions of training



Next, training goes in a third direction, with AI.

> **Exercise:**
> G-11, The Interference Championship. Follow these seven steps.

1. You need 4–8 people and 30–40 minutes.
2. The group agrees on a 20-item list to memorise.
3. Before studying, each person picks their "interference weapon". It might be counting, a second word list or a string of mental sums. Any other hard task works too.
4. You get 2 minutes to memorise the list. At the same time, each person does their chosen interference task to make storing harder.
5. Write out the full list from memory. Score it out of 20.
6. The person with the highest score explains their technique to the group. That becomes the group's target technique for the next week.
7. Change "interference weapons" each session, so you practise against all the main kinds of distraction.

Treat this as **a test round**. For learning that matters, study without distractions. Save interference for practice tests.

Quick check:

1. In the Speed Round Recall Duel, what does an item on both lists score? Answer: 2 points.
2. Why test after 48 hours? Answer: Forgetting is fastest in the first day, so a test after two days shows what has really stuck.
3. What did Chase et al. (2009) find? Answer: Students who taught a computer character tried harder to learn than when they learned for themselves.

AI-Assisted Memory Training

LARGE LANGUAGE MODELS (LLMS) are AI chat tools, such as Claude and ChatGPT. They are **a new kind of training partner** for memory practice.

An AI is **always there**, and it is patient. It can make new practice material whenever you ask. It can also change how hard the practice is as you go.

An AI partner

> - Always there
> - Patient
> - Makes new practice material
> - Changes how hard the practice is

It can make new material whenever you ask.

Apps and flashcard decks **cannot hold a real talk** with you. An AI can question your reasoning and act out scenes. It can also comment on how you store things.

Apps and an AI

	Apps and flashcard decks	An AI
Real talk	Cannot hold one	Can question your reasoning
Also	Fixed content	Acts out scenes and comments on how you store

An AI can also comment on how you store things.

The exercises in this section are **made for a chat AI**. They use what chat tools do well. They make new material and change the difficulty. They ask you questions, act out roles and give quick feedback.

They do not replace solo or group practice. They are **a third way to train**, with their own strengths.

Chatbots can also state false things as if they were true. This is called hallucination (Ji et al., 2023). It is like a friend who fills gaps in a story with things that only sound right. Check facts, dates, definitions and answer keys in a reliable source before memorising. A wrong fact learned well is **hard to unlearn**.

Leaning on outside tools to hold information is useful. But it means **you remember less of it yourself** (Risko & Gilbert, 2016). Never type passwords, PINs or other private details into a chatbot for practice.

> **Key Concept:**
> How to Use These Exercises. These five habits help.

1. **Choose your AI**. Any good chat AI works. ChatGPT (chatgpt.com) and Claude (anthropic.com) are two. Grok

(grok.com), DeepSeek (deepseek.com) and Gemini (gemini.google.com) are others. You do not need a special one.

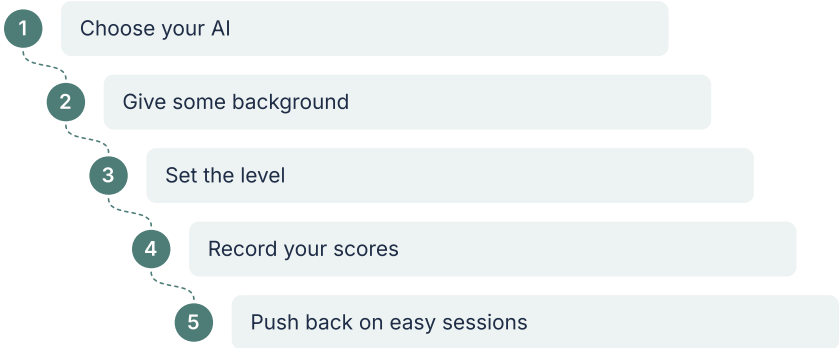
2. Start each session with **some background**. Tell the AI, "I am training my memory with this book. I want to do [exercise name]. Please follow my instructions."

3. Ask it to **set the level**. At the start, tell the AI where you are now. For example, say "I can recall 20 words after 2 minutes of study. Please set the difficulty to match."

4. **Record your scores**. Keep your Memory Journal open in every AI session. Do not rely on the AI to remember your scores. Some chatbots have a memory feature. It keeps only a loose summary, with no exact record. Keep your own log and paste it in.

5. **Push back on easy sessions**. If the content feels too simple, say so. Ask the AI to make it harder or add interference. You can also ask for less time to store items.

Five habits



These five habits help.



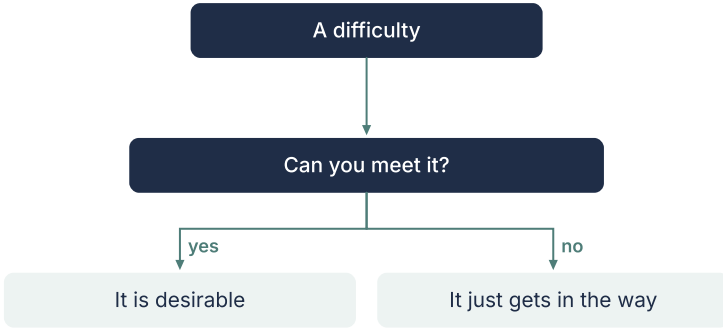
A learner tells an AI chat tool her current score and asks for practice.

With these habits, the eleven exercises that follow make **a full AI training plan**. Each one trains a different skill, from fast storing to tough recall tests. Before you start, it helps to know why this practice can work.

> **Science Says:**
>
> Learning that feels a bit harder **often lasts longer**. Testing yourself, spacing your practice and mixing topics are examples. Psychologists call these “desirable difficulties” (Bjork & Bjork, 2011).

A difficulty is **only desirable if you can meet it**. Otherwise it just gets in the way. An AI can add difficulty with surprise content and time limits. It can also make lists longer and mix topics.

Desirable difficulties



A fixed flashcard deck gets familiar, and then you put in less effort. An AI can make **fresh material every session**, which helps with word-list drills.

Keeping the challenge at **the right level** is the key. Every AI exercise in the next section uses the AI's ability to adjust. Aim for practice hard enough to help, but not so hard you give up. It should not bore you either.

Key idea:

Fresh AI material at a difficulty you can meet makes practice that helps.

Quick check:

1. What is **hallucination**? Answer: When a chatbot states false things as if they were true (Ji et al., 2023).
2. Why keep your own log of scores? Answer: A chatbot's memory feature keeps only a loose summary, with no exact record.
3. When is a difficulty desirable? Answer: Only if you can meet it. Otherwise it just gets in the way.

AI Training Exercises

Each exercise below trains **a different skill**. Work through them in order the first time. Later, go back to the ones that help you grow most. Keep them as regular training partners.



The first AI exercise shows a basic strength of an AI partner. It can **make a fresh list each time**. A fixed word list gets familiar over time, and then it trains you less. An AI can make fresh content at any level whenever you ask.

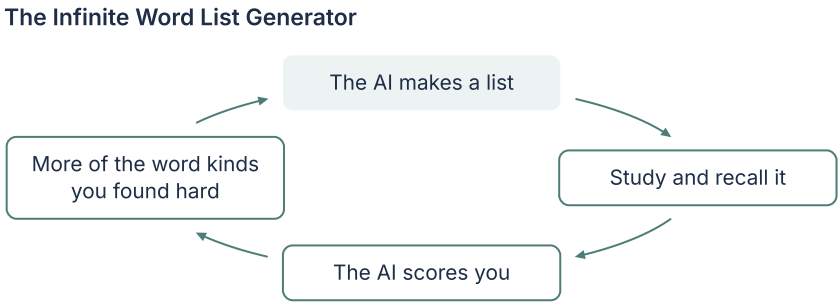
> Exercise:
>
> AI-1, The Infinite Word List Generator. Follow these six steps.

1. Open a chat with your AI. Say, "Make a list of [N] random words. Take them from many different topics, with no two from the same topic. I will study for [X] minutes, then recall the list. Do not show me the list again until I finish recalling."
2. Study the list with your favourite technique for the agreed time.
3. Recall the list to the AI, out loud or in writing. Ask it to score you. Ask which kinds of words you missed most often.

4. Ask the AI, “Next time, add more of the word kinds I found hard. Use fewer from kinds I recalled perfectly.”
5. Run 3–5 rounds each session. The AI keeps fitting each list to how you did.
6. At the end, ask the AI for a summary. Say, “Which word types did I find hard today? What storing method do you suggest for each?”



Ask the AI, “Next time, add more of the word kinds I found hard.



Run 3–5 rounds each session.

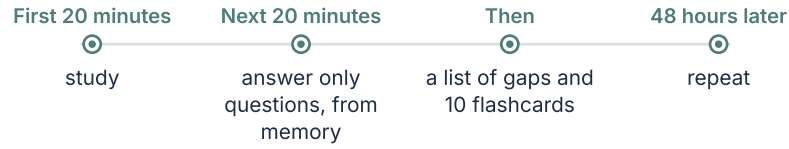
Fresh lists stop you from simply remembering **last week’s words**. Ask for a similar mix of easy and hard words each time. That keeps your scores easy to compare. Words that are easy to picture are easier to remember than words for ideas you cannot picture (Paivio, 1986).

Lists that adjust to you build speed and amount. The Socratic Examiner moves **from wide to deep**. The AI asks questions you cannot predict. They find gaps that your own review misses.

> **Exercise:**
>
> AI-2, The Socratic Memory Examiner. Follow these six steps.

1. Study some material for 20 minutes with your usual techniques. It could be a chapter, a set of facts or a module you are studying.
2. Open your AI and say, "I have just studied [topic]. Please test me with only questions, never statements. Find the edges of what I know. Start easy and get harder. Do not accept vague answers."
3. Answer every question from memory only. Do not look at your notes.
4. When you cannot answer, say "I don't know." Ask the AI to note it and come back to it later.
5. After 20 minutes, ask, "Please list my knowledge gaps, from most to least important. Then make 10 flashcards for the top gaps."
6. Study the AI's flashcards. Repeat the questioning in 48 hours.

The Socratic Memory Examiner



When you cannot answer, say "I don't know."

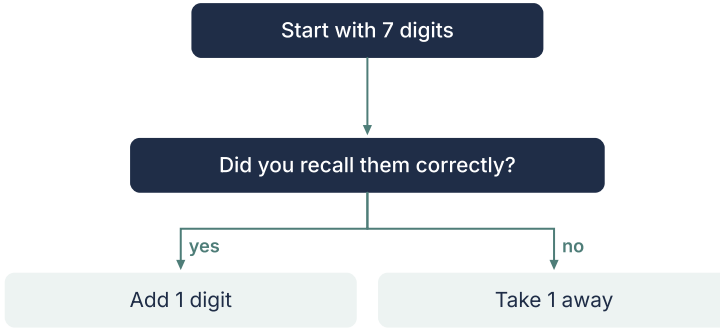
The AI is patient and always there. But chatbots can also accept a wrong answer or **state wrong facts** (Ji et al., 2023). Check any answer the AI gives you against your source.

Socratic questions show what you do not know. The Adaptive Difficulty Ladder trains one part of short-term memory you can measure. It is **digit span**, the number of digits you can hold at once. The ladder stretches it step by step, matched to your real level.

> Exercise:
> AI-3, The Adaptive Difficulty Ladder. Follow these five steps.

1. Tell your AI, "I want to train my digit span. Start with 7 digits. If I recall them correctly, add 1 digit. If I fail, take 1 away. Keep going for 20 rounds."
2. In voice mode, have the AI read the digits aloud, one per second. In a typed chat, the digits stay on screen. Cover the screen after a set time. Close your eyes, repeat the digits in your head, then type your answer.
3. After 20 rounds, ask the AI to show your results. Say, "Show my string length at each round. Work out my average steady span."
4. Run the same steps with random letters and with mixed letters and digits. Also try word strings, and digit strings you must recall backwards.
5. Track your best span across four weeks. Your span on this task will grow with practice. Do not expect it to help with unrelated tasks (Melby-Lervåg & Hulme, 2013). The gain mostly stays with what you trained.

Train your digit span

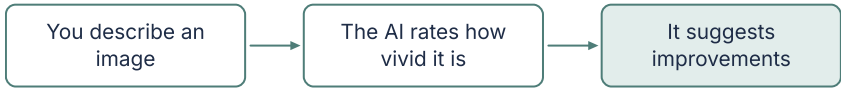


Keep going for 20 rounds.

Most adults can repeat **about seven digits** (Miller, 1956), so 7 is a sensible start. The AI is a free practice partner that you can adjust. It can make strings of an exact length and change the level at once.

Digit span training builds short-term memory. The Memory Palace Architect **puts it to good use**. An outside judge rates how vivid and reliable your images are. It also suggests improvements.

An outside judge



The Memory Palace Architect puts your skill to good use.

> **Exercise:**
>
> AI-4, The Memory Palace Architect. Follow these six steps.

1. Tell your AI, "I want to store [topic or list] in a Memory Palace. I will describe my palace as I build it, one image at a time. After each

image, rate how vivid, clear and memorable it is, from 1 to 10. Then suggest one improvement."

2. Start storing out loud. Say, "Station 1 is my front door. The first item, [word], becomes [image]. It is [description]."
3. The AI rates each image and suggests ways to boost it. It might add details for the senses, make actions bigger or link to stronger feelings.
4. When the palace is done, ask, "Which three stations will I forget, and why? How can I make them stronger?"
5. Test yourself 24 hours later. Tell the AI your results. See which weak stations it guessed correctly.
6. Across sessions, track how often the AI guesses right. Keep your own notes on its guesses, because the chatbot may not remember past sessions.

Fix weak images early. An image may be vague, dull or too like its neighbour. Images that clearly act on their station beat images that are just strange (Wollen et al., 1972).

Feedback on vividness sharpens single images. The Roleplay Encoding Session goes further. It puts the material inside **an exciting scene**. The scene uses many ways of storing at once.

> ✎ Exercise:
> AI-5, The Roleplay Encoding Session. Follow these five steps.

1. Choose a subject you are studying now, such as medicine, law, a language or history. Tell your AI, "I want to memorise [material]

through roleplay. You will be [a character from that subject]. Try a senior surgeon, a judge or a native Spanish speaker. I am your student. Teach me the material, test me in character and make me explain every answer. Stay in character."

2. Work with the material fully inside the roleplay. The AI brings in the facts as part of the scene. Then it quizzes you on them.
3. When you get something wrong, ask for a memorable story or memory trick, in character.
4. After the session, step out of the role. Say, "Exit roleplay. List everything you tested me on, and how I did on each."
5. Study the items you got wrong in the roleplay, with your usual Memory Palace technique.

Characters to try



Teach me, test me in character and make me explain every answer.

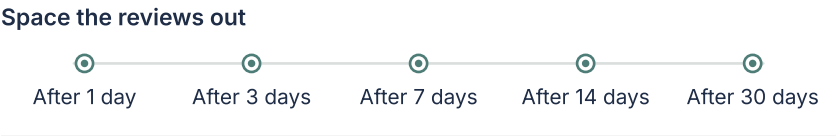
Memory can **depend on where you learn**. Divers recalled words better where they learned them, on land or underwater (Godden & Baddeley, 1975).

The average effect is small (Smith & Vela, 2001). It shrinks when people can picture where they learned. Learning through realistic cases may help you recall the material when you meet similar cases.

The Spaced Repetition Session Designer uses a different rule on the same material. It plans **when to review each item**, so you keep it in the least time.

> **Exercise:**
> AI-6, The Spaced Repetition Session Designer. Follow these five steps.

1. After any big storing session, paste your full list of studied items into your AI. Say, "I have just stored these items. Make me a personal review plan for the next 30 days. Assume I know none of them yet. Make daily review lists. Space the reviews out, for example after 1, 3, 7, 14 and 30 days."
2. Ask the AI to set this out as a day-by-day calendar you can follow.
3. Each day, do your review and tell the AI your results. Say, "Day [N] review: I recalled [X] of [Y] items. I missed [list the items]."
4. The AI updates the plan. Items you recalled move to the next gap. Items you missed come back the next day.
5. On Day 30, ask the AI for a report. Ask for the percentage kept across all items and the items that need more work. Also ask for a suggested plan for Month 2.



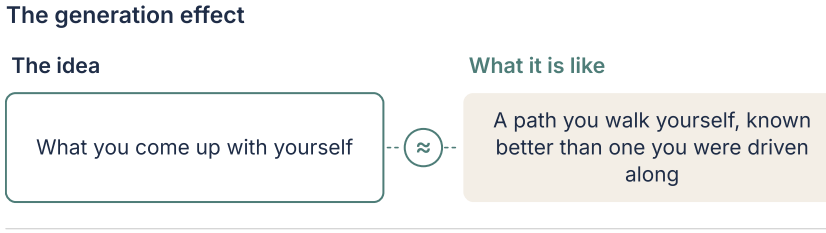
Ask the AI to set this out as a calendar.

Spacing your reviews helps you remember (Cepeda et al., 2006). The best gap **depends on when you need it**. For a test in a week, the best gap was 20–40% of that week (Cepeda et al., 2008). For a test a year away, it fell to about 5–10%.

Planning reviews by hand is dull. An AI can do the date sums and change the plan as you go. Reporting your daily results to it helps you stick to the plan.

A chatbot can make date or sum mistakes, so **check its calendar**. A spaced-repetition app can also plan reviews for you.

Spacing that fits you makes 30 days of review do more. The Generation Effect Drill uses a different way of storing. You remember what you **come up with** better than what you are given. It is like a path you walk yourself, which you know better than one you were driven along. The AI holding back answers helps as much as giving them.



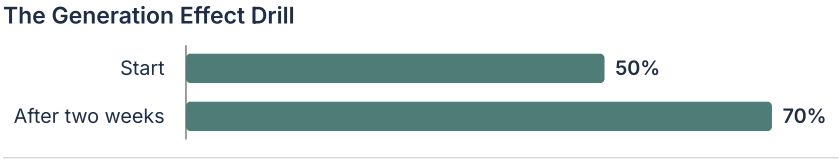
It is like a path you walk yourself, which you know better than one you were driven along.

> **Exercise:**
>
> AI-7, The Generation Effect Drill. Follow these six steps.

1. Tell your AI, "I want to practise the generation effect. Give me the first half of a fact, a word pair or a definition. I will come up with

the second half from memory or by working it out. Do not finish the item until I have tried."

2. The AI gives you prompts, such as "The capital of ___". Another is "The mitochondria is the ___ of the cell". Another might be "Ebbinghaus found that memory follows a ___ curve."
3. You finish each item. The AI confirms or corrects it.
4. For items you got wrong, ask for help. Say, "Give me a 2-sentence story that connects [prompt] to [correct answer]."
5. After 20 items, ask the AI to re-test only the items you got wrong. Use the stories as hints first, then go without hints.
6. Track how often you get items right across sessions. A personal target is to go from 50% to 70% or more over two weeks.



Track how often you get items right across sessions.

The generation effect is **a strong, well-tested finding** in memory research (Slamecka & Graf, 1978). Things you come up with yourself are remembered better than things you just read. Across 86 studies, the average gain was moderate, and it varied a lot (Bertsch et al., 2007).

Trying to answer before you see the answer helps you remember it. It works **even when your try is wrong**, if you then see the right answer (Kornell et al., 2009).

Key idea:

Try first and then see the right answer, and you remember it better.

Coming up with answers deepens how you store each item. The AI Cross-Examiner tests whether that depth holds **under hard conditions**. You give a talk, and then the AI questions every claim, number and step.

> Exercise:
> AI-8, The AI Cross-Examiner. Follow these six steps.

1. Prepare a 5-minute talk on any topic you want to master. Give it from memory, with no notes.
2. Give it out loud while the AI "listens". Type or speak your talk to it.
3. Ask the AI, "Question me closely. Find every fact I stated. For each one, ask a follow-up question. Test whether I really understand it or am just repeating it. Be strict."
4. Answer each question from memory.
5. When you cannot answer, say, "I don't know. Give me the answer in a form I can store as a palace image." The AI makes a memorable picture for that gap.
6. Give the 5-minute talk again 48 hours later. Ask the AI to compare the two talks. It should note what you added, what you lost and what you corrected.

The AI Cross-Examiner



The AI compares the two talks.

Recalling the material in two different ways is **extra retrieval practice**. Retrieval practice makes memories last (Karpicke & Roediger, 2008).

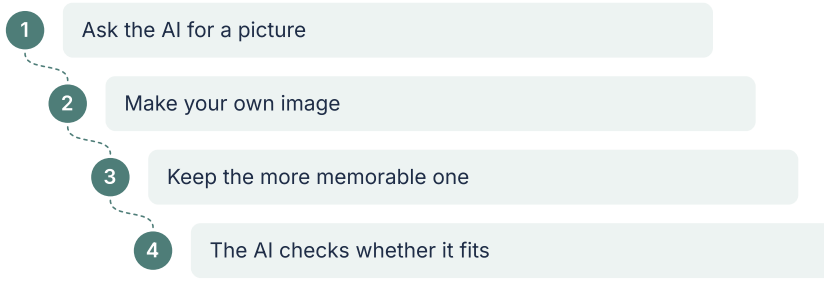
Close questioning finds the gaps that **easy review hides**. The Dual Coding Generator works on something else. It makes sure each idea you cannot see also has a real picture in your memory. Paivio's research links this two-way storing to better memory.

> **Exercise:**
> AI-9, The Dual Coding Generator. Follow these six steps.

1. Choose 20 ideas you are studying that you cannot see or touch. Try psychology terms, economic rules or ideas from philosophy.
2. For each idea, ask the AI for a picture. Say, "Give me one clear picture for [idea] to use in my palace. Make it vivid and a bit silly. It must show what the idea means, and its name alone is not enough."
3. For each picture the AI gives, also make your own image. Store it in your palace. Compare the AI's picture with yours, and keep whichever is more memorable.
4. When all 20 items are stored, ask the AI, "Now test me. Name an idea, and I will describe my image. Tell me whether my image fits the idea or is misleading."

5. Fix any misleading images before they settle into your palace.
6. Run a recall test after 48 hours. For the items you recalled correctly, ask the AI for new, harder questions. They check that you understand the ideas deeply.

The Dual Coding Generator



Fix any misleading images before they settle into your palace.

Dual coding theory says that storing things as **words and pictures** helps memory (Paivio, 1986). It works like having both a map and written directions. Storing them both ways beats one way, and many studies support it. Here, the AI checks that your picture is accurate and vivid. That stops palace images that are striking but mean nothing.

Dual coding

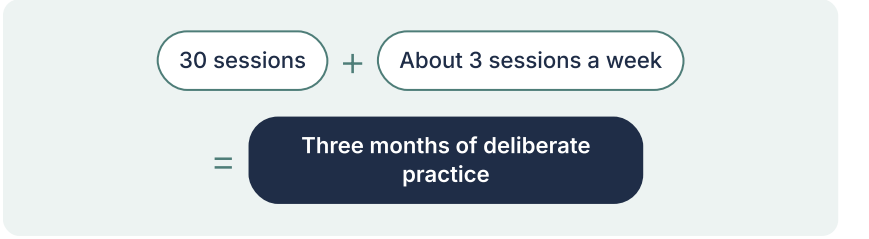


Each idea you cannot see gets a real picture.

Pictures tie ideas you cannot see to images you can. The 30-Session AI Training Log turns all these exercises into **one planned programme**.

The AI coaches you and helps you look back over 30 sessions. At about 3 sessions a week, that is three months of deliberate practice.

The 30-Session AI Training Log



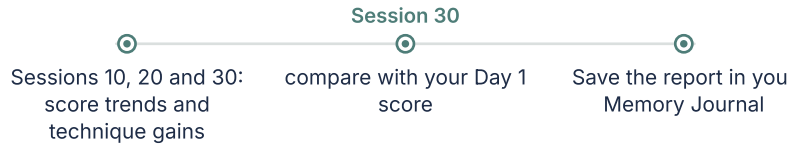
> **Exercise:**
> AI-10, The 30-Session AI Training Log. Follow these six steps.

1. At the start of every AI session, open a chat and paste this prompt. “I am on session [N] of my 30-session AI memory training log. My starting recall score was [X]/30. My last session score was [Y]/30. Today I want to focus on [technique or subject]. Please plan a 20-minute training session at [difficulty level].”
2. The AI plans a full session. It has a warm-up, a main drill and a challenge round. A calm review comes at the end.
3. After each session, tell the AI your scores. Ask it to update your progress story. Say, “Sum up my progress in 3 sentences, using what I told you today.”
4. At sessions 10, 20 and 30, ask the AI to look back over everything. Ask for your score trends and technique gains. Ask what to focus on next.

5. At session 30, compare your score with your Day 1 score from this module. Ask the AI to write one paragraph about how you have grown.

6. Save the session 30 report in your Memory Journal. It is a lasting record of your AI training progress.

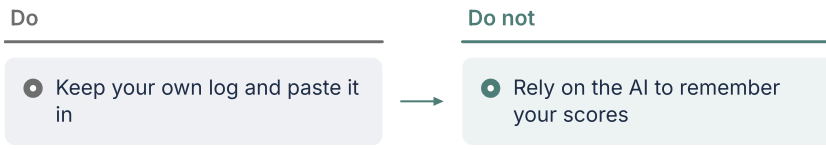
Look back over everything



Ask the AI to write one paragraph about how you have grown.

Keeping track over time is the main problem with AI training. **Do not rely on the AI** to remember your scores. A chatbot's memory feature keeps only a loose summary, with no exact record. Keep your own log and paste it in.

The AI's memory



A chatbot's memory feature keeps only a loose summary, with no exact record.



In this exercise, **you keep your own training story**. The AI helps you make sense of it. That is more accurate, because you control what is recorded.

A 30-session log shows how you change over time, which short tests cannot show. The Narrative Memory Builder ends the AI exercises with stories. **Stories are a strong way to store things**. An AI can turn any set of items into a vivid, exciting story.

> Exercise:
>
> AI-11, The Narrative Memory Builder. Follow these six steps.

1. Choose 15 items you need to memorise. Share them with your AI.
2. Ask, "Put all 15 items into one story of about 200 words. Make it silly and full of feeling. Give each item a real part in the plot, more than a passing mention. Keep the items in the order I need to recall them."
3. Read the story three times. Picture it as a film in your mind.
4. Close your eyes and replay the story in your head. When this goes smoothly, recall the 15 items in order without the story.
5. Ask the AI for a second, completely different story for the same 15 items. Study both and compare them. Which story makes recall easier, and why?
6. Spotting what makes some stories work better builds your own feel for storing with stories. I think it is a strong memory technique that people use too little.

The Narrative Memory Builder

1. Share 15 items
2. Get one story of about 200 words
3. Read it three times and picture it as a film in your mind
4. Recall the 15 items in order without the story

Then ask for a second, different story and compare.

Stories help memory. People who linked 10-word lists into stories later recalled **about 93%** of the words (Bower & Clark, 1969). People who did not recalled about 13%.

Stories help memory



People recalled about 93% of the words (Bower & Clark, 1969).

In this module, you have practised **alone, in groups and with AI**. Together, they give you a full set of ways to practise. The key points of

the module come next. They show how to plan your practice from here on.

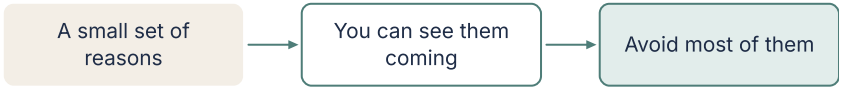
Quick check:

1. In the Adaptive Difficulty Ladder, what happens when you fail a round? Answer: Take 1 digit away.
2. In Bower and Clark (1969), how much did people who linked words into stories recall? Answer: About 93% of the words, against about 13% for people who did not.
3. For a test in a week, what was the best review gap? Answer: 20–40% of that week (Cepeda et al., 2008).

Why Memory Training Fails, and How to Succeed Where Many People Don't

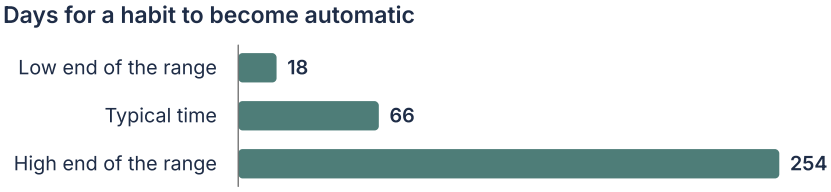
THIS MODULE HAS GIVEN you **a full training toolkit**. It covers daily practice plans, advanced storing systems and competition-style drills. It also covers group training and practice with AI.

Why people stop



Yet many people who start a memory programme stop within the first few weeks. It is not because memory training does not work. They stop for **a small set of reasons** that you can see coming. Once you know them, you can avoid most of them.

New daily habits take time to become automatic. It is like a new song, which gets easier to sing the more you sing it. For 39 people whose results were clear, the typical time was **66 days** (Lally et al., 2010). The range was 18 to 254 days. Missing a single day did not really harm the habit.



For 39 people whose results were clear, the typical time was 66 days (Lally et al., 2010).

Key idea:

A new habit takes time (66 days was typical), and one missed day does little harm, so keep going.

This section is **a guide to failure**. It covers the main reasons training stalls, techniques fall apart and people give up. For each one, you learn why it happens, the warning signs and what to do. The techniques only work if you keep practising them.

Quick check:

1. What was the typical time for a new habit to become automatic? Answer: 66 days, for 39 people whose results were clear (Lally et al., 2010).
2. What was the range? Answer: 18 to 254 days.
3. Did missing a single day harm the habit? Answer: Not really.

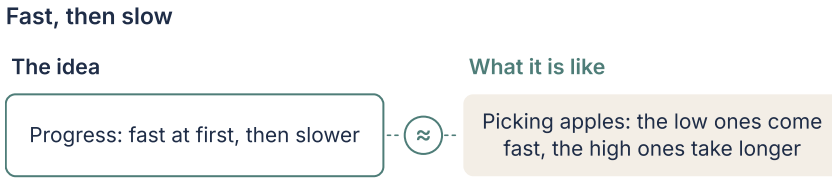
The Psychology of Quitting: Why the First Three Weeks Are Critical

In my experience, many people stall in **week two or three** of a memory programme. They often start out keen. This is not random. It follows a pattern that you can understand and break.

> **Science Says:**
>
> Progress is usually **fast at first and then slows**. This is one of the most general findings about learning a skill (Heathcote et al., 2000). It is like picking apples. The low ones come fast, and the high ones take longer. The slower phase is normal. It does not mean the method has stopped working.

Key idea:

Fast early gains + a slower phase later = normal learning. It does not mean the method has stopped working.



The slower phase is normal (Heathcote et al., 2000).

Ericsson et al. (1993) studied violinists and pianists. They argued that top performance comes from **long, hard deliberate practice**. Deliberate practice means focused practice aimed at getting better.

Progress you can see keeps you going. Tracking your progress helps you reach goals (Harkin et al., 2016). It helps more when you write it down or share it.

Many learners describe a pattern of **five stages** on the way to quitting. The day ranges are rough, and nobody has measured them. Knowing them will not keep you safe. Still, if you spot each stage early, you can act on it.

#	Stage	Warning sign	What to do
1	Motivation Spike, Days 1–5. Everything is new and exciting, and feels powerful.	"I'm going to memorise everything." Targets set too high.	Set a small 21-day target. Measure your baseline now.
2	First Friction, Days 6–9. Techniques take real effort. Sessions feel hard.	"This takes longer than I expected." Sessions feel heavy.	Cut sessions to 15 minutes. Practising often counts more than practising long.
3	The Plateau Illusion, Days 10–14. Fast early gains slow down. Progress feels invisible.	"I'm not improving any more." You compare with your early gains.	Measure with real scores. Plot them. Slow progress is still progress.
4	Rationalisation (making excuses), Days 15–18. Reasons not to practise grow and harden.	"I'll do double tomorrow." Missed days become missed weeks.	Never miss twice. One skipped session is a rest, not a collapse.
5	Abandonment (giving up), Days 19–21. Practice stops completely, often with self-blame.	"Memory training just doesn't work for me." You blame who you are.	Restart with a lower bar. The techniques did not fail. The system did.

Missing one day did not really harm a new habit in one study (Lally et al., 2010). "Never miss twice" is a popular rule, and **nobody has tested it**.

In my view, the danger point is **the first plateau**, around days 10 to 14. The first day matters less. At the plateau, the gap between hoped-for

and real progress is biggest. A visible record of your progress can decide whether you carry on or quit.

Quick check:

1. In my view, when is the danger point? Answer: The first plateau, around days 10 to 14.
2. Has the rule 'Never miss twice' been tested? Answer: No. It is a popular rule, and nobody has tested it.
3. What did Heathcote et al. (2000) describe? Answer: Progress is usually fast at first and then slows.

Why Memory Palaces Collapse, and How to Build Ones That Last

The memory palace is one of the **best-tested memory techniques**. In 13 trials, users beat comparison groups by a medium amount (Twomey & Kroneisen, 2021). In another study, beginners trained for six weeks (Dresler et al., 2017). Recall at 20 minutes more than doubled: 26.5 to 62.5 of 72 words.

Yet when a palace fails, **it fails badly**. A palace vivid in week one can be a grey blur by week four. People then decide the technique does not work, or that they lack imagination. Usually, neither is true.

Palaces collapse for four main reasons, and **you can fix each one**. Once you know them, the failure stops being a mystery. It becomes a problem you can solve.

Failure Mode 1: Vague Imagery

How it looks. Images feel "**kind of there**". You get a general sense of a scene, with no clear objects fixed in place.



A grey, blurry palace room where a clear image should be.

Why it breaks the palace. Recall needs **a clear image to set it off**. Vague images leave things on the tip of your tongue. Sometimes you draw a total blank.

The root cause. People **skip the storing step**. They treat "picturing something" as enough. Vivid, specific images work better.

The storing step

Root cause	Fix
Picturing something Treated as enough	→ Vivid, specific images Work better

People skip the storing step.

The test. Try to **describe your image in clear detail** 24 hours later. If you cannot, it was not vivid enough to last.

Bizarre, motion, emotion

Make it stand out. Make the image **interact with the place**. The item should do something to the station, and never just sit there. Odd images can help, but only because they stand out (McDaniel & Einstein, 1986).

Add action. Have the item **act on its station**. Images that interact are remembered better (Wollen et al., 1972).

Add a feeling. **Emotion helps memory**, and emotionally charged events are stored more strongly (McGaugh, 2004). A touch of humour or disgust in an image may help in the same way.

Failure Mode 2: Overcrowding

How it looks. Storing feels fine while you practise. But at recall, **the order gets jumbled**. Or you mix up stations next to each other.

Overcrowding

	While you practise	At recall
Storing	Feels fine	The order gets jumbled

A touch of humour or disgust in an image may help in the same way.

Why it breaks the palace. **Similar images next to each other** get confused. When stations are too close together or too full, the images run into each other. It is like coats piled on one hook. Pull one, and the others come with it.

A common mistake. Beginners **fill every bit** of their palace. Then they wonder why recall comes out as a blur.

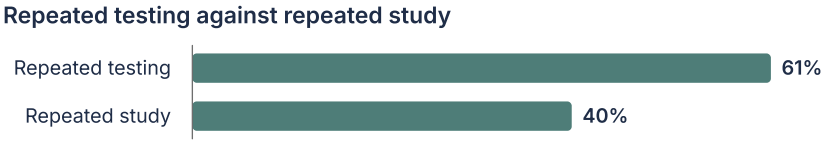
The spacing rule. Keep **one image per station**. Separate each station from the next with at least one clear border. A doorway, a new room or one marker object will do.

Failure Mode 3: Building Without Reviewing

How it looks. You build a palace once, and **it works well at first**. Then it fades.

Why it breaks the palace. Without early reviews, **much of a new palace fades**, like chalk on a path that the rain washes away unless you draw it again. Walk it again within a day or two.

Recalling beats rereading. One week later, people recalled 61% after repeated testing, against 40% after repeated study (Roediger & Karpicke, 2006).



Recalling beats rereading (Roediger & Karpicke, 2006).

The pattern. People build a new palace for new material and **never review the old ones**. Within a month, they have 8 palaces they cannot get into.

The review rule. To keep a palace, review it after about **1 day, 3 days and 7 days**. Spaced reviews work better than reviews bunched together (Cepeda et al., 2006). After that, the palace will last much longer, though an occasional walk-through keeps it fresh.

Failure Mode 4: Unfamiliar Locations

How it looks. A palace in a new place can feel right as you build it. But you cannot **move through it smoothly** at recall.

Familiar places help, but they are **not a must**. Start with places you know well, because it is the easiest way. A new place can work too, once you walk it and fix its stations.

Choosing a place

Start with	Also possible
⊕ Places you know well: the easiest way	⊖ A new place: works once you walk it and fix its stations

Familiar places help, but they are not a must.

In one study, people used **a virtual place** on a computer screen that they learned in a few minutes (Legge et al., 2012). They remembered word lists as well as people using very familiar real places. Both groups beat people given no method.

The advice. Use places you can walk through **with your eyes closed** for your first palaces. Move to new places once the technique feels automatic.

Key idea:

Clear images, one per station, and reviews at about 1, 3 and 7 days give you a palace that lasts.

> ✎ Exercise:
>
> 4.8, The Palace Vividness Audit. Follow these six steps.

1. Choose a palace you built more than 7 days ago. Walk through it without any help.
2. Rate each station's image from 1 (a vague blur) to 5 (clear, vivid and moving).
3. For any station rated 3 or below, store the image again, using bizarre, motion, emotion.

4. Test again at 24 hours and at 7 days. Anything still below 4 needs a completely different image.
5. Record your average vividness score. Aim for 4.2 or above across all stations.
6. Repeat this check for every palace you use, once a month.

The Palace Vividness Audit



← 1: a vague blur 5: clear, vivid and moving →

Aim for 4.2 or above across all stations.

Quick check:

1. When should you review a palace to keep it? Answer: After about 1 day, 3 days and 7 days.
2. What did Legge et al. (2012) find? Answer: People using a virtual place learned in a few minutes remembered word lists as well as people using very familiar real places.
3. What average vividness score should you aim for in the audit? Answer: 4.2 or above across all stations.

Why Images Fade: The Encoding Depth Problem

IMAGE FADING IS THE part of memory training that **most often makes people lose heart**. You store a vivid scene and feel sure of it. Two days later, it is gone. An image gone after two days was probably stored too shallowly or never reviewed.

> Science Says:
>
> Craik and Lockhart (1972) put forward the idea that **depth matters more than repeats**. How deeply you think about something counts more than how often you repeat it. Thinking about its meaning counts most. Later experiments backed this up (Craik & Tulving, 1975).

> Definition:
>
> **DEPTH OF PROCESSING:** how deeply you work with information, from noticing how a word looks to understanding its meaning.

Shallow processing leaves weak memories, and deeper processing leaves much stronger ones. It works like a footprint. A light step fades fast, and a deep one stays. Recalling material gave **about 50% more** than rereading it a week later (Roediger & Karpicke, 2006). Students recalled 61%, against 40% for rereading.

After just 5 minutes, **rereading did slightly better**. That is why recalling feels less useful than it is. Most students still reread, and few test themselves (Karpicke et al., 2009).

Rereading and recalling

	After 5 minutes	A week later
Better	Rereading, slightly	Recalling, by about 50%

That is why recalling feels less useful than it is.

Key idea:

Deeper thinking and recalling before looking give you images that last longer.

Images that fade often have **a lot in common**. They were made quickly and only looked at, with no recall. They were never hooked onto anything you already know. The table shows the usual causes and fixes.

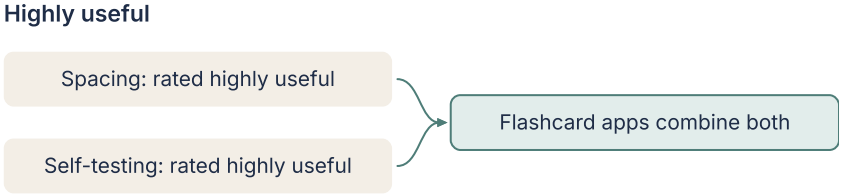
Why it fades	What you notice	How to fix it
No feeling in it	You recall the image at once, but it is gone by morning	Add one feeling. Disgust can work especially well: in one study, disgusting pictures were remembered better than frightening ones (Chapman et al., 2013).
Still image	A vague sense of the place, but no clear scene	Make the object act on something in the scene.
Plain image (nothing from your own life)	Image right during practice, missing under pressure	Swap in a person or object from your own life. Personal is powerful (Symons & Johnson, 1997).
Passive review (seeing it again, with no recall)	Sure of it during review, blank at real recall	Always recall before looking. Cover the image and bring it back first.
No word label	Image recalled, but what it stands for does not come back	Describe your image in one sentence while you store it. Words plus a picture help memory (Paivio, 1986).
Missing first review	Palace completely out of reach after 48 hours	Always review a new palace within 24 hours, however sure you feel.

Quick check:

1. Who said that how deeply you think counts more than repeats? Answer: Craik and Lockhart (1972).
2. A week later, how did recall compare with rereading? Answer: Students recalled 61%, against 40% for rereading (Roediger & Karpicke, 2006).
3. When should you review a new palace? Answer: Within 24 hours, however sure you feel.

Why Spaced Repetition Is Abandoned: The Five Deck Killers

Spaced repetition apps are among the **best-supported tools** for learning facts. A major review rated only spacing and self-testing as highly useful, out of ten methods (Dunlosky et al., 2013). Flashcard apps combine both.



Spaced repetition apps are among the best-supported tools for learning facts.

Yet many people give up on them. Usually, **setup mistakes** make the app more and more unpleasant. Once you spot them, they are easy to fix.

Deck Killer 1: The Accumulation Avalanche

What happens. You add new cards **faster than you review old ones**. The daily review pile keeps growing.

How it feels. Opening the app means facing **a growing pile of reviews**.



A learner opens a flashcard app and faces a growing pile of reviews.

The fix. Anki is a flashcard app that uses spaced repetition. The Anki Manual says 20 new cards a day means **about 200 daily reviews**. Cut new cards until reviews feel easy to handle. About 10 a day keeps reviews near 100.



Cut new cards until reviews feel easy to handle (Anki Manual).

Deck Killer 2: The Atomic Card Failure

What happens. Cards **hold too much**, like answers in several parts, joined facts or long passages.

How it feels. Cards that were fine at first get harder, until recall is **hit and miss**.

The fix. Put **one fact on each card**. If a card needs more than one sentence to answer, split it. SuperMemo's maker, Piotr Wozniak, gives the same tip from his own practice (Wozniak, 1999).

Deck Killer 3: Passive Review (Reading Not Recalling)

What happens. You read the card and look at the answer. You think "yes, I knew that" and **mark it correct**.

Why it breaks the deck. Recalling before you look gives **far better memory** than just reading the answer. A week later, people recalled 61% after testing, against 40% after rereading (Roediger & Karpicke, 2006).

A week later

	Recall
After testing	61%
After rereading	40%

Recalling before you look gives far better memory (Roediger & Karpicke, 2006).

The fix. Never read the answer before you try to recall it, even when you feel unsure. **Wrong tries still help you learn**, as long as you then check the answer (Kornell et al., 2009).

Deck Killer 4: Meaningless Material

What happens. Your deck holds loose facts with **no link to your goals** or interests.

How it feels. Reviewing the deck feels like **a chore** with no reward you can see.

The fix. Only build decks for **material you really need**. "Should know" cards drain your drive. "Must know for X" cards keep it going.

Deck Killer 5: Inconsistent Intervals

What happens. You review **now and then**, in big batches after long gaps.

Why it breaks the deck. The schedule assumes you show up **most days**. Skip a week and you face a pile of overdue cards, like dishes piling up in a sink.

The fix. A daily review of **5–10 minutes** beats a long weekly session. Showing up matters a lot, and so do good cards and real recall.

Review habits

	Daily review	Long weekly session
Time	5–10 minutes	Big batches after long gaps
Result	Better	Overdue cards pile up

Skip a week and you face a pile of overdue cards, like dishes piling up in a sink.

Key idea:

One fact per card, recall before looking and a short daily review give you a deck you keep using.

> ✎ Exercise:
>
> 4.8b, The Deck Health Audit. Follow these six steps.

1. Open your spaced repetition app. Count your total cards, today's due cards and cards added this week.
2. If daily reviews go above 100, stop adding new cards. Wait until they fall back below 100.

3. Review 20 cards at random. For each one, note yes or no. Did you try to recall it before looking?
4. If you tried first on under 18 of 20, change your review habit now. Cover the answer, try to recall it, then show it.
5. Look at your newest 10 cards. Each one should hold a single fact. Split any card that holds two or more.
6. Work out how many of the last 7 days you reviewed. Aim for 7 out of 7. The lowest you should accept is 5 out of 7.

The Deck Health Audit

Day	1	2	3	4	5	6	7
Reviewed today?	☐	☐	☐	☐	☐	☐	☐
Tried to recall before looking?	☐	☐	☐	☐	☐	☐	☐

Aim for 7 out of 7 days.

Quick check:

1. How many daily reviews do 20 new cards a day mean? Answer: About 200, says the Anki Manual.
2. What should each card hold? Answer: One fact.
3. Over the last 7 days, what is the lowest number of review days you should accept? Answer: 5 out of 7.

Why Motivation Drops After Two Weeks

Motivation for memory training does not fail because the training is unpleasant. It fails because of **how the practice is set up**. Progress stays hidden, goals feel far from daily life and rewards seem distant. Each of these plan problems can be fixed.

What kills your drive	What it looks like	The fix in your plan
No baseline score	"I feel better at memory but cannot show it."	Measure on day 1. A number you can improve drives you far more than a feeling.
No progress you can see	Practice feels like effort that never adds up.	Graph your scores. Tracking progress helps you reach goals (Harkin et al., 2016).
Techniques with no tie to real goals	"What am I even practising for?"	Choose one real-world target: a language, a qualification, a work goal. Train for it on purpose.
Practising alone	Training feels lonely and optional.	Find one practice partner. Sharing your scores with a partner makes tracking work even better.
No variety	Same exercises, same structure, every session.	Rotate between Speed Words, palaces, group exercises and AI sessions. Something new keeps you interested.
Reward too far away	"I'll be good at memory in 6 months." Today's session feels too small to count.	Set a weekly win: store one new name perfectly, recall a palace cleanly, beat your score. Close goals beat distant ones (Bandura & Schunk, 1981).
Perfectionism trap (waiting until you can do something perfectly before you start)	"I'll train properly when I have more time/energy/space."	Lower your smallest useful session to 10 minutes. Done imperfectly beats not done, every time.

Keep **a written record of your scores** and look at it each week. It works like the progress bar on a download. Across 138 experiments, this

kind of tracking helped people reach their goals (Harkin et al., 2016). It helped more when written down or shared.

Key idea:

A written score record and close weekly wins give you drive that lasts longer.



A learner looks over a written record of weekly scores.

A classic study backs up weekly wins. Children learning sums set **close, short-term goals** (Bandura & Schunk, 1981). They made faster

progress and grew more interested than children with only a distant goal.

Quick check:

1. How many experiments did Harkin et al. (2016) look at? Answer: 138.
2. What happened to children who set close, short-term goals? Answer: They made faster progress and grew more interested than children with only a distant goal (Bandura & Schunk, 1981).
3. How short can your smallest useful session be? Answer: 10 minutes.

The Complete Failure Mode Reference: Ten Weak Spots

Practice often stalls for one of **ten common reasons**. This table is my practical checklist for those times. When progress stalls, scan the table for the pattern closest to yours. Then apply its fix.

Each row gives **a problem, the reason it holds back your progress and its fix**. Where a fix rests on research, the row cites it.

#	Failure mode	Why it holds back progress	The fix
1	Vague Imagery. Images made without clear detail for the senses or feelings.	Recall brings up blank walls or vague impressions. It works in practice and fails under pressure.	Apply bizarre, motion, emotion to every image. If you cannot describe it in clear detail 24 hours later, it is not vivid enough.
2	Passive Review Illusion. Reading, re-watching or re-listening to material, and mistaking knowing it when you see it for recall.	High confidence during review, poor results in real tests. The “I knew that” trap.	Never look before you try. Recall first, always. Even wrong tries help you learn, as long as you then check the answer (Kornell et al., 2009). Recalling beats rereading (Roediger & Karpicke, 2006), yet most students still reread (Karpicke et al., 2009).
3	Overbuilding Palaces. Making more palace places than you are using, reviewing or making solid.	None of your palaces feel solid. Content is spread too thin. Review becomes impossible to manage.	Build only as many palaces as you can review weekly. Complete mastery of 3 palaces beats a vague feel for 20.

4	Underusing Retrieval. Spending most of your practice time on storing (input), with too little on recall (output).	Strong results straight after study, then a big drop within a few days.	Flip the ratio. As a rule of thumb, spend at least 70% of practice time on recall, testing yourself on material you have already stored.
5	Cognitive Overload. Starting too many new techniques at the same time, before any one is automatic.	Nothing works every time. Each session switches between techniques before any becomes smooth.	Master one technique before adding the next. Order: Memory Palace first, then Peg System, then Major System, then PAO. Spend at least a week on each.
6	Inconsistent Review Intervals. Reviewing at uneven gaps: big batches after long breaks, with no small daily sessions.	Cards reviewed last week feel new today. Overdue cards pile up.	Daily practice at your smallest useful level (10 minutes) beats long weekly sessions. Spaced repetition works best when you review a little every day.
7	No Progress Tracking. Practising without recording scores, gains or how you compare with your baseline.	Slow but real progress feels like standing still. Drive wears away when you cannot see your scores rising.	Record every session score in your Memory Journal. Review weekly. A rising graph is one of the best-supported ways to stay motivated (Harkin et al., 2016).
8	Emotional Disengagement. Treating storing as a machine task, making images with no curiosity, care or play.	Storing takes effort but does not work well. Images are correct on paper but flat in feeling.	Storing a memory is a creative act. The quality of your attention and feeling strongly affects how well you store. Split attention lowers later memory (Craik et al., 1996), and strong feelings help memories stick (McGaugh, 2004).
9	Context Collapse. Practising only in one setting (desk, same lighting, quiet) and never practising recall in other conditions.	Good recall at your desk, but weaker at the meeting, in the exam or under mild pressure.	Change where you practise on purpose: recall while walking, in noise, under mild time pressure, in the conditions where you will really need the memory. Memory is somewhat tied to where you learn (Godden & Baddeley, 1975). Studying in two rooms helped recall in a new room (Smith et al., 1978). The average effect is small (Smith & Vela, 2001).
10	Perfectionism Trap. Waiting for ideal conditions (perfect focus, enough time, the right materials) before practising.	Practice drops off steadily. Sessions happen only when everything is "right." Everything is never right.	15 imperfect minutes beat 0 perfect ones. Set a smallest useful session: 1 palace review, 10 flashcards or 5 minutes of any storing. Start before you are ready.

In my view, these ten problems **often come together**. One can set off the next, like one late train that holds up the trains behind it. Vague images make passive review feel good enough. Passive review then leads to a plateau that drains your motivation.

Sessions then get patchy, and the pile of reviews grows. Overload follows. In practice, fixing your images or your review habit **often fixes the rest**.

Key idea:

Fix your images or your review habit, and the rest often follows.

Quick check:

1. As a rule of thumb, how much practice time should go on recall? Answer: At least 70%.
2. In what order should you learn the techniques? Answer: Memory Palace first, then Peg System, then Major System, then PAO, with at least a week on each.
3. Which two fixes often fix the rest? Answer: Fixing your images or your review habit.

The Failure Mode Self-Diagnosis Protocol

THIS SECTION WORKS BEST as **a check you run regularly**. At the end of each week, check yourself against each failure mode. Three questions tell you whether a failure mode is active. They work like the warning lights on a car's dashboard.

1. Can you see it in your recent practice sessions?
2. Is your progress chart flat or going down?
3. Is your motivation here lower than a week ago?

A weekly check

The idea	What it is like
Three questions about each failure mode	≈ The warning lights on a car's dashboard

Run the check at the end of each week.

If any answer is yes, find that failure mode in the last section's table. **Its fix is your next step**.

Key idea:

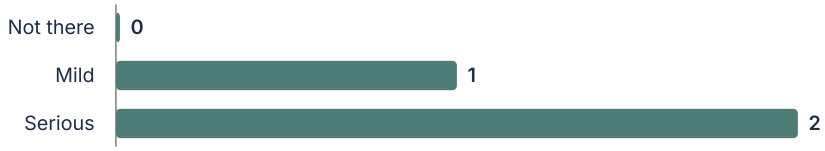
A weekly scan and one specific fix for each problem keep your practice moving.

> Exercise:
>
> 4.8c, The Weekly Failure Mode Scan. Follow these six steps.

1. Every Sunday, take 5 minutes to look over your practice log from the past week.
2. Score each of the 10 failure modes from 0 to 2. Give 0 if it is not there and 1 if it is mild. Give 2 if it is serious.
3. Add up your score. Any single score of 2 needs action before your next session.
4. A total of 8 or more means the problems run through your whole routine. Make your practice simpler. Your daily session should be easy enough for hard days.

5. Write one clear fix for each mode you scored 1 or 2. Make it a specific action, never a vague plan. For example, "Tomorrow's palace session will use bizarre, motion, emotion for every image."
6. Score yourself again after one week, and track the trend. Aim for a weekly score below 3.

Scoring each failure mode



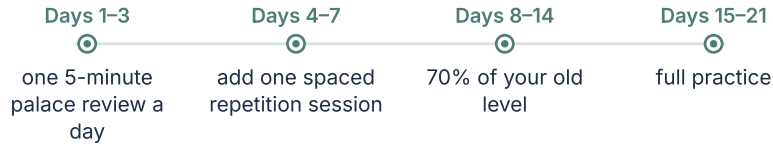
Any single score of 2 needs action before your next session.

> **Exercise:**
> 4.8d, The 21-Day Recommitment Protocol (for Returning Trainees). Follow these seven steps.

1. After more than 7 days off, do not restart at your old level.
2. On days 1–3, do one 5-minute palace review a day, and nothing else. Rebuild the habit before the skill.
3. On days 4–7, add one spaced repetition session (10 minutes). Still add no new material.
4. On days 8–14, practise daily at 70% of your old level.
5. On days 15–21, go back to full practice. Add one new technique if you feel ready.

6. Work out which failure mode caused your break. Write it down. Build one specific guard against it.
7. Take new starting scores. Skills you have built usually come back faster than they took to learn (Murre & Dros, 2015). Ebbinghaus called this "savings".

The 21-Day Recommitment Protocol



Rebuild the habit before the skill.

Most people who train meet these problems at some point. Talent, imagination and free time are not what set apart those who keep going. They read a stall as **useful information about what to fix**.

They also have a guide to find the exact problem to fix. That guide is **now in your hands**.

Quick check:

1. In the weekly scan, what does a total of 8 or more mean? Answer: The problems run through your whole routine, so make your practice simpler.
2. After more than 7 days off, how do you start again on days 1–3? Answer: With one 5-minute palace review a day, and nothing else.
3. What did Ebbinghaus call faster relearning? Answer: 'Savings'.

The Essential Principles of This Section

- Many people stall in the first weeks. Knowing the five-stage pattern helps you get through it.
- Palaces collapse for four reasons, which are vague images, overcrowding, no review and unfamiliar places. All four can be fixed.
- Images fade when they are still, general or flat in feeling. They also fade when you only look at them and never recall them.
- People give up on spaced repetition because of setup mistakes. The technique itself works.
- Motivation is a problem of how you set up practice, more than of willpower. A visible progress graph makes a real difference (Harkin et al., 2016).
- Ten failure modes cover the most common reasons practice stalls. Check them weekly, and fix them at once.

Module 4 Key Takeaways

> **Key Concept:**
>
> Module 4 Key Takeaways
>
> Daily practice is a must. Most people see their scores rise within the first few weeks.
>
> Measuring your starting point matters. You cannot know how far you have come without knowing where you started.
>
> Some advanced techniques can take you from dozens of items to thousands. They include PAO, the Major System and Layered Palaces. Top competitors show this. On the IAM list, the one-hour numbers record is 3,412 digits (Orkhan Ibadov, 2023). The WMSC list has a higher one, 4,620 digits (Ryu Song I, 2019), because the two groups keep separate lists.
>
> Its 30-minute binary record is 6,270 digits (Munkhshur Narmandakh, 2017). These are elite results after long training. You will not reach them in this module.
>
> Competition-style drills are a demanding, well-planned way to practise. They help even if you never compete.
>
> Tracking your scores and looking over your progress keeps you motivated. It also shows you where to focus next.

Use the checklist below to **track your work** through Module 4.

Exercise: Module 4 Completion Checklist. Daily Training: Building Competition-Level Memory Through Practice	
Core Ideas to Remember	
[ ]	Daily practice is a must. Most people see their scores rise within the first few weeks

[ ]	Measuring your baseline is a must. You cannot track growth without a starting point
[ ]	Advanced techniques (PAO, Major System, Layered Palaces) can take you to thousands of items, as top competitors show after long training
[ ]	Competition-style drills are a demanding, well-planned way to practise
[ ]	Speed Words and Speed Numbers build the image-making speed you use in every technique
[ ]	Teaching others and sharing scores strengthen practice
[ ]	AI tools can make fresh practice material whenever you need it. Check the AI's facts
[ ]	Track your scores: tracking progress helps you reach your goals
Exercises to Do First	
[ ]	Exercise 4.1, Day 1 Baseline Assessment (record your starting scores)
[ ]	Exercise 4.1b, The Weekly Progress Tracker (set up your tracking system)
[ ]	Exercise 4.3, Speed Words Week 1 Protocol (set up the core daily habit)
[ ]	Exercise 4.4, Speed Numbers Progressive Challenge (build number encoding)
All Exercises: Work Through the Full Set	
[ ]	Ex 4.1, Day 1 Baseline Assessment
[ ]	Ex 4.1b, Weekly Progress Tracker
[ ]	Ex 4.1c, Sensory Encoding Sprint
[ ]	Ex 4.1d, Dual N-Back Working Memory Builder
[ ]	Ex 4.2b, 30-Digit Number Challenge
[ ]	Ex 4.2c, PAO Speed Builder
[ ]	Ex 4.2d, Binary Number Sprint

[ ]	Ex 4.3, Speed Words Week 1
[ ]	Ex 4.3b, Speed Words Progressive Difficulty
[ ]	Ex 4.4, Speed Numbers Progressive Challenge
[ ]	Ex 4.4b, Number-Palace Integration Drill
[ ]	Ex 4.5, Historical Timeline Challenge
[ ]	Ex 4.5b, Personal Timeline Palace
[ ]	Ex 4.6, Abstract Symbol Encoding
[ ]	Ex 4.6b, The Symbol Alphabet
[ ]	Ex 4.7, Spoken Word Rapid Encoder
[ ]	Ex 4.7b, The Meeting Recall Protocol
[ ]	Ex G-1 through G-11, Group Training Exercises (do with a partner)
[ ]	Ex AI-1 through AI-11, AI-Assisted Training Exercises
[ ]	Ex 4.8 to 4.8d, Failure Mode Audits and Scans
Daily Practice Habits	
[ ]	7 min Speed Numbers: store a fresh string of numbers each morning
[ ]	7 min Speed Words: 15 random words into a palace or story
[ ]	6 min Spaced Review: review the palace or cards from 3 days ago
[ ]	Record your score in your Memory Journal every session
Actions to Take This Week	
[ ]	Complete Exercise 4.1 today and record your baseline scores
[ ]	Set up a daily 20-minute training schedule and block it in your calendar
[ ]	Complete at least one group exercise with a study partner this week

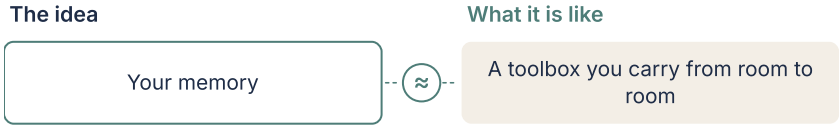
[ ]	Use AI to make 3 custom practice sessions (Exercises AI-1, AI-2, AI-3)
[ ]	Join or form a memory training group to keep each other on track and do group exercises

Daily practice turns technique into habit, and **habit into skill**. The module on memory in context takes that skill where it counts most. These are the work, study and creative fields where memory training pays off most.

Module 5: Memory in Context

YOUR MEMORY **never works on its own**. It works at school, at work and at home. Each place asks something different of it. Your memory works like a toolbox you carry from room to room, and each room needs a different tool. Study, work, art, languages and friendships each use it in their own way.

A toolbox



Each place asks something different of it.

This module takes everything from Modules 1 to 4 into those places. It shows you **where your memory skills help most**. That could be a classroom, a meeting or daily life with friends.

The how-to part of the module comes in **two halves**. The first is sorted by situation, such as a test or a talk. The second is sorted by job, such as doctor or leader. Most situations have a partner in the job half.

Social memory, for names, faces and the people in your life, **has no job partner**. It stands on its own.

> **Key Concept:**
> Module 5 Overview
>
> Your memory works at school, at work and at home. This module shows you where your memory skills help most.

This module has **four goals**. You will work toward all of them.

Key idea:

One set of memory skills + many real places = help at school, at work and at home.

- Understand how memory shapes the way you learn
- Use spaced repetition (reviewing after longer and longer gaps), active recall (testing yourself from memory) and elaborative encoding (linking new facts to things you already know, so they mean more) for school and work material
- Use memory techniques in real jobs
- Build better social memory for names, faces, and relationships

Spaced repetition



You will work toward all of them.

Memory and Learning

How Memory Affects Learning

Learning and memory **go hand in hand**. Learning something mostly means storing it, so you can pull it out later. You cannot learn what you cannot remember. You also cannot remember what you never stored well in the first place. How well your memory works decides how well and how fast you learn. **Three things tie the two together**.



Science Says: About 50% more	**A week later, students who had tested themselves on a text recalled 61% of it. Students who had reread it recalled 40% (Roediger & Karpicke, 2006).**

The first is working memory, **your mind's workspace**. It holds what you are thinking about now, like a small desk. When too much is piled on, learning suffers (Mayer & Moreno, 2003). A strong one holds more ideas at once, so harder material makes sense.



A small desk with room for only a few papers at once.

The second is long-term memory, the store that keeps what you know for days, years or life. It is **the base of being an expert**. What you already know decides how easily you learn new, related things. A student who knows biology learns new biology much more easily than a beginner. New facts slot into what is already there, so they never float alone.

Two stores

	Working memory	Long-term memory
Like	Your mind's workspace, a small desk	The base of being an expert

Learning something mostly means storing it, so you can pull it out later.

The third is retrieval practice, which means **pulling a memory back out on purpose**. Each time you do it well, the memory gets stronger. It works like a muscle that grows each time you use it. That makes testing yourself one of the most useful ways to learn (Dunlosky et al., 2013).

Scientists call this **the testing effect**. It has been found again and again, more than almost anything else in learning research (Roediger & Butler, 2011).

Key idea:

Working memory, what you already know and retrieval practice decide how well and how fast you learn.

How well and how fast you learn

- Working memory: your mind's workspace
- Long-term memory: the base of being an expert
- Retrieval practice: pulling a memory back out

Scientists call this the testing effect.

Quick check:

1. A week later, how much did students who tested themselves recall? Answer: 61%, against 40% for students who reread (Roediger & Karpicke, 2006).
2. What happens when too much is piled on working memory? Answer: Learning suffers (Mayer & Moreno, 2003).
3. What do scientists call the gain from testing yourself? Answer: The testing effect.

Techniques for Better Learning Through Memory

Spaced Repetition: A Schedule for Learning

Ebbinghaus (1885) tested his own memory for lists, again and again. He found that **we forget fast at first**, then

more slowly. A modern repeat of his study found the same shape. It also found a small rise after one day, which sleep may explain (Murre & Dros, 2015).



Ebbinghaus at his desk, testing his own memory for a list, again and again.

Spaced repetition plans each review for **roughly when the fact would start to slip**. An app can only guess that time. It is like topping up a car's fuel just before the tank runs dry. Each review that goes well pushes the next one further away. Over time, a few short reviews keep a fact for a long time.

Spaced repetition on its own handles one subject at a time. Mixing several subjects in one session feels harder, but **the extra effort helps**. It is like a sports drill that mixes shots, so you must pick the right one each time. You get better at telling similar things apart, and you remember them longer. Scientists call this mixing interleaving.

Interleaving

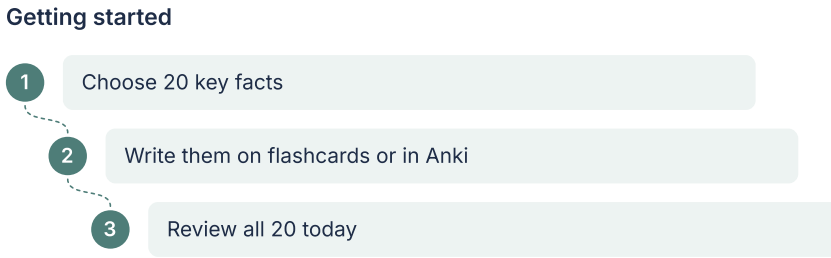


You get better at telling similar things apart, and you remember them longer.

> **Exercise:**
> 5.1, Spaced Repetition Schedule. Follow these six steps.

1. Choose 20 key facts from the first module that you want to keep.
2. Write them on flashcards, or enter them into Anki, a flashcard app that uses spaced repetition.
3. Review all 20 today. Mark each one as easy, medium or hard.
4. Review easy cards in 7 days, medium ones in 3 days and hard ones tomorrow.
5. Repeat after each review. Change the gaps based on how well you remembered each card.
6. After 4 weeks, test yourself with no hints. Note what percentage you recall. Compare it with what you kept the last time you crammed.





Write them on flashcards, or enter them into Anki.

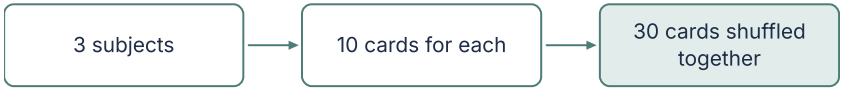
Interleaving is about **how you review** what you already know. Here is how to try it with your own subjects.

> Exercise:
> 5.2, The Interleaved Subject Review. Follow these seven steps.

1. Take three different subjects or topics you are studying now.
2. Make 10 flashcards for each subject, so you have 30 cards in total.
3. Do not review one subject's cards as a block. Shuffle all 30 cards together and review them in a fully random order.
4. Mark each card as Easy, Good or Hard. Notice how much harder it feels to switch between subjects than to stay on one.
5. Repeat this mixed review every 3 days for 2 weeks.
6. At the two-week mark, test yourself on all three subjects cold. That means no warm-up and no looking at your cards first. Compare with a classmate or colleague who studied one subject at a time.
7. In one study, people looked at paintings by different artists. Some saw the artists mixed together, and some saw one artist at a time. Later, the mixed group named the artist of unseen paintings more

often. Yet most of them thought seeing one artist at a time had helped more (Kornell & Bjork, 2008). Trust the result over the feeling of ease.

Mixing three subjects



Do not review one subject's cards as a block.

Study that feels a bit hard can make memories last longer. Spacing, mixing and testing yourself are examples. Bjork (1994) called these **desirable difficulties**. They help only when you can still succeed, so not all difficulty is useful.

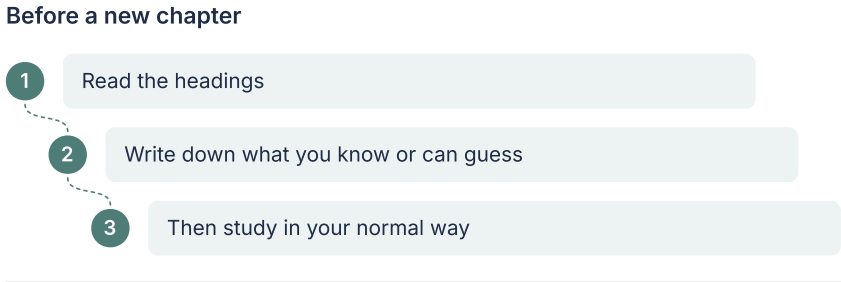
A test can also help **before you study anything new**. It is like reading the quiz questions before the show, so you listen for the answers. Trying to answer first gets you ready to spot the answers later.

> **Exercise:**
> 5.3, The Pre-Test Protocol. Follow these six steps.

1. Before you study a new topic or chapter, test yourself on it first.
2. Read the headings and write down everything you already know or can guess. Try to answer any questions at the start of the chapter.
3. You will get most answers wrong, and that is fine. This step gets your memory ready to learn.
4. Now study the material in your normal way.

5. A wrong guess before studying still makes the right answer easier to learn (Kornell et al., 2009). Scientists call this the pretesting **effect**. Mistakes you felt sure about are fixed especially well once you see the answer. That second finding is called the **hypercorrection effect** (Butterfield & Metcalfe, 2001).

6. Make this a normal part of how you study. Pre-test every chapter before you read it. Expect your scores to improve within two weeks.



Read the headings and write down everything you already know or can guess.

Pre-testing gets your brain ready for the very facts it has just tried to find. The studies below show why testing works so well. **Rereading gives you much less**.

> **Science Says:**
>
> The testing effect, key evidence (Roediger & Karpicke, 2006, *Psychological Science*). In this experiment, students read a short text. Then some of them tested themselves on it, while others read it again. One week later, the testing group remembered **about 50% more** (61% against 40%).

Both groups had the same amount of time. The rereaders even saw the text more often, about 14 times against 3. The gain came from **the act**

of recall itself. At five minutes, though, rereading was slightly ahead (81% against 75%).



The gain came from the act of recall itself.

The authors called this the testing effect. That name was **already in use** before their study.

> **Science Says:**
>
> Retrieval practice was one of the **two top-rated study methods** (Dunlosky et al., 2013, *Psychological Science in the Public Interest*). This major review rated 10 study techniques. Only practice testing and spaced practice got the top rating, high usefulness.

Five techniques got **the lowest rating** of low usefulness. They were highlighting, rereading, summarising, the keyword method and picturing a text. Three sat in the middle. They were asking yourself why, explaining to yourself and interleaving.

Rereading often **adds little** beyond the first reading (Karpicke et al., 2009). Yet most students reread, and few test themselves. Students tend to pick the methods that help them least.

The interim testing effect (Carpenter et al., 2009). Testing during a course helps **in real classrooms too**. Eighth-grade students were quizzed on some history facts and restudied others.

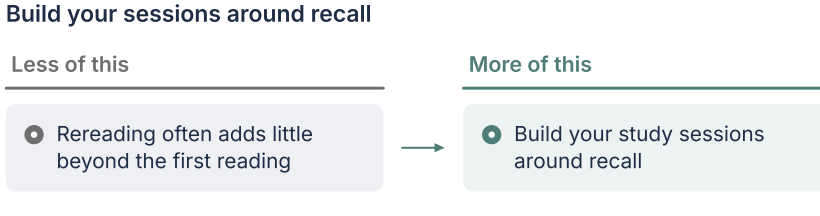


Nine months later, they remembered the quizzed facts better (Carpenter et al., 2009). By then they had forgotten a lot of both, and the gain was fairly small.

These results **point one way**. Build your study sessions around recall more than rereading. Long recall sessions also prepare you for the pressure of exams and talks.

Key idea:

Spacing, mixing, testing yourself and linking to what you know often make memories last longer.

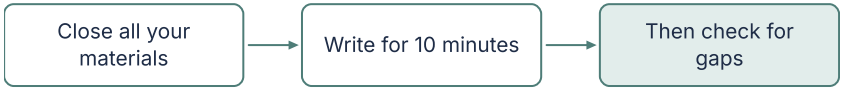


Long recall sessions also prepare you for the pressure of exams and talks.

> **Exercise:**
> 5.4, The Retrieval Practice Marathon. Follow these six steps.

1. At the end of each study session, close all your materials. On a blank sheet, write down everything you can remember from that session.
2. Do not organise it, and do not make it neat. Write whatever comes, such as facts, ideas, names, examples and links between them.
3. Set a timer for 10 minutes. Keep writing until the timer goes off.
4. Only after the 10-minute recall should you go back to your materials. Check them for gaps.
5. Circle anything in your notes that you missed in your recall. These gaps are what you study first next time.
6. Repeat this at the start of your next session, before any new study. Do a fresh 5-minute recall of the last session's material. Recalling at the start is one of the best ways to make memories stick.

The marathon



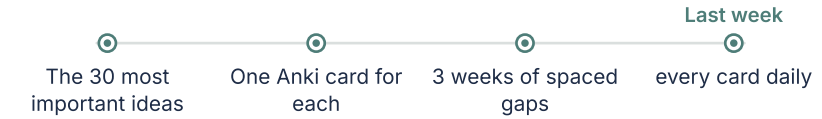
Set a timer for 10 minutes.

Students learned Swahili and English word pairs. **Testing the pairs again and again** beat studying them again and again. A week later, recall was far better (Karpicke & Roediger, 2008). Writing down what you remember ranks among the best ways to review.

A big exam needs a plan that runs **over several weeks**. The next exercise turns these tools into one week-by-week system for any important test.

> Exercise:
> 5.5, The Exam Preparation Accelerator. Follow these six steps.

1. Choose an upcoming exam, certificate or knowledge test you are working toward. If you have none, choose any subject you want to master within 60 days.
2. Find the 30 most important ideas in the material. These are the basic ideas, key terms, main differences and core processes.
3. Make one Anki card for each idea. Put a test question on the front, like what the hippocampus does in memory. Write a short, exact answer in your own words on the back.
4. Do not copy text straight from your sources. Your own words make you link the answer to what you know. So you are learning while you build your review system.
5. Run your first full review session. Sort each card honestly. Then follow the spaced gaps carefully for 3 weeks.
6. In the last week before your exam, review every card daily, whatever its gap. This makes sure everything is fresh on the day.



Sort each card honestly.

In spaced repetition, the most common mistake is cards that are **too broad**. “Explain memory consolidation” is too big for one card. Consolidation is a settling-in of memories over time. Split it into synaptic consolidation, system consolidation and the role of sleep. Smaller, more exact cards give you stronger, more reliable recall.

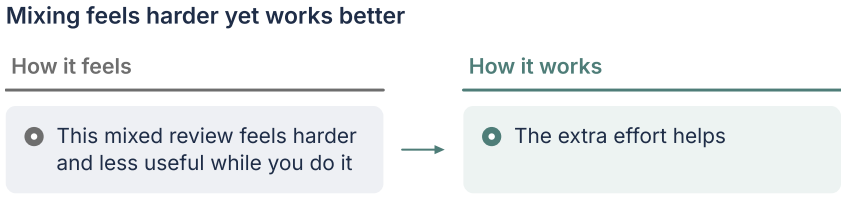
Mixing topics inside each review makes every session **harder in a useful way**. You must work out which topic a card is from before you answer.

> Exercise:
> 5.6, The Interleaved Subject Mixer. Follow these six steps.

1. Take your Anki deck or flashcard set and split it into three subject groups. For example, use the book’s ideas, its techniques and its exercises.
2. Do not review each group as a block. Shuffle all three groups together, so cards from different subjects come up in random order.
3. This mixed review feels harder and less useful while you do it. Keep going anyway.
4. After one week of mixed review, test yourself on all three subjects at once. Use fresh questions.

5. Compare your results with a starting score from studying one subject at a time. In the paintings study, mixing worked clearly better. Yet most people felt it had worked worse (Kornell & Bjork, 2008).

6. Record your results. Mixing feels harder yet works better. That gap is the main finding of mixing research. Seeing it in your own scores makes it hard to forget.



That gap is the main finding of mixing research.

Teaching shows you **gaps that testing yourself can miss**. Explaining a topic to a real person makes you organise it. It also shows what you do not know.

> Exercise:
> 5.7, The Teaching Protocol, Learn by Teaching. Follow these six steps.

1. Find someone who is happy to be "taught" a topic for 15 minutes. It could be a friend, colleague, family member or study partner.

2. Choose any section from Modules 1 to 4 that you want to make stick. Prepare nothing written, and teach it all from memory.

3. Give a 15-minute explanation of the topic. Ask your "student" to ask questions, especially ones that show your gaps.

4. After the session, go back to the material. Find every point where you paused, stayed vague or could not answer a question. These are your storing gaps.
5. Study only those gaps again. Then teach the same topic again 48 hours later, with no preparation.
6. In one study, some students expected to teach a text, and others expected a test. The future teachers recalled more of it. Their recall was also more complete and better organised (Nestojko et al., 2014). Expecting to teach changed how they studied.

Learn by teaching



Give a 15-minute explanation of the topic.

Getting ready to teach helps you learn. Really explaining it to someone helps even more (Fiorella & Mayer, 2013). Teaching makes you find how your knowledge fits together and shows every gap.

Spacing and testing handle when and how often you review. The next question is **how deeply you store something** the first time. Elaborative encoding works on that first step. It makes new facts meaningful enough that remembering them later comes easily.

Elaborative Encoding: Understanding as Memory

Copying out notes and rereading store things **only on the surface**. Those memories are shallow and easy to lose.

Elaborative encoding **goes deeper**. You link new facts to what you already know. It is like tying a boat to many posts on a dock. You think up your own examples, and you ask “why?” and “how?”. This builds deep memories that last and that you can use in new situations.



You think up your own examples, and you ask “why?” and “how?”.

That is the difference between knowing words by heart and **really understanding them**. Linking facts like this is how you get from one to the other.

> **Exercise:**
>
> 5.8, The Connection Web. Follow these five steps.

1. Choose an idea from your current studies or work.
2. Write it in the middle of a blank page.
3. Draw five branches. Label them causes, effects, real-world examples, links to other ideas and why it matters.

4. Keep branching for 10 minutes. You are building a web of links.
5. The fuller this web, the more paths you create back to the memory. You are building your own memory on purpose.

The Connection Web shows how ideas link inside one subject. Analogies go further. They help you spot **the same pattern in two very different areas**. That skill is central to solving problems in new ways.

Web and analogy

	The Connection Web	Analogies
Links	Inside one subject	Between two very different areas

They help you spot the same pattern in two very different areas.

> **Exercise:**
> 5.9, The Analogy Builder. Follow these eight steps.

1. Choose an idea that feels hard to picture, remember or understand. It can come from this programme, your studies or your work.
2. Write it at the top of a page. Below it, complete the sentence "This is like... because...".
3. Come up with at least five different analogies for the same idea. Pick each from cooking, sport, buildings, nature, friendships, machines, music or another area. They do not all need to be good. Aim for many first and good ones second.

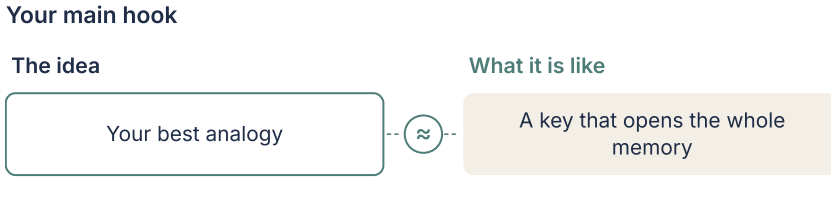
4. For each analogy, write 2 to 3 sentences. Say which parts of the analogy match which parts of the idea. Then say where the analogy breaks down.

5. Finding where an analogy breaks down forces you to understand the idea in fine detail. That detailed understanding is what makes the memory last and work in new places.

6. Now explain the idea using only one of your analogies, with no technical words. If your explanation is clear, you have stored it deeply. If it falls apart, you have found a gap.

7. Pick the analogy that feels most natural and easy to remember. That is your main hook for this idea.

8. Test yourself one week later. First recall the best analogy, then rebuild the idea from it. The analogy works like a key that opens the whole memory.



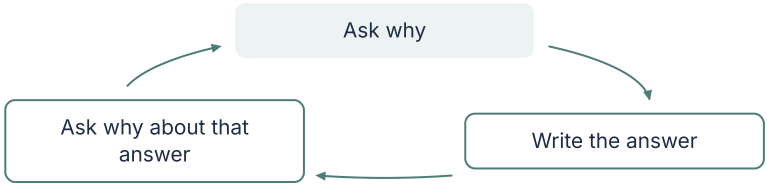
First recall the best analogy, then rebuild the idea from it.

Holyoak and Thagard (1995) see analogy as **the heart of creative thinking**. Building analogies on purpose gives you practice at it.

> **Exercise:**
> 5.10, The Five Whys Encoding Drill. Follow these six steps.

1. Choose a fact, rule or piece of information you need to remember.
2. Ask “Why is this true?” and write the answer.
3. Ask “Why?” again, this time about the answer you just wrote. Write the new answer.
4. Repeat until you have asked “Why?” five times. By the fifth answer, you should reach a basic rule that explains the first fact.
5. Now recall the first fact by working backwards from that basic rule.
6. Facts learned through a chain of reasons last far longer than facts learned alone. They also come back more easily in new situations. This is how elaborative encoding works.

Five whys



Repeat until you have asked “Why?” five times.

Knowing why each fact is true **makes it last**. A concept map, a drawing of ideas joined by labelled links, adds the next layer. It shows how a whole topic is organised. Then you can find any fact in it quickly.

> **Exercise:**
>
> 5.11, The Concept Map Sprint. Follow these five steps.

1. Set a timer for 8 minutes. On a blank sheet, map one chapter or module you studied recently.
2. Every point on the map must connect to at least one other point. Give each link a label. Use words like causes, allows, goes against, is an example of or leads to.
3. When the timer goes off, count your points and links. A chapter you know well should give 15+ points and 20+ links.
4. Now cover your map and draw it again from memory on a new sheet. Compare the two. Every missing point or link is a gap in your picture of the topic.
5. Repeat once a week for any module you are studying. Track how your maps fill up over time. That growth shows your skill growing.



When the timer goes off, count your points and links.

Physics experts and beginners were asked to sort problems. Experts sorted what they knew around **deep principles**, while beginners sorted it around surface details (Chi et al., 1981). Concept mapping is practice at building that deeper structure.

Analogies link one subject to another, which is **sideways thinking**. A concept hierarchy, a map of a topic in levels from the big ideas down to

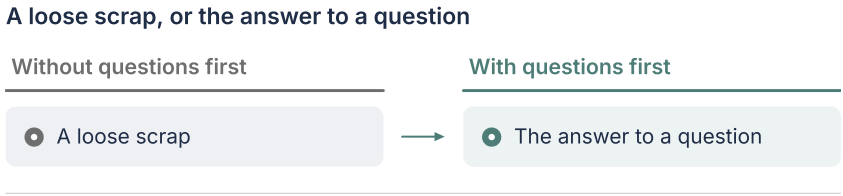
single facts, works downwards inside one subject, which is top-to-bottom thinking.

It maps the levels of a topic, from the big principles down to single facts. Then every fact has **its own address** that your memory can go straight to.

> Exercise:
>
> 5.12, The Concept Map Hierarchy. Follow these six steps.

1. Choose a broad topic, such as “The Neuroscience of Memory”, “Project Management” or “Contract Law”.
2. On a blank sheet, draw three levels. Put the topic at the top and 4 to 6 main themes in the middle. Below each theme, add the facts or examples that belong to it.
3. Use arrows to show what causes what and how ideas follow from each other. Say an arrow runs from “amygdala” to “emotional memory” with the label “amplifies”. It tells you more than a plain branch.
4. Put the map away. 24 hours later, draw it again fully from memory on a blank sheet.
5. Compare the two maps. Every missing point and arrow is a gap in your storing. Add those gaps to your Anki deck.
6. This exercise mixes mind mapping, sorting by levels and recall practice in one task. That makes it very useful for hard subjects.

Asking questions before you read is **the last tool here**. Then every new fact goes into memory as the answer to a question. It is no longer a loose scrap.

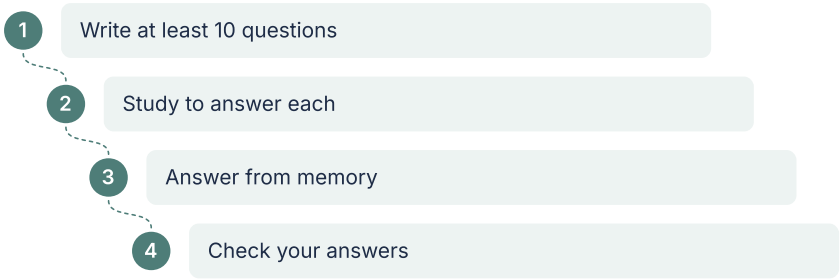


Then every new fact goes into memory as the answer to a question.

> **Exercise:**
> 5.13, The Question-First Study Session. Follow these six steps.

1. Before your next study session, spend 5 minutes writing questions about the material. Use the headings, what you half know and what you wonder about.
2. Write at least 10 questions. They become your reading plan.
3. Study the material with the goal of answering each question. Make notes only when you find a direct answer.
4. After studying, close the material and answer each question from memory. Write the answers out in full.
5. Check your answers. Go back to the text only for questions you could not answer.
6. Writing questions first helps in much the same way as pretesting. You read with a purpose, hunting for answers. A related finding is the generation effect. Words you make up yourself are remembered better than words you only read (Slamecka and Graf, 1978).

The Question-First Study Session



Use the headings, what you half know and what you wonder about.

Every question you write before reading adds **a desirable difficulty**. That is a useful kind of struggle that helps you learn (Bjork, 1994). Hunting for the answer to your own question takes more effort than just reading.

With these tools for deeper storing in place, next come **real study and work**. That is where memory training helps most, and where you see results fastest.

Quick check:

1. In the Dunlosky et al. (2013) review, which two methods got the top rating? Answer: Practice testing and spaced practice.
2. At five minutes, which was ahead, rereading or testing? Answer: Rereading, 81% against 75%. A week later, testing was ahead, 61% against 40%.
3. What is the hypercorrection effect? Answer: Mistakes you felt sure about are fixed especially well once you see the answer (Butterfield & Metcalfe, 2001).

Memory in Different Fields

THE SAME CORE MEMORY rules **work in every field**. Each field still gives you its own chances to use them. The table shows how your toolkit fits the most common work and home situations.

Four parts at once



It uses the keyword method, spaced repetition and palace storing.

Setting	What is hard to remember	Techniques to use	What to aim for
School study	Keeping lots of information for exams	Spaced repetition; active recall; elaborative encoding; mind maps (drawings with the main idea in the middle and branches for related ideas)	Strong recall after 1 week; better exam grades
Language learning	Learning the words and grammar of a new language	Keyword method (linking a new word to a familiar word that sounds like it, through a bright picture); spaced repetition (Anki); storing words inside sentences; immersion (spending time surrounded by a language, by hearing, reading and using it)	A steady stream of new words each month with daily 20-minute practice
Work talks	Giving talks without notes	Method of Loci (the Memory Palace method, using places as a frame for memory); a clear story line; rehearsing the meaning	30-minute talks given smoothly from memory
Client and colleague names	Remembering names at meetings and work events	Linking and pictures (link the name to a face feature that stands out); using the name straight after you learn it	Names recalled 24+ hours after a single meeting
Law or medical knowledge	Keeping detailed step-by-step and technical information	Chunking in levels; linking facts to real cases; concept maps	Accurate recall of many-step procedures under pressure
Creative work	Keeping ideas, inspiration and references	Idea journals; catching ideas by linking them; regular mind-mapping	A bigger store of creative material; richer links between ideas

Formal study comes first. The plan below suits any subject that ends in an exam or a qualification. From the very first session, it **mixes recall and spaced review**. It also links new facts to old ones.

> Exercise:
>
> 5.14, The Academic Study Blueprint. Follow these nine steps.

1. Choose a subject you are studying for an exam or qualification.
2. Follow the full plan below for one week.
3. Day 1. Look over the whole topic. Build a concept map of every key area. Pick the 20 most important facts, definitions or principles.
4. Day 2. Make Anki flashcards for all 20 items, and do your first review. Pre-test yourself on any new chapters.
5. Day 3. Do a recall session. Close all your materials and write everything you know about the topic for 10 minutes. Find the gaps, and study only those.
6. Day 4. Review your flashcards mixed together. Add 10 new items. Teach one idea out loud to a pretend student.
7. Day 5. Review the Day 2 cards again. Answer practice exam questions against the clock. Recall without notes.
8. Day 6. Link the new material to what you already know. Update your concept map. Do a free recall session.
9. Day 7. Test yourself on everything so far, and score it. Next week, focus on your lowest-scoring areas.

One week

Day 1	concept map
Day 2	Anki cards
Day 3	recall session
Day 4	mixed review
Day 5	practice exam questions
Day 6	link and update
Day 7	test and score

Close all your materials and write everything you know about the topic for 10 minutes.

A major review rated 10 study techniques (Dunlosky et al., 2013). This plan uses **all five that landed in its top two groups**. They are spaced practice, testing yourself, asking why, mixing topics and explaining to yourself.

Learning a language is **bigger than most study projects**. It covers words, grammar, sounds and the culture behind them, all at the same time. The system below works on all four at once. It uses the keyword method, spaced repetition and palace storing.

> **Exercise:**
> 5.15, The Language Learning Immersion System. Follow these six steps.

1. Choose a language you are learning or want to learn. This system works for complete beginners and for advanced learners.
2. Build your word base. Make Anki flashcards for 10 new words a day, using the keyword method. For each word, make a bright image

of something that sounds like it. Review all your cards daily. That is more than 3,000 new cards in a year.

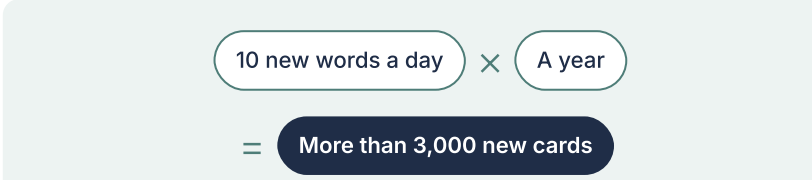
3. Learn grammar through stories. For each new grammar rule, make up a short story or sentence that shows it. Memorise the example sentence, and skip learning the rule on its own. The example becomes the rule.

4. Soak in the language. Every day, spend 15 minutes on real audio, video or text in the language. Pick material just above your level. Before each session, choose 3 words or grammar points to listen for.

5. Practise speaking or writing. Once a week, write or say a short paragraph. Use only words and grammar you learned recently. Recording yourself and playing it back helps a lot.

6. Track three things. Count the words you learn each week and the grammar you can use. Also note how much real material you understand. These numbers show you what to work on next.

New cards in a year



Review all your cards daily.

Giving a talk with no notes is the situation **many people fear most**. A palace for a talk works like a train route, with one station for each part. It tests the same skill as language learning. You need to pull out ordered material every time, in front of a live audience.

A palace for a talk



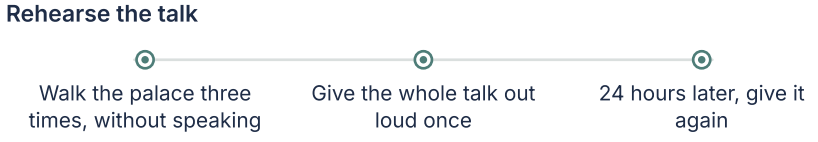
It tests the same skill as language learning.

> **Exercise:**
> 5.16, The Presentation Palace. Follow these seven steps.

1. Choose a presentation, talk or speech you need to give from memory.
2. Break it into 5 to 10 key sections. For example, start with an opening hook, the background and points 1 to 3. Then add a case study, answers to objections, a call to action and a close.
3. Build a Memory Palace with one station for each section. At each station, place a bright image that brings up that section's main message. The image stands for the idea, and you do not need the exact words.
4. Your opening and closing lines matter most, so learn their exact wording. Use the Story Chain technique, where a story links the items to remember, one after another. Place each key phrase at a smaller station inside the opening and closing spots.
5. Rehearse by walking through your palace in your mind three times, without speaking. Then give the whole talk out loud once.

6. Give it again 24 hours later, with no rehearsal in between. Notice whether the second run feels smoother after a night's sleep.

7. Set yourself a goal. Give a long talk from memory, with less preparation than notes would need. With the palace, you pull the talk out of memory. You do not recite it word for word.



Give it again 24 hours later, with no rehearsal in between.

Roman teachers of speaking said the method of loci helps a speaker remember. Cicero did so in *De Oratore*. Quintilian, a later Roman teacher, said places help with lists of things. They help less with a whole speech learned word for word.

A talk goes from one person to many. Client memory works **one to one**, and at work it often counts for even more. Remember what a person cares about, has told you and has decided. It is like a contact card in your phone, kept in your head. That shows you really listened to them.

Key idea:

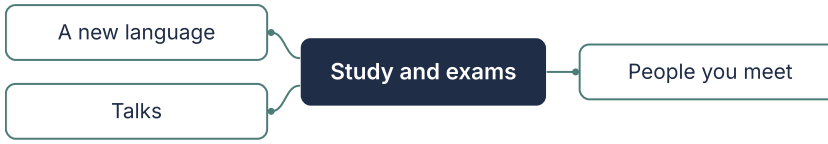
Use the same core rules with a plan for each setting, and your memory works where you need it.

> **Exercise:**
> 5.17, The Client Intelligence System. Follow these six steps.

1. Before any important meeting, client call or networking event, make a short mental file. Make one for each person you will meet.
2. Store 5 facts about each person in a small palace of their own. Use their office, or somewhere their name makes you think of. Store their role or title and something they care about at work. Add something personal they shared and the last thing you talked about. Finish with anything still to follow up.
3. Turn each fact into a bright image. Link it to the person's face or to a feature that stands out.
4. Before the meeting, walk through their palace in your mind for 30 seconds.
5. After the meeting, add any new facts while they are fresh. The file grows into a living record that deepens with every meeting.
6. When you recall what someone told you, they can tell you were paying attention. Most people appreciate that.

The fields that follow **go deeper**. They give each setting its own system, for the places where exact recall matters most.

Memory in different fields



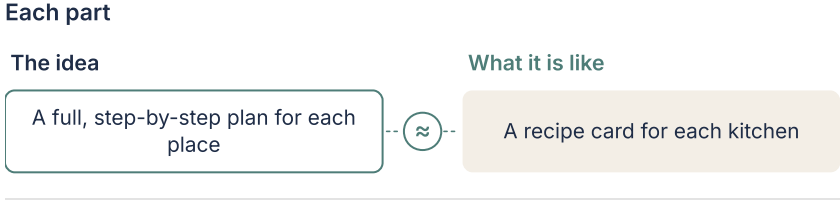
The fields that follow go deeper.

Quick check:

1. In the language system, how many new words a day do you add? Answer: 10, which is more than 3,000 new cards in a year.
2. Which lines of a talk should you learn word for word? Answer: Your opening and closing lines.
3. How many facts do you store about each person before a meeting? Answer: 5.

Applied Memory: Field-by-Field Training Protocols

THIS PART TAKES THE techniques **from ideas to real use**. It covers the places where memory is tested hardest. Think of it as a recipe card for each kitchen. Each part gives you a full, step-by-step plan that you can start today.



Think of it as a recipe card for each kitchen.

You might be a student with exams ahead. You might give talks or lead deals at work. You might be learning a language, a creative craft, or other people's names. **There is a plan for each**.

These plans put the ideas from Modules 1 to 4 to work in daily life. When research has tested a method, I **name the study**. When a step is just practical advice, I say so. Part 5.4 then sorts the same plans by job.



These plans put the ideas from Modules 1 to 3 to work in daily life.

The common thread is **steady, regular use** of what you have already learned. There are no new secrets.

Key idea:

The techniques you know, used regularly, give you a plan that works in each setting.

Quick check:

1. What does Part 5.4 do? Answer: It sorts the same plans by job.
2. What is the common thread in all the plans? Answer: Using what you have already learned, regularly and often.

Academic Excellence: The Study-to-Mastery System

Some students do well in exams and some struggle. The gap is rarely about how clever they are. It is nearly always about **how they study**.

Students who struggle tend to reread, colour over lines with a pen and cram. Students who do well **test themselves**. They also space out their study and link new facts to old ones. Linking new facts to what you know is called elaborative encoding.



One student rereads a book and colours over lines. Another tests herself with cards.

A major review looked at ten study methods (Dunlosky et al., 2013). Only two were rated **"high utility"**, which means very useful. They were testing yourself and spacing your study over time.

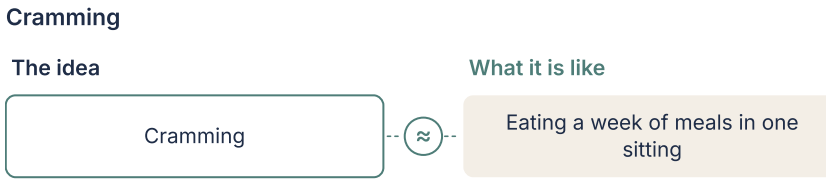
Key idea:

Testing yourself and spacing your study over time are the two methods rated most useful.

Three more were **rated moderate**. These were asking why, explaining to yourself and mixing topics. Rereading, highlighting and summarising were rated low, along with two others. This means the methods many students lean on are the weakest.

Spacing also did well in **a big study of studies**, which pooled 63 earlier studies (Donovan & Radosevich, 1999). Spaced practice beat cramming by a medium amount on average. Cramming is like eating a week of

meals in one sitting. But how much it helped depended on the task and on the time between sessions.



Spaced practice beat cramming by a medium amount on average.

Even so, most students still reread. In one survey of 177 college students, rereading was **the most common study method** (Karpicke et al., 2009). Few of them chose to test themselves.

The first plan below **sets up a full exam plan**. The second is a daily habit that keeps the plan running.

> **Exercise:**
> 5.18, The Pre-Exam Memory Architecture. Follow these six steps.

1. Six weeks before a big exam, make a Subject Map. This is one page that shows the whole course. Break it into 5 to 8 main themes. Put 4 to 6 key ideas under each one.
2. Turn each key idea into an Anki flashcard. Anki is a free flashcard app that spaces your reviews. Aim for 80 to 120 cards per subject. Put a clear question on the front. On the back, write your answer in your own words and one real example.
3. Do 20 minutes of Anki every day. In weeks 1 and 2, work on new cards. In weeks 3 and 4, mix new cards with reviews. In weeks 5 and 6, focus on reviewing all your cards.

4. Once a week, take a closed-book quiz. From memory, write the 10 most important points from each theme. Mark yourself honestly. Your mistakes show which cards need a stronger image or link.
5. In the last 3 days before the exam, add nothing new. Review your whole deck and read your Subject Map. Then walk a Memory Palace that holds the 20 facts you most need.
6. On exam day, walk your palace in your mind for 90 seconds. Do this before you write anything. This brings the shape of what you know back to mind.

The aim is for an exam to **feel different**. It should feel less like a test of whether you remember. It should feel more like a chance to show what you know.



The aim is for an exam to feel different.

> Exercise:
> 5.19, The Active Recall Loop. Follow these five steps.

1. Straight after a lecture, class or reading session, set a timer for 10 minutes.
2. Do not look at your notes. Write down everything you can remember from the session, in any order. This is called **free recall**.

Include ideas, names, links, examples and any questions it raised. Write in full sentences, not bullet points.

3. When you run out, check your notes. Add anything you missed in a different colour. The new colour shows you at a glance what you forgot.

4. Recalling before you review makes you search your memory. That search helps the facts stick. In one study, students read a passage. Then they either tested themselves on it or read it again. A week later, the testing group recalled 61% and the rereading group recalled 40% (Roediger & Karpicke, 2006).

5. Do the same free recall again 24 hours later, and again after a week. In the same study, rereading did a little better on a test five minutes later. Testing won after two days and after a week (Roediger & Karpicke, 2006).



Then they either tested themselves on it or read it again.

Quick check:

1. Which two methods were rated 'high utility'? Answer: Testing yourself and spacing your study over time (Dunlosky et al., 2013).
2. In the survey of 177 college students, what was the most common study method? Answer: Rereading (Karpicke et al., 2009).
3. How many Anki cards should you aim for per subject? Answer: 80 to 120.

Language Learning: The Word-Learning Engine

Learning a language is **one of the biggest memory jobs** you can take on. It is also one of the most rewarding, if you take it step by step.

Research on English counts **word families**. It is like counting homes on a street, not every person in them. A word family is a word plus its close forms, like use, used and useful.

You need **about 6,000 to 7,000 families** to follow 98% of speech. Reading needs about 8,000 to 9,000 (Nation, 2006).

How many word families

	Word families needed
To follow 98% of speech	About 6,000 to 7,000
Reading	About 8,000 to 9,000

A word family is a word plus its close forms, like use, used and useful.

That is a lot of words, and learning them at random is hard going. With the right memory tools, it becomes **a steady daily job**. How long it takes depends on the language and on your hours.

Research going back decades, from Atkinson and Raugh (1975) to Nation (2001), points one way. Words stick best with **meaning, clear pictures and spaced recall**. Rote repetition, or repeating something over and over, works far less well.

Key idea:

Words stick best with meaning, clear pictures and spaced recall.

Meet a word a few times in **a vivid setting** that matters to you. It will stay longer than a word copied out many times.



A learner meets a new word a few times in a lively, real setting.

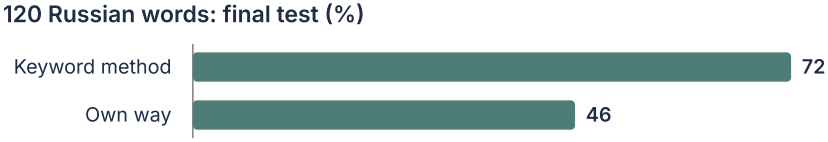
The Word-Learning Plan

Choose with care. Learn the most common words first. Use a word list sorted by how often each word is used, called a frequency list. Free lists exist online for most major languages.

Keyword Method. For each new word, find a word in your own language that sounds like it. Then make a vivid picture that links that sound-alike to the meaning.

Spanish **puerta (door) sounds a bit like quarter**. Picture a door covered in quarter coins.

In one study, students learned 120 Russian words. Those using the keyword method got **72% right** on the final test. A comparison group who studied in their own way got 46% (Atkinson & Raugh, 1975).



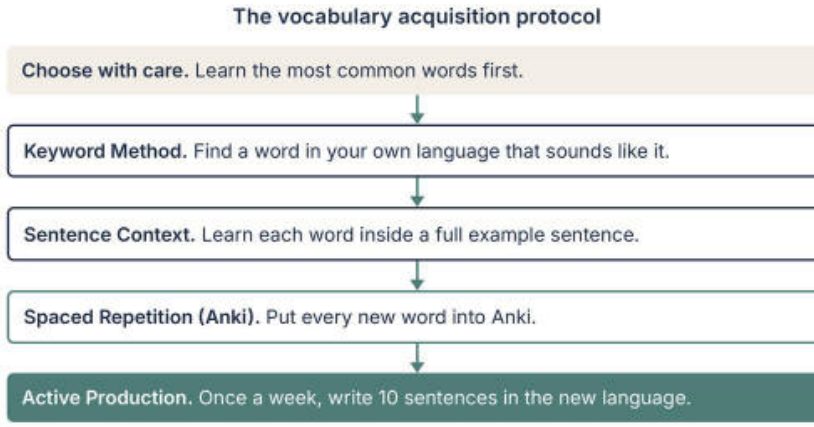
Those using the keyword method got 72% right on the final test.

The method has limits. A major review rated it low in usefulness in general (Dunlosky et al., 2013). It fits only some kinds of material, and the gain may fade. It works best with spaced review.

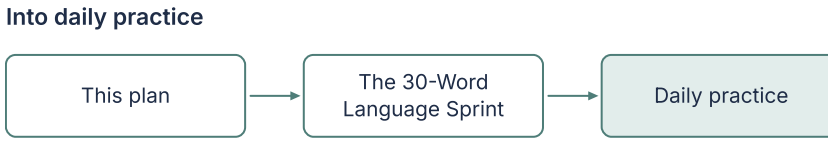
Sentence Context. Always learn a new word inside a full example sentence that means something to you. El libro está en la mesa means the book is on the table. That gives libro a setting you can find again, which a lone label lacks.

Spaced Repetition (Anki). Put every new word into Anki, the flashcard app, with the word on the front. On the back, write your keyword image, the meaning and an example sentence. Review every day.

Active Production. Once a week, write 10 sentences in the new language, using only your current words. Writing your own sentences is harder than reading. It shows you which words you really know.



The 30-Word Language Sprint turns this plan into **daily practice**. It uses the keyword method to make new words easier to remember.



It shows you which words you really know.

Words are the parts, and grammar is **how they fit together**. The Grammar Scaffold uses the same image tools for grammar rules.

> Exercise:
>
> 5.20, The 30-Word Language Sprint. Follow these six steps.

1. Choose a language you are learning, studied before or would like to start. If you are starting fresh, Spanish, French or Italian are good

choices for English speakers. Many of their words look like English words.

2. Pick 30 common words from a frequency list. If you have no list, use these 30 words.

- water, house, person, day, time, hand, eye, way, child, woman
- man, thing, work, life, place, year, door, food, tree, road
- fire, city, night, name, word, letter, book, voice, stone, heart

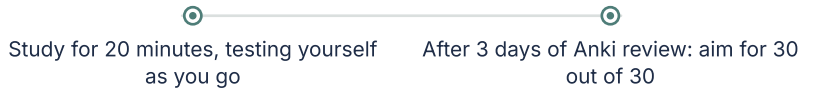
3. Use the Keyword Method on all 30 words. Find a sound-alike, make a vivid image and write a sentence.

4. Put all 30 into Anki or onto paper cards. Study for 20 minutes, testing yourself as you go.

5. Test yourself by writing the meaning of each word from memory. Aim for 25 or more right on your first try. Aim for 30 out of 30 after 3 days of Anki review.

6. This exercise sets the rhythm and the method for your language learning. Protect the daily Anki review habit you start here above all.

The 30-Word Language Sprint



Benny Lewis runs the Fluent in 3 Months site and speaks 10 languages. He teaches keyword-style picture stories for new words, as a **first hook**. They are only part of the job. His main advice is to speak the language from day one.

> **Exercise:**
> 5.21, The Grammar Scaffold. Follow these five steps.

1. Grammar rules are often learned as plain lists, and lists are easy to forget. Try turning each rule into a story or a picture instead.
2. Choose 5 grammar rules in the new language that you often get wrong. These could be verb endings, gender, tenses or irregular forms.
3. For each rule, make up a vivid character who acts out the rule. In Spanish, ser and estar both mean to be. Ser is a stern teacher who only talks about lasting facts. Estar is a restless artist who only talks about states that change.
4. When you use either verb, call up the character for a moment. The story helps you choose the right form as you go. This is a rule of thumb with exceptions, such as estar muerto (to be dead).
5. Test yourself by writing 5 sentences for each rule from memory. Then check them against a grammar book. Fix any mistakes in your Anki deck.

Ser and estar

	Ser	Estar
Character	A stern teacher	A restless artist
Talks about	Lasting facts	States that change

In Spanish, ser and estar both mean to be.

Quick check:

1. About how many word families do you need to follow 98% of speech? Answer: About 6,000 to 7,000 (Nation, 2006).
2. In the Russian word study, how did the keyword method do? Answer: 72% right, against 46% for students who studied in their own way (Atkinson & Raugh, 1975).
3. In the grammar story, who is Ser? Answer: A stern teacher who only talks about lasting facts.

Presentations and Public Speaking: The Orator's Palace

Many people fear public speaking. One survey asked **815 college students** what they feared (Dwyer & Davidson, 2012). Public speaking was ticked more often than any other item, even death. Yet when asked for their single worst fear, more students chose death.

What 815 college students feared

Ticked most often	Single worst fear
Public speaking was ticked more often than any other item	More students chose death

Dwyer & Davidson, 2012.

For many speakers, a big part of the worry is **losing their place**. Knowing your material well eases that worry more than learning a script does.

Do not try to learn the words. Know your material well, and **let your palace guide you** through it.

Roman writers on speaking **described this method**. Cicero wrote about using places and images to help a speaker remember, in *De Oratore*. Quintilian, a later Roman teacher, did the same.



A Roman speaker pictures places and images to help him recall his speech.

Quintilian also **had doubts**. He thought places help you recall a list of things. He thought they help less with a whole speech learned word for word. He advised splitting a speech into parts and learning them in order.

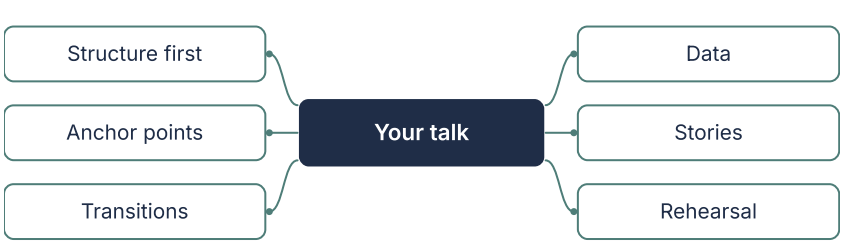
That fits the plan below. The palace holds your main points, and **you find the words as you speak**. Your eyes can then stay on the people in front of you.

Key idea:

Put the main points in a palace and use your own words on the day, and you give a talk without notes.

The Presentation Palace Protocol

Structure first. Before you store anything, plan the shape of your talk. Pick out 5 to 8 main sections. Each section becomes a room or area in your Memory Palace.



Pick out 5 to 8 main sections.

Anchor points, not scripts. At each palace stop, store the key idea of that section as a vivid image. Do not store the exact words. It is like stepping stones across a stream, where you only need the next stone in view. The image brings back the idea, and you find the words on the day.

Transitions as journeys. The walk from one stop to the next is your link between sections. As you move in your mind from kitchen to dining room, say a linking phrase. For example, “this leads us to...” or “building on that point...”.

Transitions as journeys



As you move in your mind from kitchen to dining room, say a linking phrase.

Data and statistics. Store each number with the Major System, which turns numbers into images. Place the image at a small spot inside the right room. For example, put it on the table, away from the door.

Stories and examples. These are easy to remember and rarely need palace help. A good story can even hold the ideas around it in place.

Rehearsal. Walk through your talk palace at least 5 times before you give it. Practise in different places.

The place where you learn does affect memory. The effect is **fairly small in general**. Some studies had people learn in more than one place. Their recall held up better in a new place (Smith & Vela, 2001).

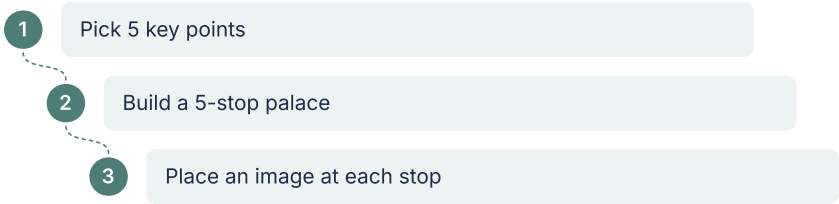
The 5-Minute Talk below tries out the full plan on a short talk. It shows whether every point is stored well enough to speak without notes. Once it works, you can **build up to longer talks**.

> Exercise:
>
> 5.22, The 5-Minute Talk from Memory. Follow these six steps.

1. Choose any topic you know fairly well. It could be your job, a hobby or a topic from this book.
2. Pick 5 key points you want to make. These are your 5 palace stops.
3. Build a Memory Palace with 5 stops on a fixed route. Your home works well. At each stop, place a vivid image for that point.

4. Walk your 5-stop palace twice in your mind. Then give the talk out loud to yourself, walking the palace as you speak.
5. Record yourself on your phone and play it back. Did you cover all 5 points? Did you move from point to point smoothly? Where did you pause?
6. Make the image stronger at any stop where you paused. Give the talk again 24 hours later, with no new preparation. Notice how well the palace holds the order after a day.

The 5-Minute Talk



Your home works well.

Aim to **speak from what you know**, with no page to read from. The palace gives you the order, and your knowledge fills in the rest.

A prepared talk tests how well you stored it. A talk with no preparation tests something harder. It tests whether you can shape a clear talk **on the spot**.

Two kinds of talk

	A prepared talk	No preparation
What it tests	How well you stored it	Whether you can shape a clear talk on the spot

A talk with no preparation tests something harder.

> **Exercise:**
> 5.23, The Impromptu Speech Palace. Follow these six steps.

1. This exercise trains a useful work skill. You learn to speak clearly on a topic with no warning.
2. Ask a partner to give you a random topic. Take 60 seconds to build a 3-stop palace for it before you speak.
3. Stop 1 holds the key meaning or background. Stop 2 holds the most important result or example. Stop 3 holds your conclusion or advice.
4. Give a 2-minute talk using your 3-stop palace. Your partner times you and notes any big gaps or repeats.
5. Practise every day with new topics. Within 2 weeks, aim to cut your planning time from 60 seconds to 20 seconds. Within 4 weeks, aim for the 3-stop shape to come to mind by itself.
6. Next level: move to a 5-stop palace for 5-minute talks with no preparation. This helps you stay calm when someone suddenly asks you to speak.

The Impromptu Speech Palace



Quick check:

1. In the survey of 815 college students, which fear was ticked most often? Answer: Public speaking, more often than any other item, even death. For their single worst fear, more students chose death.
2. How many times should you walk through your talk palace before you give it? Answer: At least 5 times.
3. In the Impromptu Speech Palace, what does Stop 1 hold? Answer: The key meaning or background.

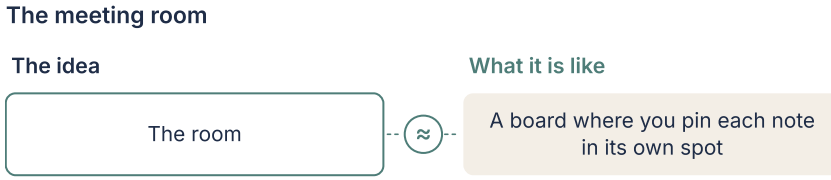
Professional Memory: Meetings, Negotiations, and Client Relationships

At work, a good memory **gives you an edge**. Think of a colleague who recalls just what was agreed three months ago. Think of someone who remembers every point raised in the last round of a deal. Think of a salesperson who knows what each client likes.

This part gives you **clear plans** for the most common memory needs at work. The first is for meetings. The second is for the people you work with over time.

Work often asks you to **remember in real time**, with no time to prepare. Meetings are the hardest case. Several people talk about several topics, and often nobody writes it all down. The room works like a

board where you pin each note in its own spot. This system helps you hold on to what was said and decided.



The room works like a board where you pin each note in its own spot.

> **Exercise:**
> 5.24, The Meeting Memory System. Follow these six steps.

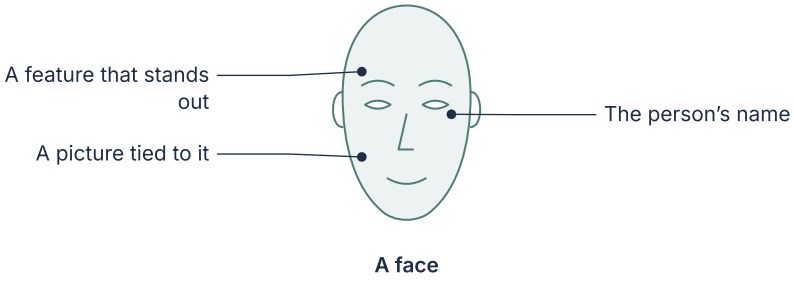
1. When a meeting starts, use the room itself as a Memory Palace. The door holds agenda item 1. The agenda is the list of topics for the meeting. The window holds item 2, the whiteboard holds item 3, and so on.
2. As each item is discussed, turn its key decision or action into a vivid image. Place it at that item's spot. Say the team agrees to push the deadline back two weeks. Picture a calendar with legs running away from the door.
3. When you meet someone new, use the Name-Face System at once (see the techniques module). It links a person's name to a picture tied to a feature of their face.
4. After the meeting, do not look at any notes yet. Spend 5 minutes walking the room palace in your mind. Write down every key point and decision you stored.

5. Check what you recalled against the official minutes, the written record of what the meeting decided. Track how much you got right over 4 weeks.

6. Over time, you will need your notes less to know what was decided. That makes follow-up faster. Still keep written minutes of decisions and actions. Your memory backs up the official record, but it does not replace it.



Name-Face System



A meeting system holds one conversation. You can also **build up what you know about one person** over many meetings. Each new talk with them then starts from a richer place.

One talk or many

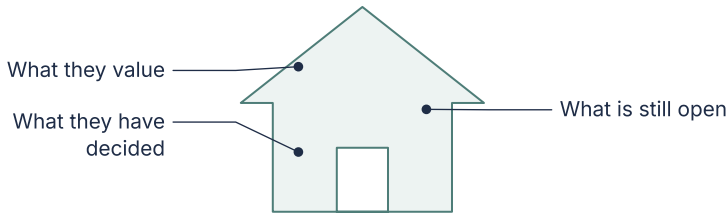
	A meeting system	Over many meetings
Holds	One conversation	What you know about one person

Key idea:

Use the room as a palace and recall straight after, and you keep what was decided, with written minutes as the record.

The Client Memory File does this. It builds a record of **what each person values** and what they have decided. It also holds what is still open. You store it in a palace room in your head.

The Client Memory File



A palace room for one person

It also holds what is still open.

> Exercise:
>
> 5.25, The Client Memory File. Follow these six steps.

1. For each important client, colleague or partner, make a character profile in your mind. Build it from vivid images.
2. Store their name with a name-face image. Add their role, their top priorities at work and how they like to communicate. Add any personal details they have shared, such as family, interests and key dates. Add the key history of your work together.

3. Store this profile in its own Memory Palace room. Picture the client's office, or a place you link with them.
4. Before any meeting with that person, spend 2 minutes walking their palace room. This brings their details back to mind before you walk in.
5. After each meeting, update the room. Walk through it and add any new details to the scene. Over time, the room becomes a full and up-to-date record of the relationship.
6. If you also write any of these details down, keep them safe. Follow your employer's rules on personal data.



Walk through it and add any new details to the scene.

Small details matter. You might recall that a client's daughter just graduated. Or you might recall a kind of meeting they dislike. Bringing that up is more than small talk.



A worker asks a client about her daughter, who just graduated.

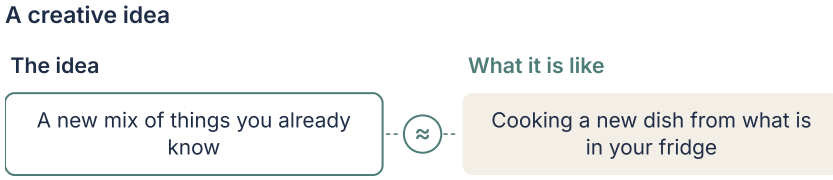
In studies of chats and speed dates, people who **asked more questions were liked more** (Huang et al., 2017). Follow-up questions helped most.

Quick check:

1. In the Meeting Memory System, which spot holds agenda item 1? Answer: The door.
2. Should your memory replace the written minutes? Answer: No. It backs up the official record, but it does not replace it.
3. What did Huang et al. (2017) find? Answer: People who asked more questions were liked more, and follow-up questions helped most.

Creative Memory: Capturing and Retaining Ideas

One theory treats creative thinking as **a memory skill**. Sarnoff Mednick put it forward in 1962. He said a creative idea is a new mix of things you already know (Mednick, 1962). It is like cooking a new dish from what is already in your fridge. It links ideas that were stored apart.



Sarnoff Mednick put it forward in 1962.

If that is right, **a richer store of memories** gives you more to work with. Catch and keep more new ideas, and you can keep up more creative work.

Key idea:

If Mednick is right, more stored ideas and new links between them lead to more creative work.

Creative memory tends to fail in two ways. First, you **forget an idea** before you can work on it. A great thought comes, and it is gone before you write it down.

Second, you **lose the details** of what inspired you. A film, a book or a talk sparked something. Then its details fade before you can use them.



This part deals with both problems. Meeting and client plans handle facts that come from outside. Ideas are different, because **they come from inside you**, often unexpectedly. Many vanish within minutes unless you catch them quickly.

Facts and ideas

	Meeting and client plans	Ideas
Where they come from	Outside	Inside you, often unexpectedly

Ideas are different, because they come from inside you, often unexpectedly.

> **Exercise:**
> 5.26, The Idea Capture System. Follow these five steps.

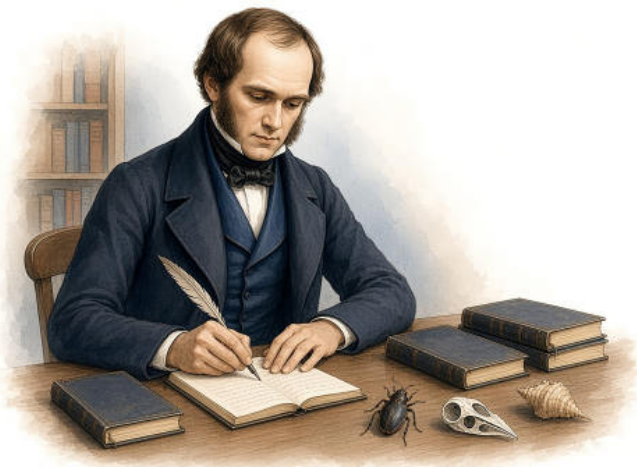
1. Start a First Landing habit. Within 30 seconds of having an interesting idea, write it down or record it. That could be in a talk, while reading or on a walk. Use whatever is fastest. A voice memo, a phone note or a pocket notebook you carry all work.
2. At the end of each day, spend 10 minutes going through what you caught. Read each idea and add one sentence about where it came from. Then tag it with a project name, a theme or a question.
3. Once a week, read the ideas you caught that week. Look for links between them. Two ideas from different days may connect in a way you did not expect. That link can be the seed of your next big piece of work.
4. Build a Creative Palace. This is a Memory Palace for your most important ideas. Give each big project its own room. When a new idea links to a project, walk that room in your mind. Store the new idea as an image at a free spot in that room.
5. Once a month, walk your Creative Palace. Notice which ideas have grown, which have stalled and which have joined with others. This monthly walk works like a weekly progress check on a work project.

The capture rhythm

Each day	Each week	Each month
10 minutes	look for links	walk your Creative Palace

Notice which ideas have grown, which have stalled and which have joined with others.

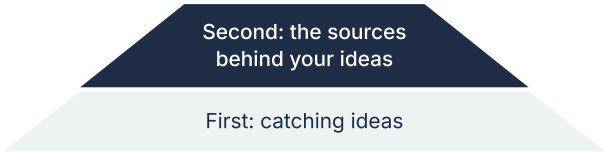
From July 1837 to mid-1839, Charles Darwin filled **four notebooks on transmutation**. Transmutation meant one species changing into another. *On the Origin of Species* came out 20 years later, in 1859. Your Idea Capture System does the same job, giving ideas time to grow.



Charles Darwin writes in one of his four notebooks on species change.

Catching ideas is **the first layer**. The second is keeping the books, articles, talks and conversations behind them. The Reference Retention Protocol stores them clearly enough to cite, revisit and build on. Without it, they may stay only as a vague impression.

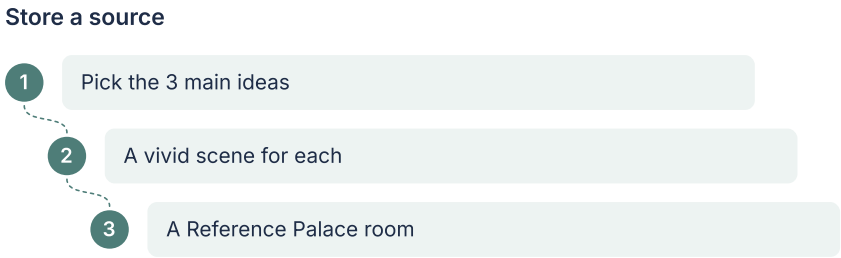
Two layers



The Reference Retention Protocol stores them clearly enough to cite, revisit and build on.

> **Exercise:**
>
> 5.27, The Reference Retention Protocol. Follow these six steps.

1. Some books, films, talks or shows spark your creative work. Afterwards, spend 15 minutes storing their key ideas. Use the five steps below.
2. Pick the 3 main ideas from the work that struck you most. Write one sentence for each.
3. Make a vivid scene for each idea. The image should hold the heart of the idea, not its exact words.
4. Put these 3 images in a Reference Palace room set aside for that work. Name the room after the title.
5. Store the source itself. Include the author's name and the year, and why it mattered to you. A name-face image can help with the name.
6. Add an Anki card that asks, "What are the 3 key ideas from [title]?" Put your 3 sentences on the back.



Put these 3 images in a Reference Palace room set aside for that work.

With this system, each source that matters becomes **something you can come back to**. You can recall it and combine it with new ideas years later.

Quick check:

1. Within how long should you write down a new idea? Answer: Within 30 seconds.
2. When did Darwin fill his four notebooks? Answer: From July 1837 to mid-1839. *On the Origin of Species* came out 20 years later, in 1859.
3. How many main ideas do you store from each work? Answer: 3.

Social Memory: Building Deeper Relationships Through Better Recall

RELATIONSHIPS GROW FROM SHARED experience, and shared experience **lives in memory**. The way you remember people shapes your friendships. It matters what you recall of what they told you. So does what you recall of their worries, your promises and the times you shared.

Relationships



It matters what you recall of what they told you.

Every detail you remember is **a small act of respect**. It tells the other person that they were worth your attention.

Showing that you listened can make people like you more. In studies of chats and speed dates, people who asked more questions were liked more (Huang et al., 2017). Follow-up questions helped most. This worked because partners **felt heard and understood**.

Key idea:

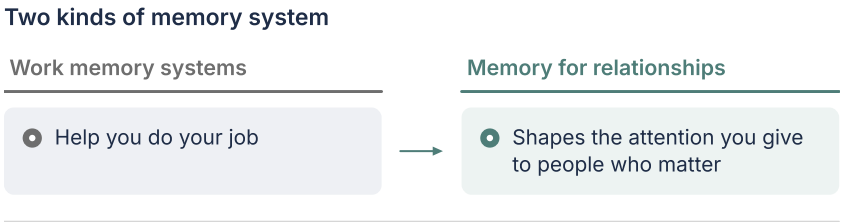
With real attention and remembering what people share, people may feel heard and like you more.



Two people chat, and one asks questions and listens closely.

This is **not a trick**. It comes from paying real attention and then storing what you hear well.

Work memory systems help you do your job. Memory for relationships serves **something deeper**. It shapes the attention you give to people who matter to you.



Memory for relationships serves something deeper.

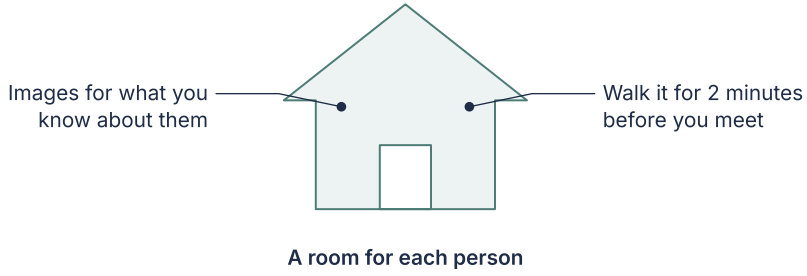
Friendships may rest **more on what you remember** than on what you mean to do. The practice below builds a habit of storing what people share. A People Palace works like a photo album with a page for each friend. Their lives are worth remembering, and they are more than data.

> **Exercise:**
> 5.28, The Relationship Memory Practice. Follow these six steps.

1. After an important conversation, spend 5 minutes writing conversation notes. It might be a first meeting, a talk with a friend or a work chat. Keep the notes in one notebook or app.
2. Write down the person's name and what they shared about themselves. Add any problems they mentioned and any promises you made. Add anything they said that surprised or moved you.

3. Move the most important points into a People Palace. This is a Memory Palace where each person you care about has their own room. Fill the room with images for what you know about them.
4. Before you see this person again, walk their room for 2 minutes. Let the details come back to mind.
5. In your next conversation, mention something they told you before. Notice how this changes the talk and how they respond to you.
6. Practise this with 5 people over the next month. Notice what changes in those relationships.

A People Palace



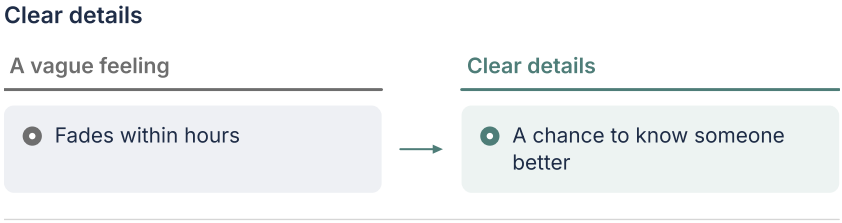
This is a Memory Palace where each person you care about has their own room.

A good follow-up question **shows that you were listening**. Remembering what someone said gives you that question. Used with care, memory is one of the kindest gifts you can give another person.

The Relationship Memory Practice builds the long-term habit. The Conversation Detail Challenge trains **the skill behind it**.

Each talk then becomes a chance to know someone better, and more than a way to pass time. You learn to **notice clear details** as people

share them. Otherwise they blur into a vague feeling that fades within hours.



You learn to notice clear details as people share them.

> **Exercise:**
> 5.29, The Conversation Detail Challenge. Follow these five steps.

1. Have your next 5 conversations, at home or at work. Quietly decide to remember 3 details from each. Pick something personal they shared and something they said they care about. Also pick one thing they are dealing with or looking forward to.
2. After each conversation, write these 3 details in your notes. Do this before anything else.
3. Within 48 hours, store them in that person's room in your People Palace.
4. When you next see each person, bring up one detail in a natural way. One is enough, and more is fine. It might be a day later or a month later. Bring it up because you want to hear more, not to show off your memory.
5. Track how many details you remembered before you checked your notes. After 4 weeks of practice, aim for 8 to 10 of the 15 details. Try to do it without your notes.

Each conversation



It might be a day later or a month later.

Quick check:

1. How long should you walk a person's room before you see them again? Answer: 2 minutes.
2. In the conversation detail exercise, how many details do you pick from each conversation? Answer: 3.
3. After 4 weeks, what should you aim for? Answer: 8 to 10 of the 15 details, without your notes.

Applied Memory Masterclass

THE LAST PART APPLIED memory science to study and work. This part goes further, into **five fields**. They are medicine and technical work, languages, public speaking, creative work and leadership.

Five fields



This part goes further, into five fields.

Each part builds on its partner in the previous section. Each one also notes **what has been tested** and what is just good practice. The exercises suit anyone, experts and beginners alike.

Key idea:

Five fields and a clear line between tested methods and good practice give you plans anyone can use.

Quick check:

1. Which five fields does this part cover? Answer: Medicine and technical work, languages, public speaking, creative work and leadership.
2. Who are the exercises for? Answer: Anyone, experts and beginners alike.

Memory for Medical and Technical Professionals

This builds on the earlier study system. Medicine asks people to hold **a huge amount in memory**. Medical students learn thousands of drug names, doses, body parts, body processes and clinical steps, the steps in caring for patients. They often do it under heavy time pressure, with patient safety at stake.

The amount is **not the only challenge**. Mistakes in recall can cost a great deal. Storing facts so they come back every time, even under pressure, is a core skill in this work. The methods medical students use apply to any technical or science-heavy field.

Working memory is **the small space** where you hold and use facts right now. It is limited. Lessons that overload it teach less, so good lessons are designed to ease that load (Mayer & Moreno, 2003).

> **Science Says:**
>
> Experts get around the limit in another way. They use well-organised knowledge stored long term as **an extra working space**. It is like a cook who keeps tools on hooks within reach, so the small counter stays clear. Medical diagnosis, working out what illness someone has, is one of the examples given (Ericsson & Kintsch, 1995).

How experts get around the limit



It is like a cook who keeps tools on hooks within reach, so the small counter stays clear.

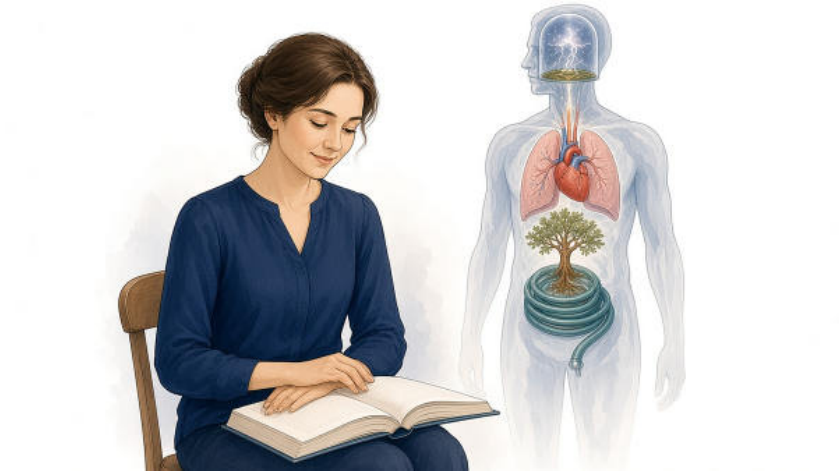
Store new facts through **more than one channel** at once. Use places, stories and steps together. The plan below matches each kind of medical knowledge to the best method.

Key idea:

Well-organised knowledge and more than one channel (places, stories, steps) make facts easier to hold under pressure.

The Medical Memory Plan

Body parts. The body itself makes a natural Memory Palace. Try placing parts, jobs and diseases where they really are in the body. That can work better than learning them from a list in a textbook.



A medical student pictures facts placed on the parts of a body.

Drug groups. Start with a drug family, like beta blockers, then one drug, like atenolol. Add how it works, what it treats and its main side effects. Store each layer as a clear image inside a Drug Palace.

Clinical steps. Store ordered steps as a Story Chain, where each step causes the next. This is a study aid. For real clinical and safety work, always follow the official written checklist.

Checklists save lives. One study tested a 19-item surgical safety checklist in 8 hospitals (Haynes et al., 2009). Deaths fell from 1.5% to 0.8%. Problems after surgery fell from 11.0% to 7.0%.

A 19-item checklist in 8 hospitals

	Before	After
Deaths	1.5%	0.8%
Problems after surgery	11.0%	7.0%

One study tested a 19-item surgical safety checklist in 8 hospitals (Haynes et al., 2009).

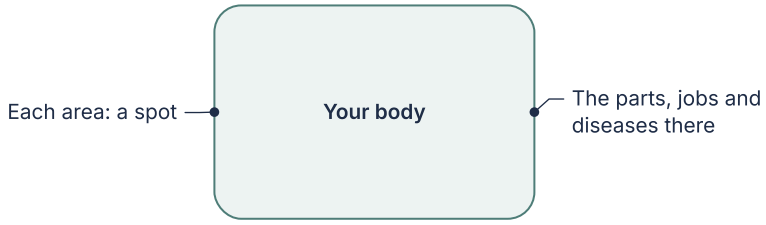
Memory aids for lists of causes. Medical schools teach many memory aids for lists of causes, such as VINDICATE. Each letter starts a type of cause, such as Vascular, Infection and Neoplasm (a growth). Versions of it vary from school to school.

Build your own memory aids for any list your field needs. The key rule is that each aid must bring back **the whole list**. Bringing back only the first few items is not enough.

Body facts are about place, so they **suit a palace**. Clinical steps add order. You need to know what must happen, in what order and when.

The Body Palace **uses the body itself** as the palace. Each area of the body becomes a spot. It stores the parts, jobs and diseases that belong there.

Body parts



Each area of the body becomes a spot.

> **Exercise:**
>
> 5.30, The Body Palace. Follow these four steps.

1. Use your own body as a Memory Palace with 12 stops. Work from the top down.

- skull, eyes and ears, throat, chest (lungs), chest (heart), upper belly (liver and stomach)
- lower belly (gut), hips, upper arms, lower arms, upper legs, lower legs

2. Use this Body Palace to learn these 12 body systems and their main jobs.

- Nervous: sends electrical signals. Cardiovascular: moves blood around the body.
- Respiratory: swaps gases in the lungs. Digestive: takes in food.
- Endocrine: controls hormones. Immune: fights germs.
- Musculoskeletal: gives movement and shape. Integumentary: skin and body heat.

- Renal: filters blood and balances fluid. Reproductive: making babies.
- Lymphatic: moves fluid and immune cells. Sensory: senses the world.

3. For each system, place a vivid scene at its body stop. Put the nervous system at the skull. Picture a lightning storm inside a glass dome. Put the cardiovascular system at the heart. Picture a red river pumping through endless tunnels.
4. Recall all 12 systems and their jobs from memory. Then add one key fact for each system, as a second image at each stop.

Two body stops

System	Stop	Scene
Nervous	Skull	A lightning storm inside a glass dome
Cardiovascular	Heart	A red river pumping through tunnels

Put the cardiovascular system at the heart.

Start your Body Palace **early in your training**. Each new fact then has a place waiting for it. It joins a map and does not sit alone in a list.

Start early



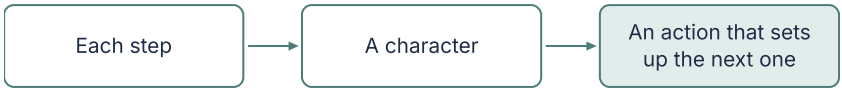
Each new fact then has a place waiting for it.

Body parts stay put, but clinical steps come in order. The Procedure Chain **stores that order** as a Story Chain.

> **Exercise:**
> 5.31, The Procedure Chain. Follow these six steps.

1. Choose a task with many steps from your work or study. It could be a lab method, a surgical checklist or a legal process. It could also be a money audit or a safety routine. For real clinical or safety work, the written checklist comes first.
2. List every step in the right order. If a step has smaller steps, list those too.
3. Build a Story Chain. Turn each step into a character, whose action shows what the step is. Each character's action must set up the next one.
4. Tell the whole Story Chain out loud. Then write down the full task from the story alone.
5. Practise until you can rebuild the whole task from memory in 90 seconds or less.
6. Test yourself under pressure. Ask someone to stop you halfway through, and then carry on. If your recall falls apart when you are stopped, keep practising until it holds.

A Story Chain



Turn each step into a character, whose action shows what the step is.

Quick check:

1. In the surgical checklist study, what happened to deaths? Answer: They fell from 1.5% to 0.8% (Haynes et al., 2009).
2. For real clinical and safety work, what should you follow? Answer: The official written checklist.
3. How fast should you be able to rebuild a many-step task from memory? Answer: In 90 seconds or less.

Memory for Language and Learning New Words

THIS BUILDS ON THE language plan in the previous section. Learning a language is a memory job of **huge scope**. It is like filling a library one shelf at a time. You need thousands of words. For most spoken English, you need about 6,000 to 7,000 word families (Nation, 2006).

Grammar means taking in **hundreds of rules**, exceptions and patterns. Sounds can be hard too. Your new language may use sounds that your own language does not have. Used in an orderly way, memory techniques make this load easier to manage.

> Exercise:
>
> 5.32, Keyword Method in Practice. Follow these six steps.

1. Choose 15 words from a language you are learning or want to learn. If you have no language on the go, use these Spanish words.

- perro (dog), libro (book), ciudad (city), agua (water), tiempo (time or weather)
- trabajo (work), casa (house), gente (people), vida (life), noche (night)
- amor (love), mano (hand), ojo (eye), boca (mouth), cabeza (head)

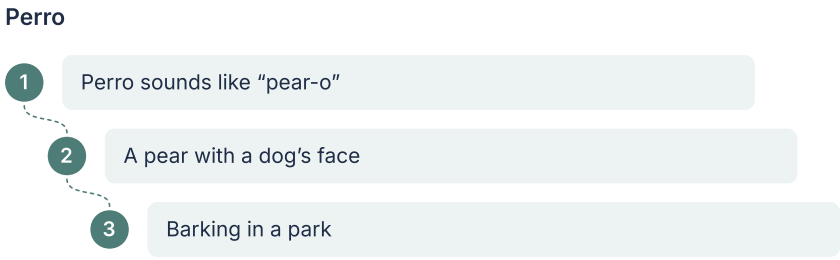
2. For each word, find an English word that sounds or looks like it. Perro sounds like “pear-o”, so picture a pear with a dog’s face. Libro looks like library, so picture a book in a library.

3. Make a vivid scene that joins the sound-alike image to the meaning. Picture the pear with a dog’s face, barking in a park.

4. Review all 15 using the scene images. Test yourself both ways, from English to Spanish and from Spanish to English.

5. Come back in 24 hours and test yourself again, with no review first. Aim for at least 13 out of 15.

6. In the classic study, students learned 120 Russian words. The keyword group got 72% right on the final test. A comparison group got 46% (Atkinson & Raugh, 1975). An early review found that the method helps people learn new words in a dependable way (Pressley et al., 1982).



Make a vivid scene that joins the sound-alike image to the meaning.

A later major review rated the keyword method **low in usefulness in general** (Dunlosky et al., 2013). The gains can fade over longer gaps. It also suits only words that are easy to picture. Pair it with spaced review.

Key idea:

Keyword images, spaced review and using the words yourself give you a word store that keeps growing.

Words are **only half the job**. Grammar gives you the rules for putting words together to make meaning. Unlike single words, grammar rules often come in steps and depend on conditions.

The Grammar Palace stores each rule at **a place you can walk to**. For another way, with a character for each rule, see Exercise 5.21.

Two ways to store a rule

	Grammar Palace	Exercise 4.21
Each rule	A place you can walk to	A character

Unlike single words, grammar rules often come in steps and depend on conditions.

> **Exercise:**
>
> 5.33, Grammar Palace. Follow these five steps.

1. Choose the three grammar rules you find most confusing in a language you are learning.
2. For each rule, write a story sentence that shows the rule at work. Make it so striking that it brings back the rule every time you recall it.
3. Build a Grammar Palace with one stop for each rule. At each stop, place the story sentence as a vivid scene.
4. For each rule, also store one wrong example with a wild result. For example, a character uses the wrong tense and lands in the wrong century.
5. Test yourself by translating 10 new sentences that need these rules. Check which rules you used correctly and which still trip you up.

Collect example sentences you like. A good example gives you a pattern for building sentences of your own.

Single sessions build depth. A 30-day sprint builds **range and a steady habit**. In time, new words come to you as you read and talk, with no search. Exercise 5.20 is a one-off 30-word version of this sprint.

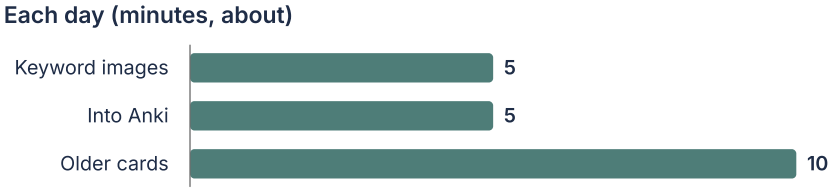
Sessions and sprints

	Single sessions	A 30-day sprint
Build	Depth	Range and a steady habit

In time, new words come to you as you read and talk, with no search.

> **Exercise:**
> 5.34, The 30-Day Vocabulary Sprint. Follow these five steps.

1. Learn 10 new words a day in your new language for 30 days. That makes 300 words. It is a good start for a traveller and a firm base for further study.
2. Each day, make Keyword Method images for all 10 words, which takes about 5 minutes. Add them to Anki, the flashcard app, in about 5 minutes. Then spend about 10 minutes on any older cards due that day.
3. Twice a week, use as many new words as you can. Write a paragraph or talk out loud to yourself. Using words yourself is harder than recognising them. It shows which ones you really know.
4. On Day 30, test yourself on all 300 words with no review first. Count any score above 240, which is 80%, as a strong pass.
5. After Day 30, drop to 5 new words a day. Keep up your Anki reviews. Your vocabulary keeps growing, and your review time stays easy to handle.



Add them to Anki, the flashcard app, in about 5 minutes.

Quick check:

1. After 24 hours, what should you aim for on the 15 words? Answer: At least 13 out of 15.
2. What counts as a strong pass on Day 30? Answer: Any score above 240 of the 300 words, which is 80%.
3. What do you do after Day 30? Answer: Drop to 5 new words a day and keep up your Anki reviews.

Memory for Public Speaking and Performance

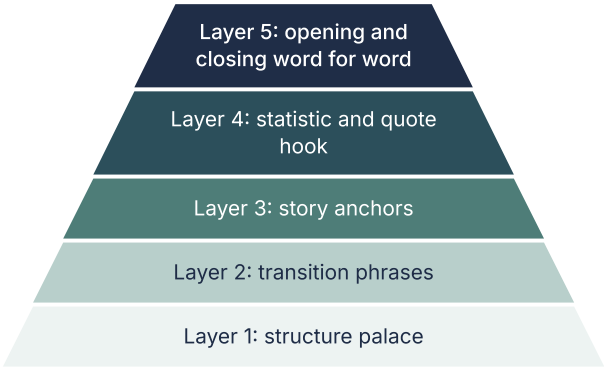
THIS BUILDS ON THE earlier Orator's Palace. Speaking from memory **frees you from notes**. Slides stop being a crutch. You can look at your audience and really connect with them.

It is a strong skill to have at work, and one that **many people fear**. For many speakers, the worry is about forgetting. When you can trust your memory, that worry eases. This part shows how to learn any talk or performance from the ground up.

The Five-Layer Speech Architecture

This is **my own plan** for a talk. It has five layers.

Five layers



This is my own plan for a talk.

Layer 1, Structure Palace. Build a Memory Palace with one stop for each main section of your talk. Each stop holds the core message of its section, as ideas with no set words. Like a map, it shows where you are and what comes next.



A speaker walks through a palace, with one stop for each part of the talk.

Layer 2, Transition Phrases. Learn the first sentence of each section word for word. These sentences are your doorways, and the content follows from the Structure Palace. As a rough guide, a 30-minute talk needs 8 to 10 of them.

Layer 3, Story Anchors. For each main point, store a real story or case that shows it. A story can also hold up the point it supports.

Stories are **easier to remember than plain statements**. One review pooled studies with over 33,000 people (Mar et al., 2021). Stories were understood and recalled better than factual texts.



Stories are easier to remember than plain statements.

Key idea:

A palace for the structure, stories for each point and a word-for-word opening and close give you a talk from memory.

Layer 4, Statistic and Quote Hook. For an exact number, make a Major System image. Learn short quotes word for word. Place these as small images at the right palace stop.

Layer 5, Opening and Closing Word for Word. Learn your first 60 seconds and your last 60 seconds word for word. These are the moments that matter most. You can rebuild everything in between, but not these.

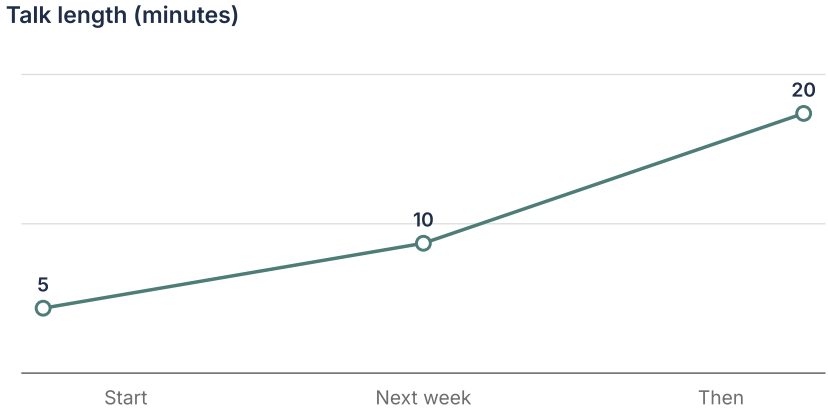


These are the moments that matter most.

The 5-Minute Memory Talk below **puts these layers to work**. It uses the 5-minute format of Exercise 5.22 and adds the five layers. A real run-through soon shows whether each point is truly stored or only feels familiar.

> **Exercise:**
> 5.35, The 5-Minute Memory Talk. Follow these five steps.

1. Prepare a 5-minute talk on a subject you know well. Try your job, a hobby, a country you know or a book.
2. Use the Five-Layer Speech Architecture. Make a 5-stop Memory Palace and learn a doorway phrase for each section. Find one story for each point, and note any numbers or quotes. Learn your opening and closing lines word for word.
3. Give the talk alone, twice in the same day. Use a mirror or record it on your phone. Notice where you pause, because those are the gaps in what you stored.
4. 24 hours later, give the talk again with no practice in between. This tests whether it has settled in your memory.
5. The next week, stretch the talk to 10 minutes. Then try 20 minutes. By the end of the month, aim for a smooth 20-minute talk from memory.



Then try 20 minutes.

Practise your opening line until you could say it **half asleep**. A sure start makes the next few minutes easier to begin.

A prepared talk tests how well you stored it. Speaking with no warning tests **something else**. You must shape what you say and recall it at the same time. The Impromptu Structure Framework gives you a fixed outline to fill on the spot.



Speaking with no warning tests something else.

> **Exercise:**
> 5.36, The Impromptu Structure Framework. Follow these five steps.

1. At work, you are often asked to speak with no warning. It might be a question in a meeting or an interview, or a toast. This framework gives you a ready outline for those moments. It is another option, next to the 3-stop palace in Exercise 5.23.
2. Learn PREP as a 4-stop Memory Palace. PREP is a widely used outline for short answers.

- Stop 1, Point: state your main view in one sentence.
- Stop 2, Reason: give the main reason it is true.
- Stop 3, Evidence: offer a real example, a number or a story.
- Stop 4, Point: state your main view again.

3. Practise PREP for 2 minutes every day. Pick a random topic. Try an object in the room, a headline word or an idea from this book. Give a 60 to 90 second answer using all four stops.
4. Keep practising daily for two weeks. Aim for the outline to come to mind by itself under pressure.
5. The framework shrinks the question you face. You stop asking "What do I say?" You only need to ask, "What is my point?" That leaves more of your attention for speaking clearly, eye contact and reading the room.

Speaking with no warning

A question in a meeting	An interview	A toast

Learn PREP as a 4-stop Memory Palace.

The question shrinks

Without the framework	With it
What do I say?	→ What is my point?

The framework shrinks the question you face.

Quick check:

1. As a rough guide, how many doorway phrases does a 30-minute talk need? Answer: 8 to 10.
2. What do the letters in PREP stand for? Answer: Point, Reason, Evidence, Point.
3. What did Mar et al. (2021) find across over 33,000 people? Answer: Stories were understood and recalled better than factual texts.

Memory for Creative Professionals

THIS BUILDS ON THE earlier section on creative memory. Writers, designers, musicians, directors and business founders face their own memory challenge. They must keep facts, and they must also keep **inspiration**.

Ideas turn up **when you do not expect them**, and links form at odd moments. The richest creative work draws on a wide web of linked ideas.

For creative people, memory training is less about keeping facts. It is about building **a large, well-linked store of ideas** in your mind. It is also about being able to reach that store.



It is about building a large, well-linked store of ideas in your mind.

The problem is **rarely a lack of ideas**. It is losing them before you can work on them. Creative people take in a great deal and use only a little. The aim is to hold on to the good ones until you can use them.

Key idea:

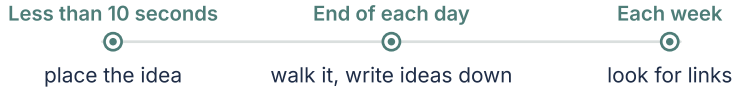
Quick capture, a palace in your head and weekly links give you more ideas you can use.

The system below joins quick capture with long-term storage in a palace. It builds on the Idea Capture System (Exercise 5.26). What is new is **the Idea Palace**. It catches ideas in your head before you write them down.

> **Exercise:**
> 5.37, The Idea Capture and Palace System. Follow these five steps.

1. Set up an Idea Capture Palace with 20 stops. Most palaces hold things in order. This one stores surprising, inspiring or useful ideas from daily life.
2. Put each idea you want to keep at the next free stop in the palace. Use the most vivid image you can make on the spot. This should take less than 10 seconds.
3. At the end of each day, spend 5 minutes walking your Idea Palace. Write the day's ideas down in a notebook, an app or a project file.
4. Each week, read through your written ideas and look for links between them. Two ideas from different days may make something new side by side. Links like these are the raw material of original work.
5. Keep up this practice as a creative habit. Trust your system to catch ideas, and you may find that more of them come.

The Idea Capture Palace



Use the most vivid image you can make on the spot.

Many great creative minds **kept notebooks of ideas**. Leonardo da Vinci filled pages with notes and drawings in mirror writing. Beethoven kept sketchbooks of musical ideas. Darwin's notebooks appear in the earlier section on creative memory.



A page from Leonardo da Vinci's notebook, with notes and drawings in mirror writing.

Your Idea Capture Palace is **a notebook in your head**. It is always with you, and it works without a phone or a pen.

Your Idea Capture Palace

The idea	What it is like
Your Idea Capture Palace	≈ A notebook in your head, always with you

Darwin's notebooks appear in the earlier section on creative memory.

Catching an idea keeps it safe, and **expanding it helps it grow**. You build a web of links, comparisons and results around it. A raw thought then becomes something you can use in your work. The next exercise builds that web for one idea at a time.

> **Exercise:**
> 5.38, The Associative Expansion Exercise. Follow these five steps.

1. Take any single word, image or idea. It can come from your work, a book, a talk or a random word.
2. Set a timer for 5 minutes. Write down every link that the word brings to mind, without judging any of them. Follow each link to the next one, and let the links branch freely.
3. When the timer goes off, look over your map of links. Circle every link that surprises you. Also circle any that joins two unlikely things.
4. Choose the most surprising link and spend 2 minutes exploring it. Ask what it would mean, how you could use it and what follows from it.
5. Practise this daily. One theory says creative thinking mixes ideas that are far apart (Mednick, 1962). This exercise trains you to look for those far links.

Associative expansion



When the timer goes off, look over your map of links.

The last exercise **sorts the sources** behind your ideas. These are the books, films, articles and talks that shaped your thinking. The Reference Library Palace stores them clearly enough to revisit and cite. It builds on the Reference Retention Protocol (Exercise 5.27).

> Exercise:
> 5.39, The Reference Library Palace. Follow these five steps.

1. Creative people gather huge stores of reference material. These can be examples, case studies, quotes, images, technical fixes and past cases. Much of it can be hard to find again when you need it.
2. Choose 10 reference examples from your field that you want to have on hand. They could be pieces of design work or good ad campaigns. They could also be first lines from novels or clever engineering fixes.
3. Build a Reference Library Palace, based on a library or gallery you know well. Give each section of it one kind of reference.
4. For each item, make a vivid scene in its section of the library. The scene should show its key quality, what makes it stand out and why.
5. Practise recalling references when you need them. Take any creative brief or problem. A creative brief is a short note that sets out a creative job. Try to recall 3 useful examples from your palace within 30 seconds.

Reference Library Palace



Build a Reference Library Palace, based on a library or gallery you know well.

Quick check:

1. How many stops does the Idea Capture Palace have? Answer: 20.
2. How long should placing an idea in the palace take? Answer: Less than 10 seconds.
3. In the Reference Library Palace test, how many examples should you recall, and how fast? Answer: 3 useful examples within 30 seconds.

Memory for Leaders and Decision-Makers

This builds on the earlier section on professional memory. Leading people puts **heavy demands on memory**. You need to recall what each person in your team does. You need their worries and what they have given.

You need **the history behind key decisions**, and the reasons for them. You need to keep big, many-part plans in mind when the pressure is on. You also need to speak from what you know, without leaning on notes. The methods here apply memory tools to these needs.

Your own memory tools help you do your own job. Leading a team calls for memory on **a bigger scale**. It covers people, projects, decisions and the history of a whole team. The Team Intelligence Palace is the first tool for this.

> **Exercise:**
> 5.40, The Team Intelligence Palace. Follow these five steps.

1. Build a Memory Palace with one stop for each person on your team. You could also use your department or your key work contacts. For a team of 10, use 10 stops in a room you know. For a bigger group, use a whole building.
2. At each person's stop, build a layered scene. Store their name with the Name-Face System from the techniques module. Add their main role and their key job. Add their latest work or project. Add one thing they care about outside work, and one open item between you.
3. Walk this palace at the start of each week. Update it after any important talk.
4. Before a review, a team meeting or a one-to-one talk, walk the stops you need. This brings your recall up to speed.
5. Use what you recall to ask good follow-up questions. In studies of chats and speed dates, people who asked more questions were liked more (Huang et al., 2017). The full version of this method for single clients is Exercise 5.25.

Size of the palace

	A team of 10	A bigger group
Use	10 stops in a room you know	A whole building

You could also use your department or your key work contacts.

Team memory holds what people know now. A record of **why decisions were made** matters too. It helps a team learn from its past, so it does not repeat it.



A team leader reads a record of past decisions and the reasons for them.

When a team forgets, **the cost grows over time**. Lost reasons pile up across people, projects and years. The Decision History Archive keeps the reasons. It works like a ship's log. It also keeps the options you weighed and what you assumed at the time.

The Decision History Archive

The idea		What it is like
A record of the reasons for decisions	≈	A ship's log

It works like a ship's log.

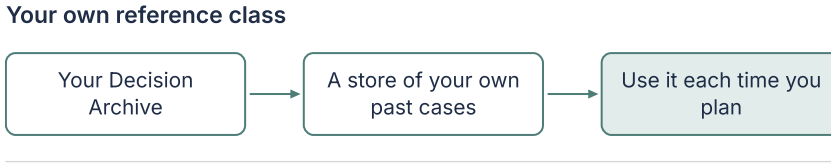
> **Exercise:**
> 5.41, The Decision History Archive. Follow these five steps.

1. Each time you make a major decision, make a short Decision Record straight away. This works at work or in life. Store it in a Memory Palace kept for key decisions.
2. For each decision, store four things. Store what was decided and why. Store which other options you turned down, and why. Store what you expected to happen at the time, and what you assumed.
3. Use vivid scenes. Show the decision as an image that holds its heart. Show the reasons as the physical cause of that image.
4. Six months later, walk your Decision Archive. Compare what really happened with what you expected. Writing your forecast down first is important. Once people know the outcome, they tend to think it was easy to predict (Fischhoff, 1975). This is called **hindsight bias**.
5. Keep up this record over time. It shows you your own patterns. It also helps you explain your reasons clearly to others.



It shows you your own patterns.

Lovallo and Kahneman wrote about why leaders' forecasts are often too hopeful (Lovallo & Kahneman, 2003). Their main fix is **the outside view**. Before you forecast, look at how similar past projects really turned out.



Use it each time you plan something new.

Those similar projects are called **a reference class**. Your Decision Archive gives you a ready store of your own past cases. Use it each time you plan something new.

Team and decision memory serve the near term. Big-picture plans look much further ahead. They work over years. These plans depend on **how you frame a decision**, more than on its details. The Strategic Framework Palace lets you call up planning models from memory, with no notes.

> **Exercise:**
> 5.42, The Strategic Framework Palace. Follow these four steps.

1. Pick 5 planning models or thinking tools that matter most in your field. Examples include Porter's Five Forces, SWOT and the Eisenhower Matrix. SWOT stands for strengths, weaknesses, opportunities and threats. First principles thinking is another example. Others are the OODA Loop, the BCG Matrix, systems thinking and scenario planning.
2. Build a Frameworks Palace with one stop for each model. At each stop, store the model's name and its core logic in one sentence. Add what it is mainly used for. Then add one vivid real example of it working well.

3. Practise using each model on a current problem or decision. Recall the model from memory, with no sheet.

4. Think of two sailors. One checks the map at every turn. The other knows the waters by heart. Under pressure, you are most likely to use the models you carry in memory.

Two sailors



The other knows the waters by heart.

Key idea:

With a team palace, decision records and planning models in memory, you recall people, reasons and plans when it counts.

Learning and memory are **closely tied together**. Work on one, and it often helps the other. The main ideas from this module are below.

Quick check:

1. What is hindsight bias? Answer: Once people know the outcome, they tend to think it was easy to predict (Fischhoff, 1975).
2. What is the outside view? Answer: Before you forecast, look at how similar past projects really turned out (Lovallo & Kahneman, 2003).
3. When do you walk your Decision Archive to compare? Answer: Six months later.

Module 5 Key Takeaways

> **Key Concept:**
>
> Module 5 Key Takeaways
>
> A major review rated ten study methods (Dunlosky et al., 2013). Only spaced practice and testing yourself were rated highly useful. Use them for anything you want to keep for the long term.
>
> Elaborative encoding means understanding deeply, linking widely and explaining clearly. It helps you build memories that last.
>
> Different fields need different memory skills. The same core techniques power all of them.

Use the checklist below to **track your work** through Module 5.

Exercise: Module 5 Completion Checklist. Applied Memory: Learning, Language, Professional and Creative Contexts	
Core Ideas to Remember	
[ ]	Spaced practice and testing yourself were rated the two most useful study methods. Use them for anything you want to keep
[ ]	Elaborative encoding (understanding deeply, linking widely) builds memories that last
[ ]	Trying to answer before you study helps you learn the right answer later
[ ]	Mixing topics can beat studying one at a time when you need to tell similar things apart
[ ]	The Keyword Method and Memory Palace can work together for language learning, with spaced review

[ ]	Presentation memory can be learned: Memory Palace plus the five-layer speech plan
[ ]	Work memory (meetings, clients, names) helps you follow up and show you listened
[ ]	Creative people can catch more ideas and keep their sources within reach
Exercises to Do First	
[ ]	Exercise 5.1, Spaced Repetition Schedule (apply it to what you are studying now)
[ ]	Exercise 5.8, The Connection Web (map the links in one subject you are studying)
[ ]	Exercise 5.14, The Academic Study Blueprint (build your exam study plan)
All Exercises: Work Through the Full Set	
[ ]	Ex 5.1, Spaced Repetition Schedule
[ ]	Ex 5.2, The Interleaved Subject Review
[ ]	Ex 5.3, The Pre-Test Protocol
[ ]	Ex 5.4, The Retrieval Practice Marathon
[ ]	Ex 5.5, The Exam Preparation Accelerator
[ ]	Ex 5.6, The Interleaved Subject Mixer
[ ]	Ex 5.7, The Teaching Protocol, Learn by Teaching
[ ]	Ex 5.8, The Connection Web
[ ]	Ex 5.9, The Analogy Builder
[ ]	Ex 5.10, The Five Whys Encoding Drill
[ ]	Ex 5.11, The Concept Map Sprint
[ ]	Ex 5.12, The Concept Map Hierarchy
[ ]	Ex 5.13, The Question-First Study Session
[ ]	Ex 5.14, The Academic Study Blueprint
[ ]	Ex 5.15, The Language Learning Immersion System
[ ]	Ex 5.16, The Presentation Palace

[ ]	Ex 5.17, The Client Intelligence System
[ ]	Ex 5.18, The Pre-Exam Memory Architecture
[ ]	Ex 5.19, The Active Recall Loop
[ ]	Ex 5.20, The 30-Word Language Sprint
[ ]	Ex 5.21, The Grammar Scaffold
[ ]	Ex 5.22, The 5-Minute Talk from Memory
[ ]	Ex 5.23, The Impromptu Speech Palace
[ ]	Ex 5.24, The Meeting Memory System
[ ]	Ex 5.25, The Client Memory File
[ ]	Ex 5.26, The Idea Capture System
[ ]	Ex 5.27, The Reference Retention Protocol
[ ]	Ex 5.28, The Relationship Memory Practice
[ ]	Ex 5.29, The Conversation Detail Challenge
[ ]	Ex 5.30, The Body Palace
[ ]	Ex 5.31, The Procedure Chain
[ ]	Ex 5.32, Keyword Method in Practice
[ ]	Ex 5.33, Grammar Palace
[ ]	Ex 5.34, The 30-Day Vocabulary Sprint
[ ]	Ex 5.35, The 5-Minute Memory Talk
[ ]	Ex 5.36, The Impromptu Structure Framework
[ ]	Ex 5.37, The Idea Capture and Palace System
[ ]	Ex 5.38, The Associative Expansion Exercise
[ ]	Ex 5.39, The Reference Library Palace
[ ]	Ex 5.40, The Team Intelligence Palace
[ ]	Ex 5.41, The Decision History Archive
[ ]	Ex 5.42, The Strategic Framework Palace
Daily Practice Habits	

[ ]	Review your spaced repetition cards every morning (10 minutes at least)
[ ]	Use the Pre-Test Protocol before you read a new chapter or document
[ ]	After each meeting or important talk, do a 2-minute palace recall
[ ]	Catch one idea in your Idea Capture System every day
Actions to Take This Week	
[ ]	Set up Anki, or a similar app, with your most important study material
[ ]	Give a 5-minute talk from memory this week, using the palace method
[ ]	Make Client Memory Files for your 5 most important work relationships
[ ]	Build a Connection Web for the subject you find hardest
[ ]	Teach someone one memory technique this week, using the Teaching Protocol

The next module asks how a trained memory can help your **other thinking skills**. The working memory research below lays the groundwork.

Working memory is the small mental space where you hold and use facts right now. One study tested children at age 5 and again **six years later** (Alloway & Alloway, 2010).

Children tested twice



Working memory is the small mental space where you hold and use facts right now.

Working memory at age 5 predicted reading and maths at about age 11. It did so **better than IQ**, a score from a standard reasoning test.

Can working memory be trained? Training does improve the tasks people practise. But a large review found that the gains **do not spread to other skills** (Melby-Lervåg et al., 2016). Reasoning and school results did not improve.

> **Science Says:**
>
> Alan Baddeley and Graham Hitch described working memory in **three parts** (Baddeley & Hitch, 1974). Think of a small office with a voice recorder, a sketch pad and a boss who decides what to work on. The phonological loop holds sounds and words, and the visuospatial sketchpad holds pictures and places. The central executive directs attention and runs the other two.

In 2000, Baddeley added a fourth part, **the episodic buffer** (Baddeley, 2000, *Trends in Cognitive Sciences*). It links information from the other parts and from long-term memory into single scenes. Baddeley looked back on the whole model in a later review (Baddeley, 2003).

Experts seem to break the usual limit in their own field. Ericsson and Kintsch called this **long-term working memory** (Ericsson & Kintsch, 1995).

Experts store their field's knowledge very well. They can pull up large chunks of it quickly. They then use those chunks like **an extra working space**. The paper's examples include reading, mental arithmetic, medical diagnosis and chess.

A heart doctor reading a heart trace sees **one familiar pattern**, not 12 wave lines. Memory Palace training also builds well-stored structures. The next module looks at how far that can go.



Memory Palace training also builds well-stored structures.

Module 6: Memory as an Amplifier

I TREAT MEMORY AS **the base for your other thinking skills**. It works like the roots of a tree, which feed every branch. That is my own view.



It works like the roots of a tree, which feed every branch.

Without memory, attention has **nothing to focus on**. Without memory, creativity has no stored ideas to mix in new ways.

Without memory, your reasoning has **no stored patterns** to work from. Without memory, what you take in from the world has nowhere to go.

Module 6 Overview

This module looks at my model of **four thinking pillars**, four thinking systems that hold each other up. They are Extractivity, Memory, Intellect and Creativity. Extractivity means how well you take in information and keep it.

David's uming model groups memory and attention together as **the extractive group**. Here, that group is split in two, as Extractivity and Memory. The Attention book covers the attention half.

The module shows how memory can **feed each of the other three pillars**. Its exercises work on the links between the pillars. They do not train each one alone.

> Science Says:
>
> **Some links have been tested**, such as working memory (short-term memory that also works on what it holds) and reasoning. What you already know helps you grasp and recall new things. Creative thinking and intelligence share some of the same mental control skills.

Other parts are my own model and **have not been tested**. Training working memory does not improve other skills in a dependable way (Melby-Lervåg et al., 2016).

This module has **six goals**. You will work toward all of them.

Key idea:

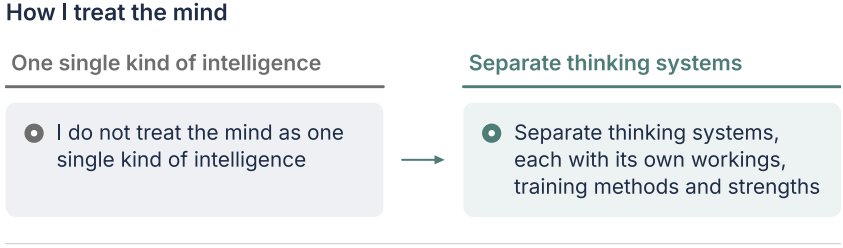
Memory, together with each of the other three pillars, makes for stronger thinking, in my model. Only some of these links have been tested.

- Understand the four-pillar model and the role it gives to memory
- Learn which studies link memory to taking things in, to creativity and to reasoning

- Practise linking exercises that let your memory feed your creative work
- Build intake habits that store what you take in deeply, so it does not fade
- Build ways of reasoning that draw on a rich, well-sorted long-term memory
- Combine all four pillars in one daily practice

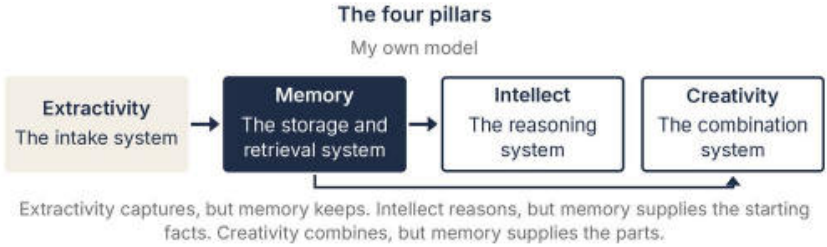
The Four Pillars of Cognitive Excellence

I DO NOT TREAT THE mind as one single kind of intelligence. I treat it as a set of **separate thinking systems**. They depend closely on each other. Each has its own workings, its own training methods and its own strengths.



Knowing these systems is important. Knowing **how they work together** matters even more. That is the base of any serious plan to train your mind.

This is my own model, the four pillars. In my uming model, memory and attention form one extractive group. Here, the intake side and the memory side get **a pillar each**.

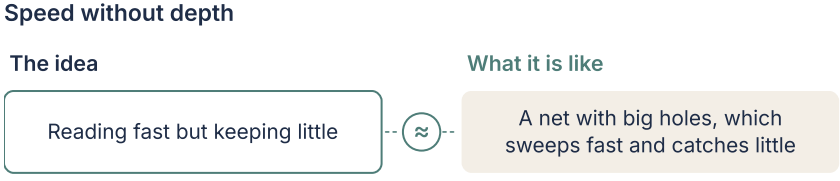


Pillar 1: Extractivity, the Intake System

Extractivity is your skill at taking in information from the world. It covers **speed, depth and accuracy**, in fast reading, careful listening and close watching. It also includes spotting patterns in detailed data. And it means picking out what is important.

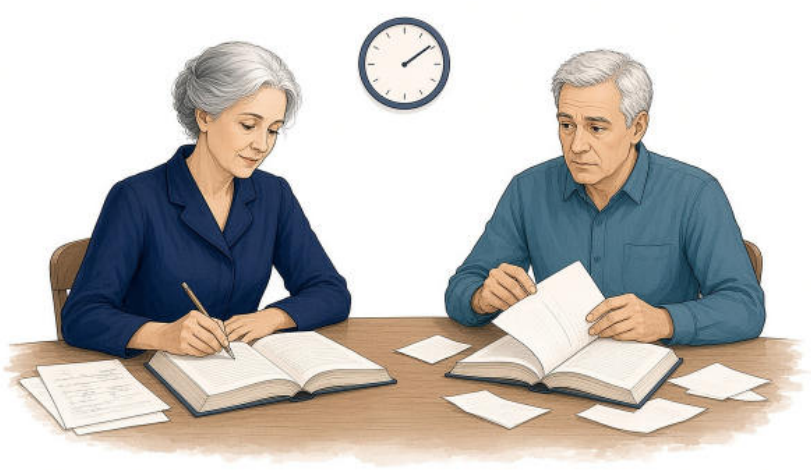
At its heart, extractivity answers **one question**. How quickly and accurately can you move information from the world into your mind?

Extractivity is **not the same as speed**. Someone who reads fast but keeps little has speed without depth. It is like a net with big holes, which sweeps fast and catches little. The best extractivity is both fast and deep. You get through a lot of material and come out with its main structure clear.



The best extractivity is both fast and deep.

Think of two readers who **each spend 40 minutes** on a hard text. One can still describe how it fits together a week later. The other keeps only scraps.



Two readers each spend 40 minutes on the same hard text.

Extractivity and memory work **in both directions**. Extractivity feeds memory, because you can only remember what you took in. Memory also helps extractivity. What you already know helps you understand and recall new material on the same topic (Recht & Leslie, 1988).

Pillar 2: Memory, the Storage and Retrieval System

Memory is your skill at **storing, keeping and recalling** information. It turns passing experience into lasting knowledge.

Here, memory is **the central pillar** that the other three work through. Extractivity captures, but memory keeps. Intellect reasons, but memory supplies the starting facts. Creativity combines, but memory supplies the parts.

The central pillar

	Does	Memory
Extractivity	Captures	Keeps
Intellect	Reasons	Supplies the starting facts
Creativity	Combines	Supplies the parts

Here, memory is the central pillar that the other three work through.

Key idea:

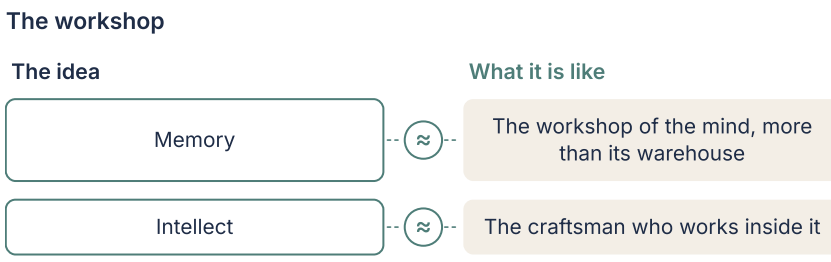
Extractivity captures, memory keeps, intellect reasons and creativity combines. These are four pillars that all work through memory.

Memory's full role is easy to miss. People usually judge it by **one narrow test**, which is recalling single facts. But memory does more.

Working memory lets you hold several things in mind while you work on them. It is **closely linked with reasoning**. In four studies of military recruits, working memory and reasoning scores were very strongly related (Kyllonen & Christal, 1990).

A review of 14 data sets also found a strong link (Kane et al., 2005). A larger study of studies found **a more moderate link** (Ackerman et al., 2005). These are links, and they do not prove that one causes the other.

Long-term memory is the depth and richness of what you have stored. It helps you reason about familiar topics. In this model, memory is **the workshop of the mind**, more than its warehouse.



It helps you reason about familiar topics.

If memory is the workshop, intellect is **the craftsman** who works inside it. The quality of that work depends on what the workshop holds.

Pillar 3: Intellect, the Reasoning System

Intellect is your skill at reasoning. You **draw sound conclusions** from what you know. You build models of how systems with many parts work. You weigh arguments, spot flaws in logic and compare competing ideas.

It is the skill of moving from what you know to what follows from it. At its best, intellect gives **real insight**. You see a true link that others missed, even though they had the same facts.

IQ tests, which give a score of how smart you are, measure word and general knowledge as well as speed. Researchers have long split intelligence into **two kinds** (Cattell, 1963). Fluid intelligence is reasoning with new material. Crystallized intelligence is the knowledge and skills you have stored.

Intellect, in the full sense used here, **needs memory**. You cannot reason well from facts you have not stored correctly. You cannot spot a pattern you have not seen often enough to know its shape.

You cannot build a model of a system you have not studied deeply. Take someone with **strong reasoning but thin knowledge**. They can reason well from facts given to them. But they cannot supply those facts themselves.



Take someone with strong reasoning but thin knowledge.

Intellect uses stored knowledge to reason forward. Creativity does something different. It searches stored knowledge for **links that are not obvious**. Those links give new ideas.

Pillar 4: Creativity, the Combination System

Creativity is your skill at making **new, useful and surprising mixes** of what you know. You see links that others miss, and carry a pattern from one field to another.

You blur the lines between groups of things. What you make is both **unexpected and useful**.

Many people picture creativity as a magic gift of sudden ideas. I see it as working with what you have stored. That means **the raw material of creativity** is memory. You cannot combine what you have not stored.

You cannot carry a pattern from physics to economics with **thin, patchy physics**. Nor can you spot a surprising link between two fields you know only vaguely.

Howard Gruber studied the mind. He looked at how Darwin's ideas grew (Gruber, 1974). He found that creative work **builds slowly**,

through a long-running web of projects. I read that as a sign of a rich, well-linked memory.

With all four pillars defined, **the next parts** trace how memory can feed each one. I start with the pillar most shaped by what you already know, extractivity.

Four systems

Extractivity: intake	**Memory:** storage and retrieval	**Intellect:** reasoning	**Creativity:** combination

With all four pillars defined, the next parts trace how memory can feed each one.

Quick check:

1. In four studies of military recruits, how were working memory and reasoning related? Answer: Very strongly (Kyllonen & Christal, 1990). These are links, and they do not prove that one causes the other.
2. What is fluid intelligence? Answer: Reasoning with new material.
3. What did Howard Gruber find about how Darwin's ideas grew? Answer: Creative work builds slowly, through a long-running web of projects (Gruber, 1974).

Memory as the Engine of Extractivity

A FINDING ABOUT READING SURPRISES many people. What you already know **strongly affects** how well you take in new facts. It counts along with your eyes, your attention and your speed.

The key is **how much related knowledge** you have stored. Know more about a topic, and you get more from new material on it.

Researchers call these **stores of related knowledge** schemas. They work like a filing cabinet with labelled drawers. A schema is an organised set of what you know about a topic.

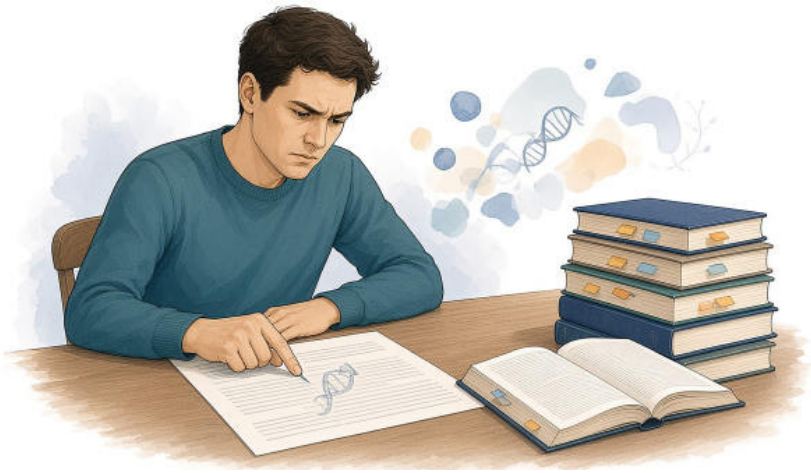
Schemas



They work like a filing cabinet with labelled drawers.

In a field you know well, **you spot patterns at once**. New facts slot into groups you already have, without much effort. That frees your mind for the parts that are truly new.

Picture a beginner reading a paper on molecular biology. They must **decode every term** and hold every idea in mind. An expert reads the same paper with much of its structure already in place. Their stored knowledge does the work that the beginner's working memory does with effort.



A beginner reads a paper on molecular biology, stopping at every term.

> **Science Says:**
>
> One study tested 64 young teenagers on a passage about baseball (Recht & Leslie, 1988). Some were good readers and some were poor readers. Some knew a lot about baseball and some knew little.

Reading skill was **not the whole story**.



Young teenagers read a passage about baseball.

Those who knew baseball understood and recalled the passage better **on every measure**. This held for good and poor readers alike. Stored knowledge of the topic made a big difference to understanding. Prior knowledge, what you already knew before you started, also shapes how you understand and recall what you read (Bransford & Johnson, 1972).

In one test, students read a passage that was hard to follow. Some saw a picture of the scene first. They recalled **8 of 14 ideas**, against fewer than 4 for those with no picture. Seeing the picture afterwards did not help.

A picture of the scene

	Picture first	No picture	Picture afterwards
Ideas recalled, of 14	8	Fewer than 4	Did not help

Some saw a picture of the scene first.

In another study, students read passages that **could mean two things** (Anderson et al., 1977). One story could be about a prison break or a wrestling match. Students read each story in line with their own background. Most did not notice the other meaning.

Chunking is grouping several items into one unit. Working memory holds **only a few chunks** at a time. Miller put it at about seven (Miller, 1956), and a later review put it at about four (Cowan, 2001). What counts as a chunk depends on what you have stored.



Experts chunk in **bigger units** than beginners do. In one chess study, a master looked at a real game position for 5 seconds (Chase & Simon, 1973). He recalled it far better than weaker players.

With random positions, **his advantage disappeared**. The master's edge came from stored chess knowledge. It did not come from a bigger memory. That knowledge is built by study and practice in the field itself.

Key idea:

With more stored knowledge of a topic, you take in and keep more of new material on it.

In my model, memory feeds extractivity in **five ways**. The table sets them out.

What memory brings	How it helps you take in more
Rich stores of field knowledge (domain schemas)	New facts in a familiar field slot into place with less strain on working memory. This helps you understand and recall them.
Filling gaps by working things out (inferential gap-filling)	What you already know lets you work out what a text leaves unsaid. You can settle unclear points and build a full picture from part of one.
Big chunks (high-level chunking)	Deep knowledge lets you take in bigger units. You move from words to sentences, from sentences to arguments and from arguments to patterns.
Knowing where to look (selective attention guidance)	Knowing what matters in a field helps you sort quickly. You can focus on what is new or surprising. You do not need to give everything equal weight.
Guessing what comes next (predictive processing)	Knowledge helps you predict what comes next. Readers skip predictable words more often and look at them for less time (Rayner et al., 2011). You can slow down where the text surprises you.

As your knowledge grows, you can **notice each of these** in your own reading. Selective attention also links to the Attention book. In the uming model, attention and memory together form the extractive group.

The exercises that follow train each of these ways. They start with **calling up what you know** before every learning session.

Quick check:

1. In the baseball study, who understood and recalled the passage better? Answer: Those who knew baseball, good and poor readers alike (Recht & Leslie, 1988).
2. How many chunks can working memory hold? Answer: Miller put it at about seven (Miller, 1956), and a later review put it at about four (Cowan, 2001).
3. What happened to the chess master's advantage with random positions? Answer: It disappeared.

Extractivity Exercises: Building the Memory-Intake Connection

THESE THREE EXERCISES **link what you take in to what you keep**. The first trains you to read with what you know already in mind. The second checks how deep your reading went. The third does the same for listening.

> Exercise:
> 6.1, The Schema-First Reading Protocol. Follow these six steps.

You do this alone. Each session takes **30 to 45 minutes**. Use it for any new book, paper or long document. It is close to the Question-First Study Session (Exercise 5.13).

1. Before you open the text, spend 3 minutes recalling what you know about the topic. Write down everything you know, every related idea and every question you have. This is your schema pre-load. It gets your stored knowledge ready to sort new facts as you read.
2. Skim the text first. Look at the contents, headings and diagrams. Read the first and last sentences of key sections. Your goal is not to understand it yet. Your goal is to see its structure and where the new parts fit.
3. Read actively. Treat the text as a conversation with what you already know. Mark three kinds of content in different ways. Put a tick by what you already knew. Put a plus by what adds to it. Put an X by what goes against it. Give the most attention to the pluses and the Xs.
4. After each main section, stop and write a one-paragraph summary from memory, without looking back. If you cannot write it, the

section did not reach your memory. Read it again and try once more.

5. When you finish the text, rebuild its whole argument from memory, using only your marks. The parts you cannot rebuild did not turn into lasting memory. Those are the parts to study again.

6. One week later, recall the text's argument from memory, without your notes. Check how much you kept. Over 10 sessions, track whether your scores rise as your pre-load gets richer.

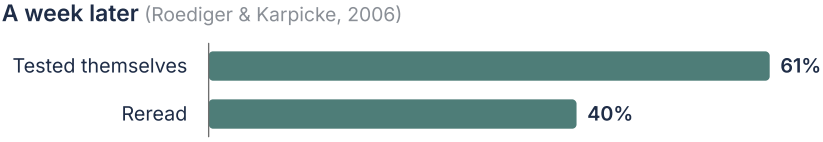
The pre-load step is **a core part of the exercise**. In one study, some students saw a picture of the scene before an unclear passage (Bransford & Johnson, 1972). They understood and recalled it far better. Seeing the same picture afterwards did not help.



Students look at a picture of a scene before reading an unclear passage.

Steps 4 to 6 are **retrieval practice**, which means recalling from memory. A week after reading a passage, students who tested themselves

recalled 61%. Those who reread it recalled 40% (Roediger & Karpicke, 2006).



A week after reading a passage, students who tested themselves recalled 61%.

Key idea:

Recall what you know first and rebuild from memory afterwards, and your reading stays with you.

> Exercise:
>
> 6.2, The Chunking Elevation Drill. Follow these seven steps.

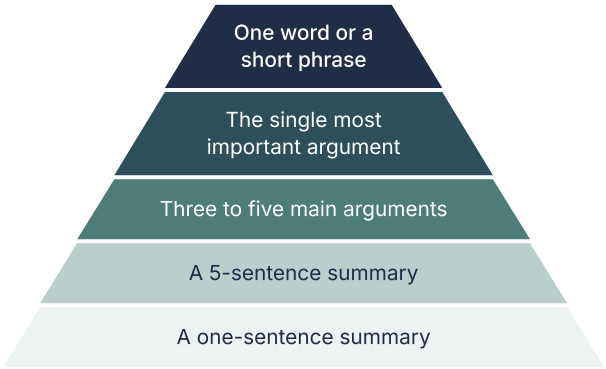
You do this alone. It takes **20 minutes**. You need a text you have read recently.

1. Take a text you read in the past week. From memory, write a one-sentence summary of the whole text.
2. Now write a 5-sentence summary of the whole text, from memory.
3. Now rebuild the text's three to five main arguments, each in one sentence.
4. Now pick the single most important argument. It is the one that all the others follow from or depend on. State it in one sentence.
5. Finally, write one word or a short phrase that sums up what the text adds. This is the highest-level chunk.

6. Compare your rebuild at each level with the actual text. Where does your memory hold the structure well? Where does it fall apart, flatten or twist? Those weak points show where your reading stayed on the surface.

7. Repeat this drill every week for 6 weeks, on different texts. Track which levels get better fastest. That shows your current limit and the level to work on next.

From one word up



Finally, write one word or a short phrase that sums up what the text adds.

Single facts are often easier to recall than **the shape of an argument**. This drill trains the second skill. It is like zooming out on a map, from single streets to the whole city. It helps you take in whole ideas, beyond single sentences.

Zooming out



This drill trains the second skill.

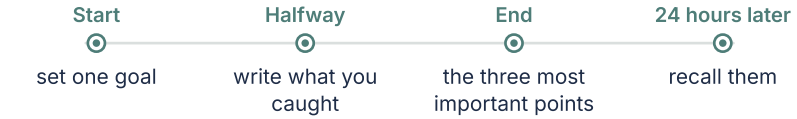
Reading lets you go back and look again. Spoken information is harder. It **passes once** and cannot be replayed, so talks and meetings often leave little behind. The last exercise trains listening.

> Exercise:
> 6.3, The Active Listening Memory Build. Follow these five steps.

You can do this **alone or in a group**. It takes 20 minutes. Use it for lectures, podcasts and conversations.

1. At the start of a talk, podcast or meeting, set one goal. Plan to find the three most important things said in the next 20 minutes. Write three empty slots in your notebook before you start.
2. Listen actively. Keep asking yourself whether what you hear is one of the three. You are not trying to store everything. You are trying to catch the points that matter most.
3. Halfway through, pause if you can. Write down what you have caught so far. Do not replay anything, and rebuild it from memory instead. The effort of rebuilding helps you store it.
4. At the end, write the three most important points from the whole session. Do not look at your notes. Compare your halfway list with your final list. Did your choices change as you learned more? That change shows how well you update what matters as the talk goes on.
5. 24 hours later, write what you remember of the three main points. Use nothing to help you. Score yourself. Over 20 sessions, compare these scores with sessions where you listened with no goal.

One talk



Did your choices change as you learned more?

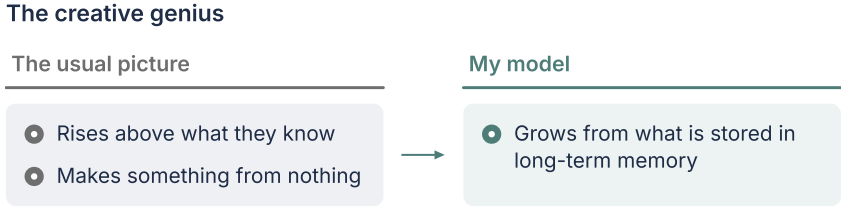
The goal you bring **shapes what you take away**. In one study, students read the same story in line with their own background (Anderson et al., 1977). A goal helps you keep the points that fit it. It can also mean you miss the rest.

Quick check:

1. How long is the schema pre-load at the start of Exercise 6.1? Answer: 3 minutes.
2. What do the tick, the plus and the X mark? Answer: What you already knew, what adds to it and what goes against it.
3. When do you recall the three main points of a talk again? Answer: 24 hours later, with nothing to help you.

Memory as the Raw Material of Creativity

MANY PEOPLE PICTURE THE creative genius as someone who **rises above what they know**. In this picture, they make something from nothing, through pure inspiration. I argue against that picture.



In this picture, they make something from nothing, through pure inspiration.

In my model, creative work **grows from what is stored** in long-term memory. It depends on how rich, well organised and widely linked that memory is. Inspiration is the feeling of memory making a link you had not yet noticed.

The brain's default network is active when you remember, imagine and let your mind wander. In creative tasks, it tends to **work with the networks** that direct your thinking.

In my model, this search draws on all you have stored. That includes ideas, images and stories. Its results feel as if they come from nowhere, yet come from **a hidden search**. It is like fishing, where you can only catch what is in the lake. Improve what your mind has to search, and you improve what it finds.

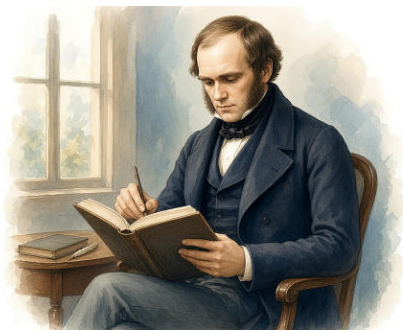
> **Science Says:**
>
> Howard Gruber made a close study of how Darwin's theory grew (Gruber, 1974). It came from years of work. It did not come in a sudden flash.

Darwin later wrote that he read Malthus on population in 1838 "**for amusement**". He said that at last he "had got a theory by which to work".

Darwin's theory



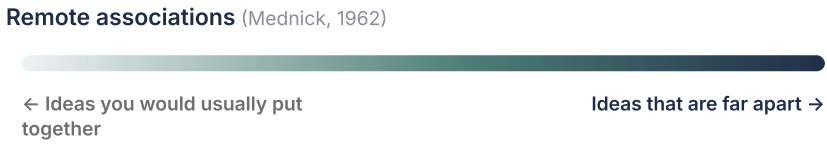
Darwin later wrote that he read Malthus on population in 1838 "for amusement".



Charles Darwin reads Malthus on population in 1838.

Historians see the idea as building up slowly. It did not arrive all at once. Darwin had studied natural history, rocks and animal breeding **for years before it**.

Sarnoff Mednick put forward a theory of creative thinking (Mednick, 1962). He said it means forming links between ideas that are **far apart**. He called these remote associations, and he made a test to measure them. Ideas that are far apart are ones you would not usually put together.



He called these remote associations, and he made a test to measure them.

Creativity and intelligence are also linked. One study found they **share a mental skill** called updating (Benedek et al., 2014). Updating means refreshing what you hold in working memory.

Updating predicted **both reasoning and divergent thinking** scores. Divergent thinking means coming up with many different ideas. People better at updating tended to score higher on both tests.

Taking a break from a hard problem can help you solve it. A large review found **a positive effect** of such breaks (Sio & Ormerod, 2009). The effect was bigger when people had worked on the problem longer first. During the break, light activity often beat pure rest.

Sleep can also help. In one study, people practised a task that had **a hidden shortcut** (Wagner et al., 2004). Some then slept, and others stayed awake.

More than twice as many sleepers found the shortcut. Sleep did not help people who had not practised first. The practice came first, and the sleep helped it along.

Sleep (Wagner et al., 2004)



Sleep did not help people who had not practised first.

Darwin's notebooks show the same idea in one life. In my model, **what you store shapes** your creative work. How you organise it matters as well.

Steve Jobs gave his view in a 1996 interview with Wired. "Creativity is **just connecting things**," he said. Creative people, he said, often feel a little guilty when asked how they did something. They just saw something, and after a while it seemed obvious.

He **put that down to experience**. They could connect experiences they had had and make new things from them. He added that they had either had more experiences or thought more about them.

You need **things to connect** before you can connect them. The table shows my model of how memory feeds creative work.

What memory brings	How it feeds creative work
Deep knowledge of one field	The deeper you know a field, the more parts you have to combine. You can also judge better whether an idea is truly new or just unfamiliar.
Knowledge across many fields	The most surprising ideas often link two fields that share a hidden likeness. To see that link, you need knowledge of both fields.
Vivid, concrete storing	Memories stored as vivid pictures, as in Memory Palace training (walking through places in your head, each one holding something to remember), may give you more to combine. This is my view, not a tested finding.
Stories stored in memory	Memory stored as stories gives you shapes to reuse, such as cause and effect, characters and conflicts. These shapes can give form to new ideas.
Remembered solutions (analogies)	How a problem was solved in one field can show how to solve one in another. For that, you need to remember how the solution worked. What it looked like is not enough.

These links show up in every creative session. The exercises that follow are **memory exercises at heart**. They aim to make what you have stored easier to search and combine.

Key idea:

Richer, better-linked memory gives creative thinking more to search and combine, in my model.

Quick check:

1. What did Gruber's study find about Darwin's theory (Gruber, 1974)? Answer: It came from years of work. It did not come in a sudden flash.
2. When did a break from a hard problem help more? Answer: When people had worked on the problem longer first (Sio & Ormerod, 2009).
3. Who did sleep help find the hidden shortcut? Answer: Only people who had practised the task first (Wagner et al., 2004).

Creativity Exercises: Building the Memory-Creativity Connection

These three exercises are my own. The first makes **two fields of your stored knowledge collide**. The second uses your Memory Palace to search for ideas on a real problem. The third borrows a solution from one field and tries it in another.

All three look for **shared structure**, not surface likeness. Structure is how something works. It is not what the thing is about.



The third borrows a solution from one field and tries it in another.

> **Exercise:**
> 6.4, The Cross-Domain Collision. Follow these six steps.

You do this alone. **It takes 15 minutes**. It works best at the start of a creative work session.



A person starts a creative work session with a journal open.

1. Open your Memory Journal, your notebook of what you stored in past sessions, with an entry for each session, at two random pages from different fields. For example, pick one session where you stored a historical event. Pick another where you stored a science idea.

2. Set a 5-minute timer. Write down every way the two entries are alike in structure. They are about different topics, so ignore the topic. Do they share a similar pattern of cause and effect? Do they share a pull between two forces, or a way of being resolved? Do they share a similar network of parts?

3. For each shared structure, make a new idea in the field you work in now. Use the same structure. The structure from one field is your template, and your current field supplies the content.

4. Rate each new idea for surprise and for use. Surprise asks how unexpected the link is. Use asks how helpful or interesting the idea is. The best ideas score high on both.

5. Over 10 sessions, track which kinds of collision give you your highest-scoring ideas. This shows your own collision profile. It tells you which pairs of fields work best for you.

6. Advanced version: on purpose, store new knowledge in fields far from your own. That widens the ground you can draw on for collisions.

Rate each new idea

	Surprise	Use
Asks	How unexpected the link is	How helpful or interesting the idea is

The structure from one field is your template, and your current field supplies the content.

This exercise uses your Memory Journal, and there is a reason. In my view, a collision is **only as good as the memories behind it**. Two shallow impressions give shallow mixes. It is like mixing two paints, where weak colours give a weak new colour. Two deeply stored structures can give deep insights.

Shallow mixes

The idea		What it is like
Two shallow impressions	≈	Two weak colours, which give a weak new colour

It is like mixing two paints, where weak colours give a weak new colour.

In my view, memory training is **part of creative practice itself**. The Cross-Domain Collision is the place to start. Then build on it with the next two exercises.

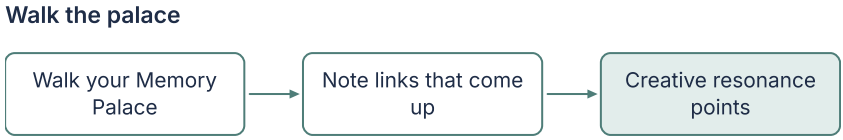
Key idea:

Deeply stored knowledge from different fields and a search for shared structure give you new ideas you can use.

> Exercise:
>
> 6.5, The Memory Palace Story Engine. Follow these six steps.

You do this alone. **It takes 20 minutes**. It works best for creative writing, design or problem-solving.

1. Choose a creative problem you are working on now. It could be a story, a product design, a message or a plan.
2. Walk the Memory Palace you use most. At each stop, ask how its image links to your problem. Do not force a link. Simply note whether one comes up by itself, and what it suggests.
3. The stops that give you links are your creative resonance points. Write down every link they suggest, however thin or silly.
4. Now pick the three most surprising links. These are the ones furthest from the obvious ways into the problem. For each, write one paragraph on how the problem looks from that angle.
5. Weigh up the three angles. Which one shows a side of the problem that your usual approach misses? That is your creative way in. Memory found it, not deliberate reasoning.
6. Come back to this exercise after 48 hours, with sleep in between. In one study, people worked on a task with a hidden shortcut (Wagner et al., 2004). More than twice as many of those who slept found it. Sleep helped only those who had worked on the task first.



The stops that give you links are your creative resonance points.

Here you walk a palace to search for ideas, not to recall facts. This is **an advanced use of the palace**. In my view, its vivid images in fixed places give you rich material.

Story links work through pictures and places. The Analogical Transfer Drill is a **more formal version** of the same process. It is like trying a key that opens one lock on a different door. You take the core logic of a clever solution into a new field.

> **Exercise:**
> 6.6, The Analogical Transfer Drill. Follow these seven steps.

You do this alone. **It takes 30 minutes**. It works best with a real problem you need to solve.

1. Write your current problem or creative challenge at the top of a page.
2. In your Memory Journal, find 5 problems solved in a way you find elegant. They can come from any field. Try science, history, nature, maths, business, art or your own life. Write one sentence on each solution and why it is elegant.
3. For each solution, pull out its structural logic. Focus on how it solved the problem, not what it solved. What was the core mechanism, and what was the principle behind it? State it in the most general terms you can, with no field-specific words.

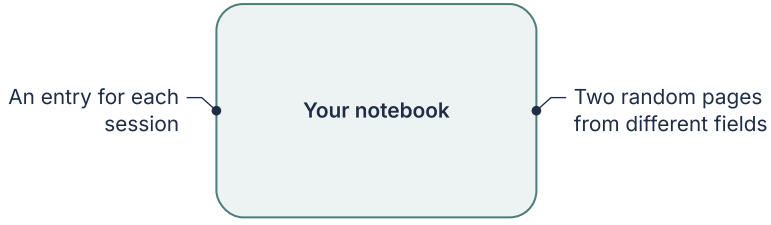
4. Now apply each general logic to your current problem. Say the core mechanism is X, and your problem has a similar structure. Ask what a solution might look like in your field.

5. You are not looking for a figure of speech. You are looking for a real transfer of structure. Your solution might share its structure with one from a very different field.

6. Rate each transfer for how specific it is. A vague one, like "evolution, but for business", scores 1. A concrete one you can act on scores 5. Take competitive exclusion in ecology, where one species wins a shared, limited resource. You might find the one limited resource in your market. Then focus everything on winning it.

7. Repeat this drill over many sessions. An analogy is seeing that two things from different fields work in the same way. People often fail to use an analogy from a single example. Comparing two similar examples helps them find the shared principle (Gick & Holyoak, 1983). Then they can use it on a new problem. So, for each transfer, try to find two elegant solutions that share it.

Your Memory Journal



It is not what the thing is about.

In my view, analogy is **a skill you can practise**. You cannot draw an analogy to a field you have never stored. Each new field you learn deeply gives you new structures to borrow.

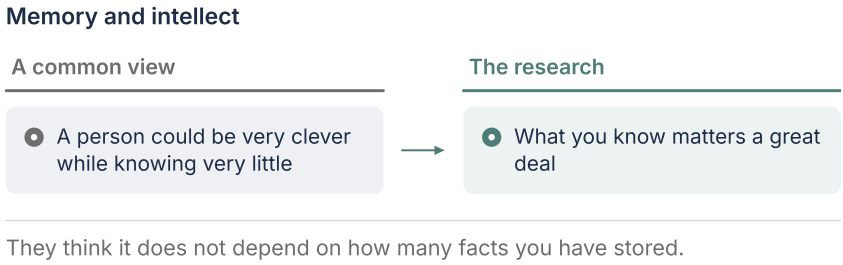
Creative analogy searches for shared structure. Reasoning works on the same structures, but **with a different goal**. It aims for accuracy. Novelty is not its goal. The next part looks at how memory links to reasoning.

Quick check:

1. How long is the timer in step 2 of the Cross-Domain Collision? Answer: 5 minutes.
2. When do you come back to the Memory Palace Story Engine? Answer: After 48 hours, with sleep in between.
3. What helps people find the shared principle behind an analogy? Answer: Comparing two similar examples (Gick & Holyoak, 1983).

Memory as the Foundation of Intellect

People often get the link between memory and intellect wrong. Many **treat intellect as a skill** that works on facts. They think it does not depend on how many facts you have stored. On this view, a person could be very clever while knowing very little.



The research gives a different picture. What you know **matters a great deal** to how well you reason.

Working memory gives reasoning **a place to work**. Long-term memory gives it the content. Strong reasoning on thin or wrong knowledge gives thin or wrong conclusions. That holds however sound each step of the reasoning is.

What reasoning gets

	Working memory	Long-term memory
Gives reasoning	A place to work	The content

Strong reasoning on thin or wrong knowledge gives thin or wrong conclusions.

> **Science Says:**
> Reasoning and working memory are closely tied. In four studies of military recruits, the two were **very closely related** (Kyllonen & Christal, 1990). Reasoning was also fairly closely related to general knowledge.

A review of 14 data sets also found a strong link with reasoning (Kane et al., 2005). A larger study of studies found a **more moderate one** (Ackerman et al., 2005).

Working memory is also closely tied to the control of attention (Engle, 2002). Focus and working memory **go hand in hand**. The Attention book covers that side.

Familiar content can help you reason. In one classic logic task, people had to check a rule (Griggs & Cox, 1982). It is known as Wason's selection task.



A person works out how to check a rule in a classic logic task.

The group did much better when the rule came **from their own experience**. It was a drinking-age rule they knew from daily life. Other everyday versions of the task did not help.

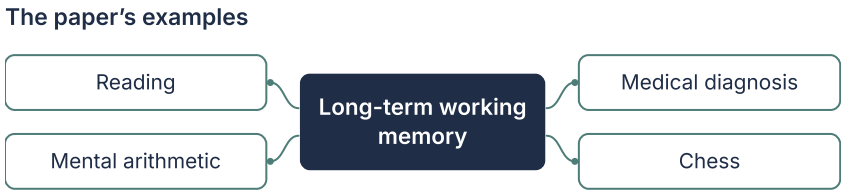
Wason's selection task (Griggs & Cox, 1982)

A drinking-age rule from daily life	Other everyday versions
Much better	Did not help

The group did much better when the rule came from their own experience.

The study pointed to memory as the reason. A familiar rule brings back past cases. But familiar content can also mislead you. That happens when what you believe clashes with the logic. This is called **belief bias**.

Experts stretch their working memory in their own field. Ericsson and Kintsch called this **long-term working memory** (Ericsson & Kintsch, 1995). Experts store well-used structures in long-term memory, and pull them up as single units.



Ericsson and Kintsch called this long-term working memory (Ericsson & Kintsch, 1995).

This lets them hold more of their field in mind than **the usual limit**. It is like packing many tools into one bag that you can lift at once. The paper's examples included reading, mental arithmetic, medical diagnosis and chess.

Chess shows the same thing. A master recalls real game positions **in chunks** (Chase & Simon, 1973). With random positions, the master does no better than a beginner.

The gain **stays inside the field**. Training working memory in general improves the practised tasks themselves. But the gains do not spread to intelligence or reasoning (Melby-Lervåg et al., 2016).

Methods that help beginners can stop helping experts (Kalyuga et al., 2003). This is called the **expertise reversal effect**. Worked examples are one case. Beginners learn faster from seeing a problem solved step by step.

Experts may gain little from the same examples, or even do worse. The extra guidance repeats what experts already know. That gets in the way. Good teaching **cuts back guidance** as skill grows. In my view, this shows how closely expert reasoning and knowledge are bound.

In my view, stored knowledge is **part of reasoning skill itself**. Growing smarter means building knowledge as well as practising

reasoning. The table shows my model of the memory structures that feed reasoning most directly.

Key idea:

Reasoning uses working memory and stored knowledge, and it is only as sound as what it works on.

What memory brings	How it helps you reason
Cause-and-effect knowledge	Stored knowledge of how systems work, such as chains of cause and effect, feedback and tipping points. It lets you reason about similar systems without working out the logic from scratch each time.
Cases that broke the rule	A good memory for cases that broke the expected pattern. It lets you test a suggested rule against cases that challenge it.
Knowing kinds of argument	Knowing the main kinds of argument and how each one should work. It lets you judge an argument by its form. Whether it sounds right is not the only test.
Rules of thumb for a field	Experts build up rules of thumb that work in their field. These often make their judgments faster and better, though not always.
How often things happen (base rates)	Knowing how often things really happen in a field. Without this, you may judge how common something is by how fast cases spring to mind (Tversky & Kahneman, 1973). This is called the availability heuristic. Vivid or recent cases can then seem more common than they are.

You can build each of these with **careful, planned practice**. The exercises that follow train three of them. They check your starting

points, map causes and test your view against the best points against it. Each one targets a different place where reasoning tends to go wrong.

Quick check:

1. How closely were reasoning and working memory related in the military recruit studies? Answer: Very closely related (Kyllonen & Christal, 1990).
2. What is the expertise reversal effect? Answer: Methods that help beginners can stop helping experts (Kalyuga et al., 2003).
3. Does training working memory in general improve reasoning? Answer: It improves the practised tasks, but the gains do not spread to intelligence or reasoning (Melby-Lervåg et al., 2016).

Next: three exercises



Intellect Exercises: Building the Memory-Reasoning Connection

These three exercises are my own, and each **checks what your reasoning stands on**. The Premise Audit looks at the base of a single conclusion. The Causal Chain Builder maps the causes behind something complex. The Strongest Counterargument Protocol tests your view against the best argument against it you can find.

Three exercises

	Looks at
The Premise Audit	The base of a single conclusion
The Causal Chain Builder	The causes behind something complex
The Strongest Counterargument Protocol	The best argument against your view

These three exercises are my own, and each checks what your reasoning stands on.

In all three, you sort **what you really know** from what you only assume. Both come from memory, but only one has been checked.



A person sorts notes into two piles: what they know and what they assume.

> **Exercise:**
>
> 6.7, The Premise Audit. Follow these six steps.

You do this alone. **It takes 20 minutes**. Use it when you prepare for any important decision or analysis.

1. Write down the conclusion you are leaning toward. It might be a judgement, a decision or a belief. State it as clearly as you can. Put it in a way that could be shown wrong.

2. List every premise your conclusion depends on. A premise is a statement that must be true for the conclusion to follow. Work backwards. Say to yourself, "For my conclusion to be right, I must be assuming that..." Then keep adding "and also that...". The first few premises come quickly. Finding the rest takes steady effort.

3. For each premise, ask where in your memory it came from. Is it from your own experience, or from a single source? Is it from a model you built years ago and never checked again? Is it from someone you trusted without checking?

4. Rate each premise in two ways. First, give your confidence from 0 to 100%. Second, note when you last saw evidence for it. Some fields change quickly. There, watch for a firm premise you have not checked in a long time. That is a risk point.

5. Take the premise with the lowest confidence, or the one checked longest ago. Spend 10 minutes testing it. Look for evidence against it and other ways to read it. Recall cases where it failed.

6. Revise your conclusion in light of the full audit. Often the conclusion stays the same. Still, you can now state it more clearly and honestly. Sometimes it changes a great deal.

Rate each premise

	Rate
First	Your confidence, 0 to 100%
Second	When you last saw evidence for it

There, watch for a firm premise you have not checked in a long time.

In my view, many reasoning failures come from **wrong premises**. The logic itself is often sound. Instead, a fact stored in memory is wrong, out of date or only half stated.

The Premise Audit trains you to treat your stored beliefs as **ideas to test**. You stop taking them for granted as a firm base.

The Premise Audit comes first. Before you can improve an argument, you need to see clearly **what it rests on**. It is like checking the bricks at the bottom of a wall before you build higher. Some premises are well grounded in memory. Others are guesses dressed up as facts.

> Exercise:
> 6.8, The Causal Chain Builder. Follow these six steps.

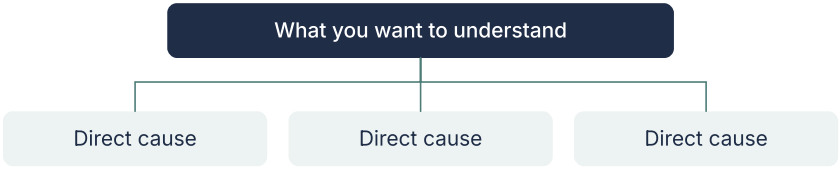
You do this alone. **It takes 25 minutes**. It works best for making sense of complex systems or situations.

1. Choose something you want to understand. It could be a market trend or a result in your own life. It could be a historical event, a body process or a pattern in society.
2. Write it in the centre of a page. Now work backwards through its causes. What caused it directly? Write 2 to 3 direct causes. For each

one, ask what caused that, and write those causes down. Keep going for 4 to 5 levels.

3. At each level, ask yourself a question. Is this from real memory of checked facts? Or am I filling the gap with a guess that sounds right? Mark each link M, for memory, or A, for assumed.
4. Find the longest run of A links in a row. That is your blind spot in this analysis. There, you are reasoning without the knowledge you need about how the causes work.
5. For that run of A links, spend 10 minutes building the missing knowledge. Look up **how the causes really work**, using reliable sources. Store what you find on purpose. Then go back to the chain and replace guesses with knowledge.
6. Do this over 10 sessions on different topics. Each time, count the M and A links you start with. As you learn more about causes in your field, aim for more M links.

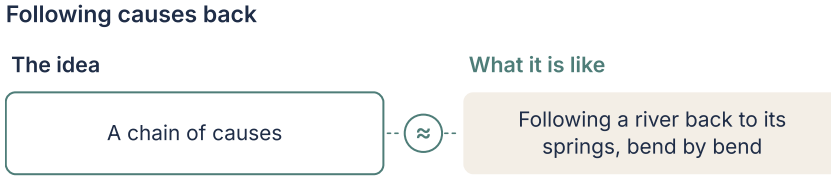
Work backwards through its causes



For each one, ask what caused that, and write those causes down.

Careful thinking in any field needs chains of causes that are **accurate**. Chains that only sound right are not enough. In my view, stored knowledge is much of what sets an expert apart.

The expert **has stored** how the causes really work. It is like following a river back to its springs, bend by bend. The amateur fills the gaps with guesses from general rules.



The expert has stored how the causes really work.

Chains of causes build depth. The next exercise tests whether that depth holds up against **the strongest challenge**. That pressure separates a position that is well supported from one that only feels convincing.

> Exercise:
> 6.9, The Strongest Counterargument Protocol. Follow these six steps.

You can do this **alone or with a partner**. It takes 20 minutes. Use it before any important decision or message.

1. State your current position on an important question. It could be about work, ideas or your own life. Write it as clearly and precisely as you can.
2. Search your memory on purpose for arguments against it. What has happened to you that your position does not explain well? What cases do you know where the opposite was true? What do you know from other fields that goes against what your position assumes?

3. Come up with the three strongest counterarguments you can build. Draw on your memory as much as you can. Rate each one from 1 to 5 for strength. Ask how much evidence from your memory really supports it.

4. For the strongest counterargument, write the best answer you can. Your answer must rest on specific memories, such as facts, cases, causes and evidence. Simply repeating your position does not count.

5. Perhaps you cannot answer the strongest counterargument with specific evidence. Then your position is weaker than you thought. Write that down plainly. Either research the counter-evidence and store it, or change your position.

6. This works for work decisions and personal choices as well as for ideas. Any important decision gains from facing the strongest counterargument that you can build.

Thinking about the opposite view **does reduce bias**. It is like asking a friend to push hard on a bridge before you drive across. In two experiments, some people were told to consider the opposite. They were less biased than people told just to be fair (Lord et al., 1984). In my view, a richer memory across fields gives you stronger counterarguments.

Key idea:

Sort what you know from what you only assume, test the weak points, and your reasoning gets firmer.

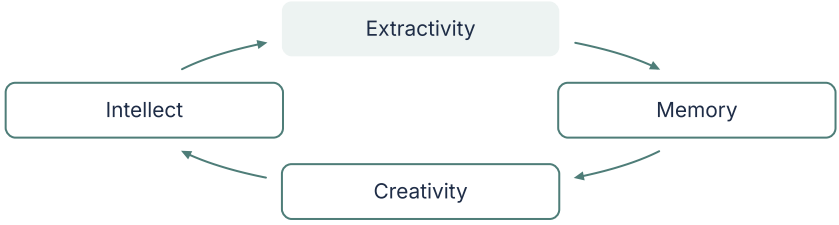
Quick check:

1. What do the marks M and A stand for in Exercise 6.8? Answer: M is for memory of checked facts, and A is for assumed.
2. How long do you spend testing your weakest premise? Answer: 10 minutes.
3. What did people told to consider the opposite show (Lord et al., 1984)? Answer: They were less biased than people told just to be fair.

Integration Exercises: All Four Pillars Working Together

THE EARLIER EXERCISES PAIRED memory with each other pillar, one at a time. In my model, the best thinking comes when **all four work in a loop**. Each part then feeds and strengthens the others.

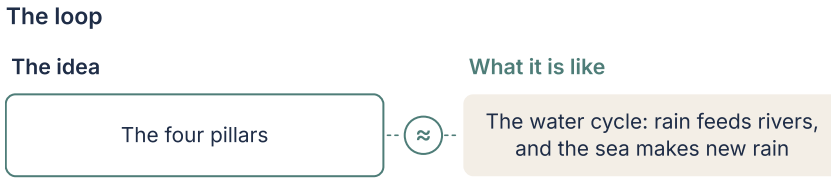
All four in a loop



In my model, the best thinking comes when all four work in a loop.

Here is how the loop runs. Extractivity is your skill at **drawing meaning** from what you read and hear. It brings rich material into memory. It is like the water cycle, where rain feeds rivers, rivers feed the sea and the sea makes new rain. Memory then gives creative links and reasoning something to work on.

Creativity comes up with new ideas, and **intellect tests them**. The conclusions that survive become new schemas. A schema is a stored framework of knowledge. It guides what you look for next time.



A schema is a stored framework of knowledge.

The two exercises below **train that full loop**. The Full Cognitive Cycle runs it once, in a single hour. The Knowledge Synthesis Project keeps it going for two weeks. That is long enough to produce a real piece of work, a synthesis. That is a piece of writing that combines ideas from several sources.

> **Exercise:**
> 6.10, The Full Cognitive Cycle. Follow these six steps.

You do this alone. **It takes 60 minutes**. Make it a weekly session.

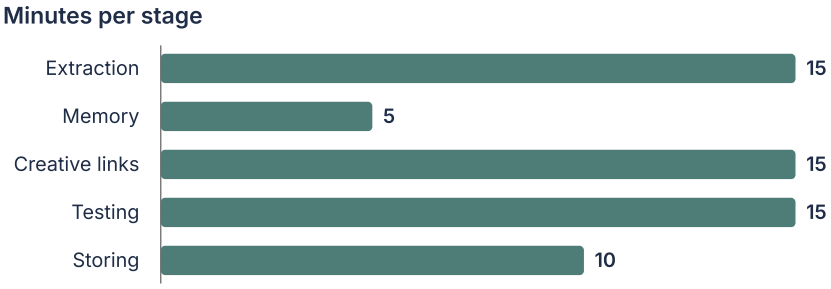
1. Extraction, 15 minutes. Read one hard text in a field that is important to your work. Use the Schema-First Reading Protocol, Exercise 6.1. First load what you already know. Mark what is new and what you knew. Then rebuild each part from memory.
2. Memory, 5 minutes. From memory, sum up the text at three levels. Write one sentence, then one paragraph, then the core argument. Name the one new schema you gained that adds to what you already knew.

3. Creative links, 15 minutes. With the new schema in mind, run the Cross-Domain Collision, Exercise 6.4. Ask what it links to in your Memory Palace. Find 5 links to knowledge in other fields that are not obvious. Rate each one for surprise and for use.

4. Testing, 15 minutes. Take the top-rated link from step 3. Run the Premise Audit, Exercise 6.7, on it. Ask what the link depends on, and whether that is really true. Ask what would have to be shown for the link to be useful in practice.

5. Storing, 10 minutes. Add what this cycle produced to your Memory Palace as a new station. Make one vivid image for three things. Show the new schema and its most surprising link. Also show the key condition the link depends on.

6. Journal. Write one sentence on what this cycle gave you. Pick something you needed all four stages to get. Over time, these entries show what the full loop adds beyond any one pillar.



Pick something you needed all four stages to get.

In my view, this is **the most important exercise** in the module. It trains smooth moves between reading, storing, linking and testing in one session.

I hold that this **smooth switching** marks the best performers in knowledge-heavy fields. In my view, ease of moving through all four matters more than any one strength.

Key idea:

Reading, storing, linking and testing in one loop give more than any one pillar gives, in my view. The loop itself has not been tested.

The one-hour cycle builds the habit of **joining all four** in one session. The Knowledge Synthesis Project stretches the same loop across two weeks. It shows what the four can do when they work together over time.

The Knowledge Synthesis Project

	Choose a complex question
Week 1	find 5 good sources from at least 3 different fields
Week 2	creative linking and building your case
Final piece	a 500-word synthesis

> Exercise:
>
> 6.11, The Knowledge Synthesis Project. Follow these six steps.

You do this alone. It is a project that **runs for 2 weeks**.

1. Choose a complex question, ideally one tied to your work or your learning. It should need knowledge from several fields to answer well.

2. Week 1 is for reading and building memory. Find 5 good sources from at least 3 different fields that bear on the question. Use the Schema-First Reading Protocol on each one. Build a Memory Palace just for this question. After each source, add new stations for what you learned from it.

3. Also in week 1, run the Causal Chain Builder, Exercise 6.8, twice. Do it once at the start, when your knowledge is thin. Do it again at the end of the week, once you know far more. Compare the two chains. This is a personal before-and-after check. It is no controlled test. Still, it shows you how your own chains changed as your knowledge grew.

4. Week 2, creative linking and building your case. Walk your Memory Palace on purpose, looking for new ideas. Run the Cross-Domain Collision across its stations. Look for links in structure across the five sources. Ask what combined view is possible that no single source tried.

5. Final piece. Write a 500-word synthesis, a piece that combines ideas from all five sources. It should go beyond any one of them. Defend its main argument against the two strongest counterarguments your memory can now supply.

6. Review. Ask whether you could have written this piece at the start of week 1. If not, that gap gives a rough, personal sense of the project's gain.

Two chains



It is no controlled test.

I treat this project as **a small model of idea-making**. Give each stage full effort, and I expect a piece different in kind.

Reading alone, brainstorming alone or logic alone would not get you there. I call that difference **the four-pillar effect**.

The four-pillar effect



Quick check:

1. How long does the Full Cognitive Cycle take? Answer: 60 minutes, as a weekly session.
2. How long does the Knowledge Synthesis Project run? Answer: 2 weeks.
3. How long is the final piece in the project? Answer: 500 words.

Module 6 Key Takeaways

Key Concept:

Module 6 Key Takeaways

In my model, memory sits at the centre of the other three pillars. It shapes how they grow, how you use them and where they reach their limits.

What you know about a field helps you read and understand texts in that field (Recht & Leslie, 1988; Bransford & Johnson, 1972). Building knowledge of a field is one strong way to read it better.

Creative work draws on what you have stored. You cannot combine ideas you do not have. A wider and deeper store gives you more to work with.

Within their own field, experts can hold far more in mind than usual (Ericsson & Kintsch, 1995). Your reasoning can only be as good as the premises your memory supplies.

In my model, the four pillars feed each other in a loop. Better reading builds a richer memory. That memory helps creativity and reasoning, which then raise better questions to read about.

The two integration exercises train all four pillars together. I hold that this smooth switching marks the best performers in any field.

In my view, this module's exercises are an advanced form of memory training. Memory used together with the other pillars is put to work.

Module 5 Key Takeaways



In my view, this module's exercises are an advanced form of memory training.

The box below sorts these links into the ones that are **tested** and the ones that are not.

> **Science Says:**
>
> Some links in this module are tested. Studies of reasoning and working memory find the two **closely related** (Kyllonen & Christal, 1990; Kane et al., 2005; Ackerman et al., 2005). Knowing a field helps you understand what you read about it (Recht & Leslie, 1988).

Time away from a problem can help solve it (Sio & Ormerod, 2009). Sleep made a hidden shortcut more likely to be spotted in **one study** (Wagner et al., 2004).

Other parts have **no test behind them**. These include the four-pillar loop itself. They also include the idea that memory training helps other skills.

In fact, general working memory training does not dependably lift other abilities (Melby-Lervåg et al., 2016). This module does not claim that a better memory improves everything. What is supported is **narrower**. Knowledge in a field helps you understand, reason and create within that field.

Cheat Sheet: The Four Pillars

Key Concept: The Four Pillars Cheat Sheet		
Pillar	What memory gives it	One exercise to start with
Extractivity	A base of knowledge to read new material against	Exercise 6.1, The Schema-First Reading Protocol
Creativity	Stored ideas from many fields to combine	Exercise 6.4, The Cross-Domain Collision
Intellect	Premises, causes and counterexamples to reason with	Exercise 6.7, The Premise Audit
All four together	One loop of reading, storing, linking and testing	Exercise 6.10, The Full Cognitive Cycle

The four-pillar model is now **both a framework and a way to practise**. The next module turns it into full working systems for real-life settings. It also builds a personal knowledge system so that every technique keeps adding up.

The module after that **changes focus**. It looks at common problems that hold your thinking back, and how to fix them.

Module 7: Transfer to Real Life, Complete Integration Systems

You now have every technique. This module asks the next question. How do you join them into **one working system** for your own life?

First, you will see why techniques alone fall short. Next come **seven full blueprints**, full plans that show how the parts fit together, for different settings. They cover university, office work, languages, law, medicine, business and lifelong reading. Last, you build your Personal Knowledge System, your own lasting setup to gather, link, review and use all you learn, so that your learning adds up over time.

Techniques and a system



Last, you build your Personal Knowledge System, so that your learning adds up over time.

Up to now, each technique has come on its own. Techniques must be learned that way, **one at a time**, until they feel easy. Still, a set of separate techniques does not make a system.

A Memory Palace is places you walk through in your head, each one holding something to remember. It is **a strong tool**. Now picture one built into your term plan and joined to a spaced repetition deck, which has you review after longer and longer gaps. You review it on a timetable set by your exam dates. That version can change your results.



A term planner, a Memory Palace sketch and a flashcard deck, side by side.

In my view, **structure is what splits** knowing techniques from having a system. It is like the gap between a pile of bricks and a house. This module gives you that structure.

What structure adds

The idea		What it is like
Knowing techniques	≈	A pile of bricks
Having a system	≈	A house

It is like the gap between a pile of bricks and a house.

It adds no new ways to encode, or get something into memory. Its new named structures only combine methods you already have. It shows how to join them into one system that **keeps itself going**. Each system is built around your setting, your goals and your time frame.

Key idea:

Join the techniques you know with a structure, and you get one system that keeps going.

The Integration Principle: Why Techniques Alone Are Not Enough

Picture someone with **three strong tools**: the Method of Loci (the Memory Palace method, using places as a frame for memory), spaced repetition and elaborative encoding (storing something deeply by explaining it in your own words, making links and coming up with examples). Someone who has built a system knows more. They know which tool suits each kind of material. They know when in the learning cycle to use it.



Someone with a system also knows how often to review, and **which daily cue** sets each step off. In my view, a system turns now-and-then success into steady, growing mastery.

> **Science Says:**
> Morris and colleagues tested people on words studied in two ways (Morris et al., 1977). Some people **focused on meaning** and others on rhyme.



People study a list of words, some for meaning and some for rhymes.

Meaning-based study won on **a standard recognition test**.
Rhyme-based study won on a test that asked about rhymes.

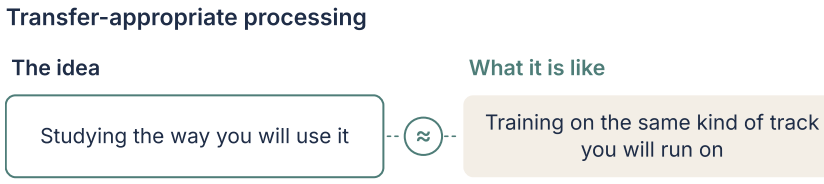
Morris et al., 1977

Test	Which study won
A standard recognition test	Meaning-based study
A test about rhymes	Rhyme-based study

Some people focused on meaning and others on rhyme.

Memory depended on how well the kind of study matched the kind of test. It is like training for a race on the same kind of track you will run

on. This is called **transfer-appropriate processing**. It means you should study in a way that suits later use.



This is called transfer-appropriate processing.

Key idea:

When the way you study matches the way you will be tested, recall on that test is better (Morris et al., 1977).

I take this **a step further**. In my view, the best memory system fits where you will use your learning.

Each blueprint in this module answers **three questions**. First, what does this setting ask of your memory? Which tools best fit those demands? How do those tools link into a routine that keeps going without constant willpower?

Your answers to these three questions **make up your system**. Each answer is shaped by your own setting.

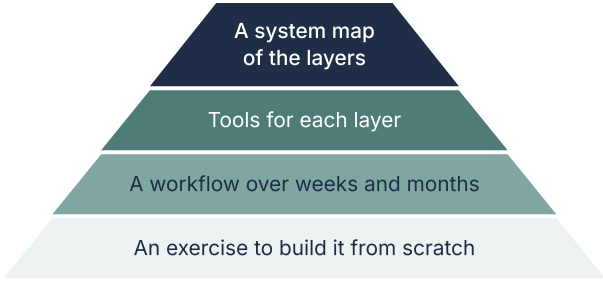
Quick check:

1. In the Morris study (Morris et al., 1977), which kind of study won on the standard recognition test? Answer: Meaning-based study.
2. Which kind of study won on the test about rhymes? Answer: Rhyme-based study.
3. How many questions does each blueprint answer? Answer: Three. What the setting asks of your memory, which tools fit, and how they link into a routine.

The Seven Context Blueprints

Each blueprint below has **the same design**. It is like a set of recipe cards that all use one layout. A system map shows the layers of the memory task. Next come the tools for each layer. A workflow then links them over weeks and months.

The same design in every blueprint



Next come the tools for each layer.

Every blueprint ends with an exercise that builds that system **from scratch**. Start with the blueprint for your main setting. Come back to the others as your goals grow.

Key idea:

Layers, tools for each layer, a workflow and one exercise give you a blueprint you can build from scratch.

The table below **can help you choose**. Its times add up each blueprint's own workflow.

Blueprint	Regular time per week	Plus, per event	Busiest phase
University	About 2.6 to 3.5 hours	10 minutes per lecture	45 minutes a day for the 4 weeks before exams
Office work	About 1.4 to 1.7 hours, over a 5-day week	7 minutes per meeting	60 to 90 minutes each quarter
Language	About 5.4 to 6.6 hours	None	40 to 50 minutes every day
Law	About 2.4 to 3 hours	5 minutes per case, 30 to 45 minutes per topic	20 minutes a day in the last 2 weeks
Medicine	About 2.8 hours, with 5 placement days	10 minutes per anatomy session	30 minutes a day in the last 2 weeks
Business	About 1.7 to 2.3 hours	5 minutes per meeting	None
Lifelong reading	A few minutes, in monthly and quarterly steps	About 45 to 60 minutes per book	20 to 30 minutes once a year

Quick check:

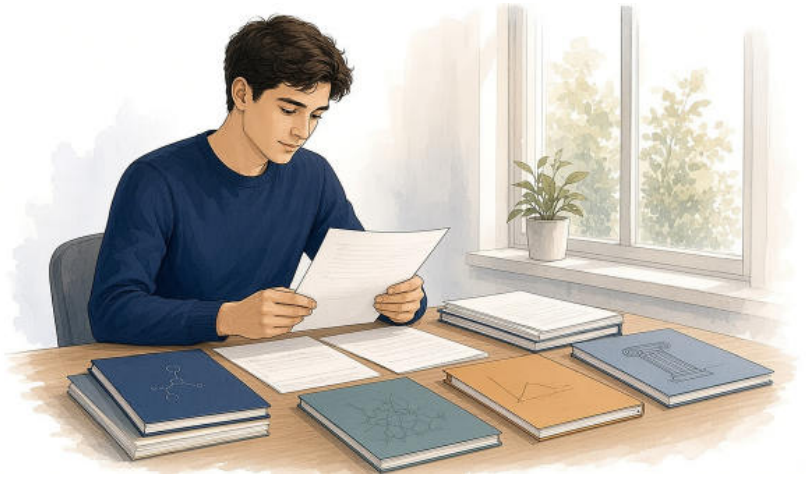
1. What does every blueprint end with? Answer: An exercise that builds that system from scratch.
2. Which blueprint should you start with? Answer: The one for your main setting.
3. Which blueprint asks 40 to 50 minutes every day in its busiest phase? Answer: Language.

University Curriculum Blueprint

> **Key Concept:**
>
> University Curriculum: From Term to Mastery
>
> University study asks memory to do three jobs at once. The first is breadth, storing what you learn across several subjects. The second is depth, knowing each subject to exam standard. The third is transfer, using what you know on new questions under time pressure.

The workflow

Daily	Weekly	Last 4 weeks
review the Anki cards that are due	walk the full palace	sit 3 full timed papers



A university student studies notes from several subjects at one desk.

Rereading and highlighting feel useful but help less than self-testing. It is like watching someone ride a bike

when you need to ride it yourself. Students who restudied **felt surer** than students who tested themselves. Yet after two days and after a week, they recalled less (Roediger & Karpicke, 2006).

Layer	Tool or technique	What it stores	Result
Layer 1	Memory Palace, one per subject	Core ideas, theories, frameworks and key names	Fast recall by place during written exams
Layer 2	Anki deck, one per course unit (Anki is a flashcard app that uses spaced repetition)	Word meanings, formulas, dates, terms and how things work	Reviews spaced out for you, up to the exam
Layer 3	Feynman Protocol (explaining an idea in plain words, as if you were teaching it, to find your gaps)	Deep grasp of how things work and of hard arguments	Fluent essays and better answers
Layer 4	Retrieval practice (pulling facts back out of your head)	Past papers (old exams you sit for practice), practice answers and timed recall	Steady results under exam pressure
Layer 5	Connection Web	Links across subjects and frameworks for comparing them	Strong answers that pull ideas together

The workflow below runs these layers as one regular routine. It takes **about 2.6 to 3.5 hours** weekly, plus 10 minutes a lecture.

Key idea:

With a palace for ideas, Anki for facts and testing yourself, you are ready on the day of the exam.

How often	What to do	Time
Daily	Review the Anki cards that are due. Add 1 new palace station for each subject you studied today.	15 to 20 minutes
Per lecture	Use SQ4R active reading. SQ4R is a way to read in six steps, Survey, Question, Read, Recite, Record and Review. Right after the lecture, store 3 key ideas in the palace.	10 minutes after the lecture
Weekly	Walk the full palace for every subject you studied this week. Do 1 Feynman Protocol drill.	30 to 40 minutes
Every two weeks	Try a past paper question from memory. Find the gaps, then store those parts again.	45 to 60 minutes
Last 4 weeks before exams	Pull together each subject's palaces. Speed up Anki intervals. Sit 3 full timed papers.	45 minutes a day
After exams	Add weak areas to your decks and reset their intervals. Start building for the next term.	One 1-hour session

> Exercise:
>
> 7.1, The Semester Memory Architecture Build. Follow these seven steps.

Step	What to do
1	Map your term. List every subject, every main topic and each exam date.
2	For each subject, choose 1 place for a memory palace. Build a 10-station palace this week.
3	Make a separate Anki deck for each subject. Add 10 cards today. Add no more than 15 new cards a day per deck. The Anki manual gives a rough guide. At 15 new cards a day, expect about 150 reviews a day per deck.
4	Set one fixed time each week for a full palace walk. Keep it apart from your Anki sessions.
5	From week 4 on, put one practice past paper in your calendar every two weeks.
6	Four weeks before your first exam, start the pre-exam routine from the workflow table.
7	After the exam, check where you went wrong. Turn each wrong or weak answer into 5 new palace stations and 10 new Anki cards.

Quick check:

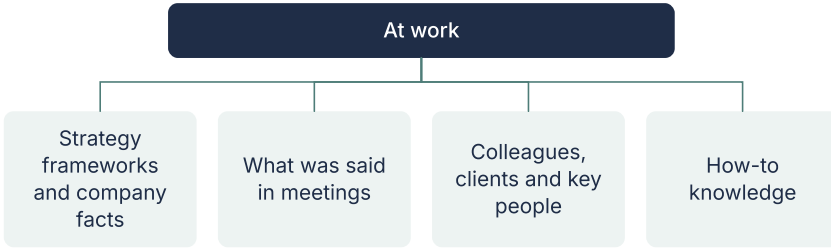
1. After two days and a week, who recalled less (Roediger & Karpicke, 2006)? Answer: The students who restudied, even though they felt surer.
2. How many new Anki cards a day per deck should you add at most? Answer: 15.
3. What do you do in the last 4 weeks before exams? Answer: Pull together each subject's palaces. Speed up Anki intervals, and sit 3 full timed papers.

Corporate Workflow Blueprint

> **Key Concept:**
>
> Corporate Workflow: Memory as a Work Asset
>
> At work, memory demands are spread out and never stop. You keep four kinds of knowledge at once. First come strategy frameworks and company facts, for decisions.

Second is **what was said in meetings** across your projects. Third is what you know about colleagues, clients and other key people. Fourth is how-to knowledge about workflows and systems.

Four kinds of work knowledge



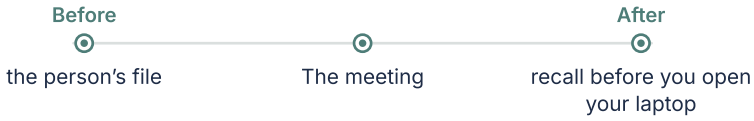
Third is what you know about colleagues, clients and other key people.



A worker reads back notes from meetings across several projects.

No single technique covers all four. It is like a sports kit, where each sport needs its own gear. This system layers them into one daily routine. On a day with no meetings, it adds about 14 minutes. Each meeting adds about 7 minutes more.

Around one meeting



Layer	Tool or technique	What it stores	Result
Layer 1	Client Intelligence Files (a short file on one person each)	Each person's name, role, priorities and past conversations	Better-prepared conversations with the people you work with
Layer 2	Meeting Palace (a Memory Palace where you store what each meeting decided)	Decisions, action items and key arguments from each meeting	Stronger recall, so you lean less on notes
Layer 3	Strategic Framework Palace	Core business models, frameworks and the competition	Quicker strategic thinking in the moment
Layer 4	Anki deck for your field	Industry data, terms and rules you must follow	Accuracy in conversations with experts
Layer 5	Decision History Archive	Why major decisions were made, and what else was considered	A record of the organisation's past, and the patterns in it

The workflow below runs these layers as one steady routine. A 5-day week takes **about 1.4 to 1.7 hours**, plus meetings.

Key idea:

One tool for each kind of work knowledge and one daily routine take about 14 minutes a day, plus about 7 per meeting.

How often	What to do	Time
Before a meeting	Review that person's Client Intelligence File. Decide on 1 thing you mean to remember.	2 minutes
After a meeting	Before you open your laptop, recall the decisions and action items using your palace.	5 minutes
Each morning	Review your Anki deck for your field. Store any new industry facts you came across.	10 minutes
Weekly	Update the Client Intelligence Files. Walk the Strategic Framework Palace. Add an entry to the Decision History Archive.	20 minutes
Monthly	Check your relationships. Pick the 5 that need a refresh and review those files.	30 minutes
Quarterly	Ask what has changed in your field. Replace palace stations that are out of date.	60 to 90 minutes

> **Exercise:**
>
> 7.2, The Professional Memory System Setup. Follow these six steps.

Step	What to do
1	List your 10 most important work relationships. Make a Client Intelligence File for each one. Include their name and role, their key priorities, and the last 3 things you discussed. Add what they care about most. Store these files safely, following your employer's data rules and any data-protection law that applies.
2	Choose a place for your strategic framework palace. This week, store the 5 business frameworks you use most as 5 separate stations.
3	Build one Anki deck for your field. Start with 20 cards on core terms and facts you often have to look up.
4	After your next meeting, spend 5 minutes recalling it from memory before you write notes. Note what you missed.
5	Start your Decision History Archive. Write down the last 3 big decisions you made, with your reasons and the other options you weighed.
6	Block 20 minutes in your calendar every Friday to keep the system up to date.

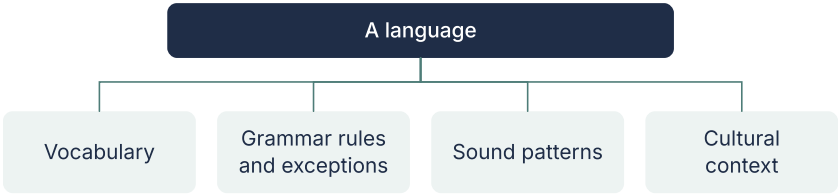
Quick check:

1. How much time does the system add on a day with no meetings? Answer: About 14 minutes.
2. What do you do after a meeting, before you open your laptop? Answer: Recall the decisions and action items using your palace, for 5 minutes.
3. How many work relationships do you list in step 1? Answer: 10.

Language Learning Blueprint

> **Key Concept:**
>
> Language Learning: From Vocabulary to Fluency
>
> Learning a language means storing four kinds of knowledge side by side. They are vocabulary, grammar rules with their exceptions, sound patterns and cultural context. Sound patterns must become automatic. Cultural context gives words their exact sense.

Four kinds of knowledge side by side



Sound patterns must become automatic.

Vocabulary alone is **a big job**. Cambridge B2 learners (B2 is an upper-middle level of skill in a language) in one study knew about 3,250 to 3,750 words (Milton, 2010). That counts only the 5,000 most common English words.

Each tool has a role. It is like a band, where each player has a part. The Memory Palace ties words to a context. Spaced repetition handles review. Reading and listening at the right level make it all stick through real use.



A language learner reviews word cards, then reads in the new language.

Layer	Tool or technique	What it stores	Result
Layer 1	Vocabulary Palace, one per topic area	Nouns, verbs and adjectives grouped by topic	Words recalled by place, in context
Layer 2	Keyword Method (linking a new word to a familiar word that sounds like it, through a bright picture)	Common single words, each tied to a sound-alike image	Quick recall of single words
Layer 3	Anki sentence deck	Whole sentences with the target word in natural use	Grammar recalled along with the words
Layer 4	Grammar Palace	Each rule with 3 examples and its common exceptions	Correct structure when you speak and write
Layer 5	Graded input	Daily reading or listening a little above your level. This is Krashen's "i + 1" idea. It is a theory, and it has not been proven (Krashen, 1982).	Patterns picked up without effort

The workflow below runs these layers as one routine. It takes **about 5.4 to 6.6 hours** a week.

Key idea:

A palace for context, Anki for review and daily graded input give you words that stick through real use.

How often	What to do	Time
Daily	Review your Anki sentences. Learn 5 new words with the Keyword Method.	20 minutes
Daily	Read or listen to graded material at your target level.	20 to 30 minutes
Weekly	Add 5 words to the Vocabulary Palace. Walk all the palace sections you are using.	15 minutes
Weekly	Walk the Grammar Palace. Write 1 short paragraph using this week's target structures.	20 minutes
Monthly	Test yourself. Write 50 target words from memory, then check them against your deck.	30 minutes
Quarterly	Write for 20 minutes on any topic. Find the gaps in your grammar, and update the Grammar Palace.	45 minutes

> **Exercise:**
>
> 7.3, The Language Memory Architecture Build. Follow these six steps.

Step	What to do
1	Choose your first Vocabulary Palace, a room you know well. Give each wall and large object one topic, such as kitchen items, travel, feelings or work.
2	Take your top 50 target words. Make Keyword Method images for the 20 you find hardest. Add all 50 to Anki as sentence cards.
3	Build your Grammar Palace in your front hallway, with one door for each tense. Place the rule and an example at the door handle. Place the exception at the door frame.
4	Set your daily Anki limit at 15 new cards at most. Keep to it, as steady work beats volume. At 5 new words a day, reaching the B2 range above takes about 2 years.
5	Choose graded input at the right level. It should feel slightly hard, but you should know nearly all the words. Reading research puts the bar at 95 to 98% of words known (Laufer & Ravenhorst-Kalovski, 2010). Make it a fixed daily slot.
6	Every Friday, walk your Vocabulary Palace. If a word does not come at once, rebuild its image.

Quick check:

1. How many words did Cambridge B2 learners know in one study? Answer: About 3,250 to 3,750 of the 5,000 most common English words (Milton, 2010).
2. What share of words should you know in graded input? Answer: 95 to 98% (Laufer & Ravenhorst-Kalovski, 2010).
3. At 5 new words a day, how long does reaching that B2 range take? Answer: About 2 years.

Legal Study Blueprint

Key Concept:

Legal Study: Case Law, Statute and Legal Argument

Law asks for accuracy at every level at once. In my view, the exact words of a statute, a written law passed by a law-making body, must be learned as written. Case names and their principles must come back fast under exam pressure.

Case names and their principles

- Store each case at once
- Walk the palace daily
- Join the palaces before exams



A law student learns the exact words of a statute.

Legal arguments must be built fluently. Reciting them word for word is not the aim. Knowledge of procedure must run on its own. This system splits these **four demands** and gives each its own tool. It is like a kitchen with one drawer for knives

and another for spoons. That keeps you from treating all legal knowledge as one kind of thing.

Layer	Tool or technique	What it stores	Result
Layer 1	Case Law Palace	Case name, facts, principle and ratio decidendi, the principle the decision rests on	Fast answers to "name the case that sets out X"
Layer 2	Statute Palace	Section numbers, key definitions and the words that do the work	Accurate citing of statutes without notes
Layer 3	Anki deck of case principles	One principle per card, with the key phrase word for word	Fluent legal reasoning in essays and moots (practice court cases that students argue)
Layer 4	Argument Story Chains	The steps of a legal argument, told as a story	A clear structure for spoken and written argument
Layer 5	Procedural Peg System (a peg system is a list of 'pegs' learned by heart first, on which you hang new information)	The numbered steps of each legal procedure, 1 to 10 per procedure	Accurate recall of procedure under pressure

The workflow below takes **about 2.4 to 3 hours** a week. Add 5 minutes per case and 30 to 45 minutes per topic.

Key idea:

A separate tool for each kind of legal knowledge gives you fast, exact recall under exam pressure.

How often	What to do	Time
Each case you read	Store it at once. Turn the case name into an image for the palace. Put the principle on an Anki card.	5 minutes per case
Daily	Review Anki. Walk the part of the Case Law Palace you covered this week.	15 to 20 minutes
Weekly	Walk the Statute Palace for each statute covered this week. Review your procedure pegs.	25 minutes
Each topic	Build one Argument Story Chain for the main legal debate in that area.	30 to 45 minutes
Monthly	Write a timed essay from memory on one topic for 40 minutes, with no notes. Then find the gaps.	60 minutes
Before exams	Join all the case law palaces into one main review route. Walk it daily for the last 2 weeks.	20 minutes a day

> **Exercise:**
>
> 7.4, The Legal Knowledge Architecture Build. Follow these six steps.

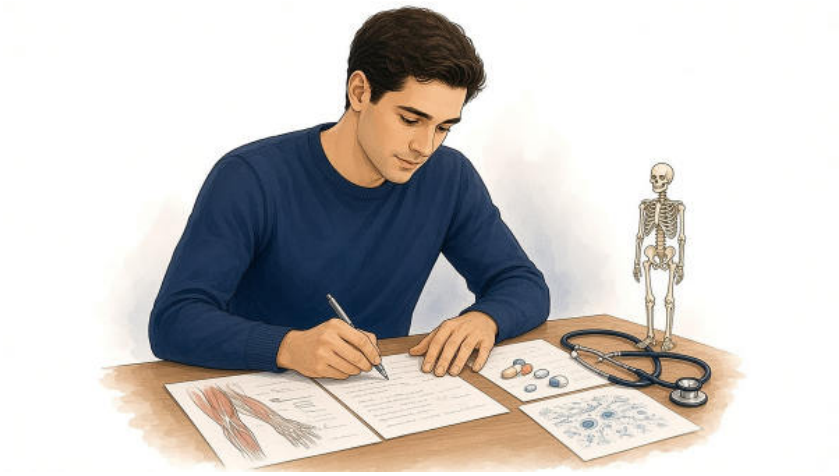
Step	What to do
1	Choose one area of law you are studying now. List every case you need to know, aiming for 20 to 30. At 5 minutes each, that is 100 to 150 minutes of storing.
2	Build a Case Law Palace, with one room for each area of law and one piece of furniture for each case. Turn the case name into an image on the object. Put the principle in the object's action.
3	Make 1 Anki card per case. On the front, write "What does [case name] establish?" On the back, give the principle in one clear sentence. One idea per card keeps cards easy to learn (Wozniak, 1999).
4	Take your most complex statute section and build a Statute Palace. Use one room, with one section on each wall. The key words become the object on that wall.
5	Choose the most important legal argument in your current topic. Write it as a story. The start is the rule, and the middle is the leading case. The turn is the exception, and the end is where the law stands now.
6	Test yourself. Close everything, open a blank page and write every case name and principle you know. This is your starting score. Repeat it monthly.

Quick check:

1. How long does storing one case take? Answer: 5 minutes.
2. How long is the monthly timed essay? Answer: 40 minutes, from memory, with no notes.
3. What goes on the front of each case card? Answer: "What does [case name] establish?"

Medical Study Blueprint

> **Key Concept:**
>
> Medical Study: Anatomy, Drugs and Clinical Reasoning
>
> You need a huge store of facts on anatomy, drugs and disease processes. You need quick pattern spotting to diagnose, and how-to knowledge for clinical skills. You must use all three at once under real clinical pressure.



A medical student studies notes on the body, drugs and disease.

This system keeps **fixed facts apart** from changing ones. It is like keeping a city map apart from the daily traffic news. Anatomy gets its own palaces. Disease processes become story chains. That suits learning how a disease works.

Fixed facts apart



Disease processes become story chains.

Experienced doctors diagnose a little differently. They rely mostly on "**illness scripts**", stored pictures of typical patients and their context (Schmidt et al., 1990). Students without clinical experience lean more on cause-and-effect models.

Layer	Tool or technique	What it stores	Result
Layer 1	Anatomy palaces	Structures, where they sit, how they connect, their nerve and blood supply	Recall by place that follows the real body
Layer 2	Drug deck in Anki	Drug class, how it works, what it treats and its side effects, one card per drug	Quicker drug recall when you see patients
Layer 3	Disease story chains	How a disease works, told as a story from trigger to chain of events to symptom and sign	Fluent explanations of disease processes
Layer 4	Diagnostic Peg System	A 5-step diagnostic framework pegged to fixed images	A steady structure for clinical reasoning
Layer 5	Procedure chains	Clinical procedures as a numbered story, step by step	Better recall of each step, alongside the official checklist

With 5 placement days, the workflow takes **about 2.8 hours** a week. Anatomy sessions add more.

Key idea:

Palaces for fixed facts, stories for how a disease works and pegs for diagnosis give you facts you can use with real patients.

How often	What to do	Time
Daily	Review the drug cards that are due in Anki. Add no more than 3 new drug cards a day.	15 minutes
Each anatomy session	Study the structure. Store it in the anatomy palace at once. Cover it and recall it before you leave.	10 minutes of storing per session
Weekly	Walk the whole anatomy palace for the body systems covered this week. Do 1 disease story chain.	30 minutes
Each placement day	Before you start, review the diagnostic pegs. Review the 3 drug cards most relevant to today's specialty.	5 minutes before the shift
Monthly	Read 1 case summary, then rebuild a full working diagnosis from memory, against the clock.	30 minutes
Before an OSCE (a hands-on exam where you show clinical skills at a row of stations) or exam	Walk all the procedure chains. Review the whole drug deck, and walk a short anatomy route.	30 minutes a day for the last 2 weeks

> Exercise:
>
> 7.5, The Medical Knowledge Architecture Build. Follow these six steps.

Step	What to do
1	Choose one body system, such as the brachial plexus or the blood vessels of the liver. Use your own body as the palace. Map the main structures to places on an imagined version of that anatomy.
2	Build your drug deck for your current rotation. Note every drug you meet, but add no more than 3 new cards a day. On the front, write “Drug: [name]. Mechanism?” On the back, give the mechanism in 1 to 2 sentences. Check each drug fact against the official label, such as DailyMed.
3	Choose 3 common diseases in your current specialty. Write each one as a story: the trigger, the chain of events in the body and how the patient presents. Store the story in a palace.
4	Build your Diagnostic Peg System. Peg the 5 steps of the usual clinical assessment to 5 vivid images. The steps are presenting complaint, history, examination, investigations and diagnosis.
5	Take the clinical procedure you are tested on most. Write every step as a numbered list, and store it as a story chain. Rehearse until you can recall the full order from memory. In real practice, always follow the official written checklist.
6	After every patient encounter, spend 2 minutes recalling one thing you saw. If you cannot, it was not stored. Ask one question and store the answer at once.

Quick check:

1. What do experienced doctors rely on mostly? Answer: Illness scripts (Schmidt et al., 1990).
2. How many new drug cards should you add a day at most? Answer: 3.
3. In real practice, what should you always follow? Answer: The official written checklist.

Entrepreneur Learning System Blueprint

> **Key Concept:**
>
> Entrepreneur Learning System: Fast Learning When the Stakes Are High
>
> Learning as a founder is urgent, broad and hard to predict. You must quickly learn fields you never studied formally. You must also pull useful facts from books, podcasts, advisers and markets, and keep them.

Each meeting





A founder reads up fast on a field she never studied.

LAST, YOU MUST TURN that knowledge into decisions, **under uncertainty** and on tight deadlines. This system puts fast storing and quick use first. It skips the deep review built for

exams. It is like packing a light bag for a quick trip. Still, it keeps enough review to stop key knowledge from fading.

Layer	Tool or technique	What it stores	Result
Layer 1	Mental Model Palace (a palace of mental models, which are simple pictures of how something works, used to make decisions)	Core frameworks for decisions, such as the OODA loop (observe, orient, decide, act), first principles (breaking a problem down to the basic facts you are sure of) and inversion (thinking about how a plan could fail, so you can avoid that)	Quicker use of these frameworks at work
Layer 2	Book Encoding System	One key idea per chapter, stored in the palace right after reading	A store of knowledge that grows with each book
Layer 3	Anki deck for your field	Industry terms, market data and facts about competitors	Accuracy when you talk with investors and experts
Layer 4	Idea Capture Palace	Your own ideas, patterns and links across fields	Material for new combinations and product thinking
Layer 5	Adviser Intelligence Files	Each adviser's key advice, how they think and what you promised to follow up	More value from each talk with an expert

The workflow below takes **about 1.7 to 2.3 hours** a week. Add 5 minutes per meeting and the storing you do while reading.

Key idea:

Fast storing, quick use and just enough review keep knowledge ready for decisions.

How often	What to do	Time
Each morning	Review Anki. Walk the Mental Model Palace for any models you are using this week.	10 to 15 minutes
Each book	Store one palace station per chapter. Do it at once. Do not leave it for later.	While you read
Each meeting	Before it, review that adviser's file. After it, recall it with your palace for 3 minutes.	5 minutes in all
Weekly	Walk the Idea Capture Palace. Join 3 of this week's ideas into one clear idea.	20 minutes
Monthly	Ask what changed in your market this month. Replace palace stations that are out of date.	45 minutes
Quarterly	List every book you read this quarter. Recall one core idea from each from memory.	30 minutes

> **Exercise:**
>
> 7.6, The Entrepreneur Knowledge System Build. Follow these six steps.

Step	What to do
1	Name the 10 mental models you use most. Build a Mental Model Palace with one room and 10 stations. Give each station one model, as a vivid action image.
2	Take the last business book you read. Try to recall 5 key ideas without looking. If you cannot, store them now, one idea per station.
3	Make Adviser Intelligence Files for your 5 most useful advisers. For each, sum up how they see the world in one sentence. Add the best advice they have given you, and your next question for them.
4	Build an Idea Capture Palace on a walk you take often, such as your commute or a morning walk. Each landmark holds one idea. Make a habit of storing one new idea per walk.
5	Set up an Anki deck for your field. Start with 20 cards on the terms and facts that mark you as an insider in your industry.
6	After your next big decision, record your reasoning in a Decision History Archive, as in the office blueprint. Note what you decided and why, what you turned down and what you assumed.

Quick check:

1. When do you store the palace station for each chapter? Answer: At once, while you read.
2. How many mental models go in the Mental Model Palace? Answer: 10.
3. How long does the weekly Idea Capture Palace walk take? Answer: 20 minutes.

Lifelong Reading Pipeline Blueprint

> **Key Concept:**
>
> Lifelong Reading Pipeline: Making Each Book Last
>
> For many readers, a good book brings an insight, a lift and then forgetting. This pipeline turns reading into building. Each book becomes a set of stored ideas that stay with you. They link to what else you know, and come back when they are relevant.



Each book becomes a set of stored ideas that stay with you.

By its own table, the system adds **about 30 to 35 minutes** per book. Counting the later reviews in the book palace section, it is about 45 to 60. A Book Palace is a Memory Palace that holds the key ideas of one book.

Memories do still fade. In one large study, the best review gap grew with the time until the test (Cepeda et al., 2008). It is like a new neighbour's name. You need to check it often at first, then less and less. That is why the pipeline keeps a review cycle.

Key idea:

Store 5 to 7 ideas, link them to what you know and review on a schedule, and each book lasts.

Layer	Tool or technique	What it stores	Result
Layer 1	Active reading (SQ4R)	Questions before each chapter, key claims while reading and a summary after	Deeper engagement with the text
Layer 2	Book Palace, one per book	5 to 7 key ideas per book, one per palace station	Recall of the core arguments by place
Layer 3	Anki deck, per book or theme	Facts, figures and quotes worth keeping, in your own words	Easier recall of the evidence behind each idea
Layer 4	Connection Notes (short notes that link a book's ideas to things you already know)	Links between this book's ideas and 3 other things you know	Knowledge that builds up across books
Layer 5	Annual Book Review Palace	One summary idea for each book you read this year	A yearly walk through it all in 20 to 30 minutes

How often	What to do	Time
Before reading	Skim the contents. Write 3 questions you want answered. This sets what you mean to remember.	5 minutes
While reading	Mark only the ideas that answer your questions. Store 1 station per chapter.	As you go
After each book	Build a book palace of 5 to 7 stations. Add 5 to 10 Anki cards, and write 3 connection notes.	25 to 30 minutes
Monthly	Walk all the book palaces from this month. Check that you can recall each book's core argument.	15 minutes
Quarterly	Write one paragraph on the theme that links the books you read this quarter.	20 minutes
Yearly	Walk your Annual Review Palace, 1 station per book. Recall the most useful idea from each book.	20 to 30 minutes

> Exercise:
>
> 7.7, The Book Encoding Masterclass. Follow these six steps.

Step	What to do
1	Choose the last nonfiction book you finished. From memory, list every key idea you recall, and count them. This is your starting count.
2	Now read the table of contents. Count how many chapter arguments you can sum up in one sentence. Each chapter you cannot sum up is knowledge you paid for but did not keep.
3	Build a Book Palace for this book in one room. Put the 5 most important ideas on 5 stations, each as a vivid, specific image. Walk the palace three times.
4	Make 5 Anki cards: one figure, one striking claim, one finding that surprised you, one practical use and one quote in your own words. Add them to a "Books" deck.
5	Write three Connection Notes, such as "This book's idea about X links to [something I know] because..." In my view, these links are where the real value lies.
6	In 4 weeks, walk your palace without opening the book. Count how many stations are still vivid, and rebuild any that are not. Make this your new reading habit.

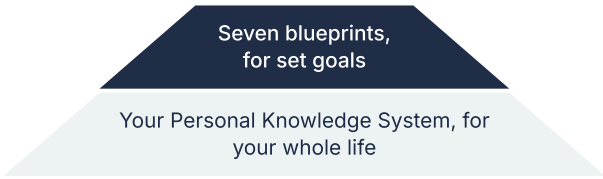
Quick check:

1. By its own table, how much time does the system add per book? Answer: About 30 to 35 minutes, or about 45 to 60 with the later reviews.
2. What did one large study find about the best review gap (Cepeda et al., 2008)? Answer: It grew with the time until the test.
3. How many questions do you write before reading? Answer: 3.

How to Build Your Personal Knowledge System

THE SEVEN BLUEPRINTS EACH meet a specific outside demand. The Personal Knowledge System is **the layer under them all**. It is your lasting setup for gathering, linking, reviewing and using all you learn.

The layer under them all

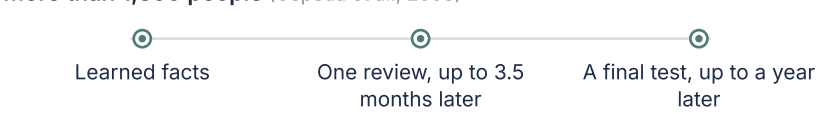


The seven blueprints each meet a specific outside demand.

The blueprints are built for set goals. In my model, this system is the structure you carry through **your whole life**. I see it as what turns a skilled person into a truly learned one.

> **Science Says:**
>
> Spacing out your reviews helps. One large review pulled together 317 experiments from 184 articles on spaced practice (Cepeda et al., 2006).

A later experiment tested **more than 1,350 people** (Cepeda et al., 2008). They learned facts and reviewed them once, up to 3.5 months later. Their final test came up to a year later.



They learned facts and reviewed them once, up to 3.5 months later.

The best gap **grew as the test got further away**. It is like stops on a long drive, where a longer trip means stops further apart. For a test one week later, it was about 20 to 40% of that delay. For a test one year later, it fell to about 5 to 10%.

Key idea:

The further away a test is, the longer the best gap between reviews, from about 20 to 40% of the delay for one week to about 5 to 10% for one year.

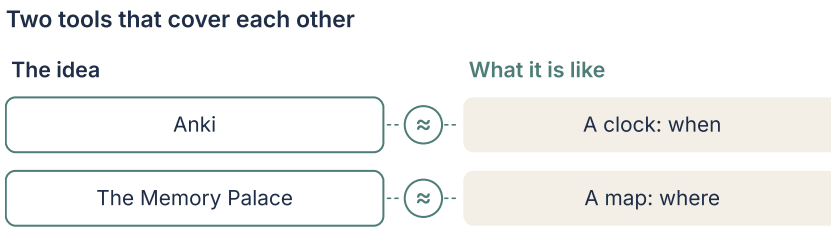
The Personal Knowledge System **puts this idea to work** across a lifetime of learning. It spaces your reviews out over time.

Quick check:

1. How many experiments did the large review pull together (Cepeda et al., 2006)? Answer: 317 experiments from 184 articles.
2. How many people did the later experiment test (Cepeda et al., 2008)? Answer: More than 1,350.
3. For a test one year later, what was the best gap? Answer: About 5 to 10% of the delay.

The Anki and Memory Palace Integration Architecture

Anki and the Memory Palace are two of the strongest tools in this book. It is like having a clock and a map, where one tells you when and the other tells you where. Used together well, **each covers the other's weak spot**.



Anki and the Memory Palace are two of the strongest tools in this book.

Anki schedules reviews with **exact timing** but gives no sense of place or story. It uses either its older SM-2 method or the optional, newer FSRS scheduler, which you can turn on. Both are ways of timing reviews. The Memory Palace gives rich context, but you must plan its reviews yourself. Joining them sends each kind of knowledge to the best tool.

Part	What it stores	How often you review	How it links in
Memory Palace	Frameworks, arguments, sequences, stories and how ideas relate	By hand, in a weekly walk	Anki cards name the palace place as a cue
Anki deck	Single facts, definitions, names, dates, figures and foreign words	Set by the app, daily	Palace stations give context to Anki cards on the same topic
Connection Notes	Links across fields, analogies, combined ideas and patterns	Monthly	Strong links become new palace stations and new Anki cards
Decision Log	Why decisions were made, which options were turned down and which assumptions held	Quarterly	Fix in Anki any wrong fact that a decision exposed
Annual Review Palace	One key idea per book, project or learning cycle each year	A yearly walk, plus a look back over 5 years	Sets what you aim to learn next year

The system runs on **one simple rule**. If the knowledge is a single fact or definition, it goes in Anki. If it is a concept, argument, framework or story, it goes in a Palace.

Cross-references join the two. A cross-reference is a note in one place that points to another. Each palace station that holds a concept should have a matching Anki card. That card tests the concept's core claim, and its answer names the palace place.

Key idea:

Single facts go in Anki. Concepts, arguments, frameworks and stories go in a palace. Cross-references join the two, so they work as one.

When you review in Anki, the palace place **works as a cue**. When you walk the palace, the Anki card keeps the concept sharp over time.

Anki cards work best when each holds **one small idea** (Wozniak, 1999). The Anki manual adds that a card taking over 60 seconds needs simplifying.

Is the knowledge...	Send it to	Then
A single fact, name, date or definition?	Anki only	Make 1 card. Put the question on the front and a one-sentence answer on the back.
A concept, framework or argument with several parts?	Memory Palace	Make 1 station. Add 1 Anki card that names the palace place.
A sequence of steps, such as a procedure?	Story chain and Anki	Store the steps as a story. Make an Anki card that tests one step in the middle.
A link between two ideas you already have?	Connection Notes and Palace	Write the link in 2 sentences. Build a new palace station for it.
A story, such as a case study or historical event?	Memory Palace	Use one station per big change in the story. Make an Anki card that tests how it ends.
A word in a foreign language?	Anki and a keyword image	Make a sentence card with the word in context. Create the image as you store it.

> Exercise:
>
> 7.8, The Integration Audit: Sort What You Already Know. Follow these five steps.

Step	What to do
1	Open your Anki decks and review 20 cards at random. Take any card whose answer needs more than 1 sentence out of the deck. It belongs in a palace.
2	Look through the memory palaces you are using. Find any station that holds a simple fact, such as a date, a name or a single definition. Move it to Anki, and keep the palace simple.
3	For your 3 most important fields, count your Anki cards and your palace stations. This shows how your knowledge is split between the two tools.
4	Add cross-references. Make sure each palace station has a matching Anki card. Write the palace place in the card's notes field.
5	Find any field where you have Anki cards but no palace. That field lacks a structure to hang its facts on. This week, build a palace of at least 5 stations for it.

Quick check:

1. Where does a single fact or definition go? Answer: Anki.
2. When does a card need simplifying, by the Anki manual? Answer: When it takes over 60 seconds.
3. In the audit, what do you do with a card whose answer needs more than 1 sentence? Answer: Take it out of the deck. It belongs in a palace.

How to Encode Books into Memory Palaces

BOOKS PACK **a great deal of knowledge** into a small space. Yet everyday reading habits serve them poorly. It is like filling a bath with the plug out. The method below turns any nonfiction book into a memory structure you can walk through.

It takes about 45 to 60 minutes per book, counting the later reviews. It has **three phases**. You prepare before and during reading, and you store right after you finish. Then you review over the next 30 days.

Phase	When	What to do	What it gives you
Before reading	Before you start	Read the table of contents and write 3 questions you want answered. Skim the chapter headings, and guess the book's argument.	A clear aim, so you notice what is relevant
While reading	Each chapter	Pick 1 key idea per chapter and mark it. Do not mark everything. Aim for one idea, one mark and one image forming in your mind.	Active storing as you read
Right after	Within 1 hour of finishing	Build a Book Palace of 5 to 7 stations, one per key idea. Store each idea as a vivid, specific, moving image.	A structure in space for the book's core argument
Anki cards	The same day	Make 5 to 10 cards on striking figures, surprising findings, definitions and practical uses. Give each single fact its own card.	Reviews of the evidence and detail, timed by the app
Connection notes	The same day	Write 3 sentences, such as "This idea links to [something I know] because..." In my view, this is where the system pays off.	Your knowledge starts to build on itself
Review 1	After 24 to 48 hours	Walk the Book Palace from memory. Check that you recall all 5 to 7 stations, and rebuild any that are vague.	A first check in the days when forgetting is fastest
Review 2	After 7 days	Walk it again. Add the book to your Annual Review Palace as one station, with one sentence that sums up the whole book.	The book joins your long-term structure
Review 3	After 30 days	Walk the Book Palace once more. Then keep reviewing it from time to time.	A firmer memory of the book

Forgetting is fastest in the first day, and then it slows down. This pattern is called the forgetting curve. A modern repeat of Ebbinghaus's forgetting study found the same (Murre & Dros, 2015). That is why the first review comes so soon.

The 5 to 7 station limit **makes you choose**. You must decide which few ideas matter most. In my view, that choice makes you read more deeply.

Testing yourself also beats rereading. Students who practised recall remembered more of a passage than those who reread it. That held on tests two days and a week later (Roediger & Karpicke, 2006). No study has yet set a Book Palace against rereading.

Roediger & Karpicke, 2006



That held on tests two days and a week later (Roediger & Karpicke, 2006).

Key idea:

Pick 5 to 7 ideas, store each as an image and review after 1 to 2 days, 7 days and 30 days, and you have a book you can walk through.

> Exercise:
>
> 7.9, Live Book Encoding Session. Follow these seven steps.

1. Choose a nonfiction book you read in the last 3 months. You will store it now.
2. Open it at the table of contents. From memory first, write down the 5 ideas you think matter most in the book.
3. Skim the chapters that match your 5 ideas. Confirm or change your list.

4. Choose a place for the palace. Use a route you know well, such as your home or a regular walk. Walk it in your mind, and give each idea one station.
5. At each station, make one vivid, specific image that captures the idea. The image must hold the idea itself. An image that only shows the idea exists is not enough. Test it this way. Could someone who saw only your image rebuild the idea?
6. Make 5 Anki cards for this book. Include one surprising fact, one key definition, one figure and one way to use the idea. Add one summary card that starts "The author argues that...".
7. Review the palace after 24 hours, and check how vivid it is. Review it again after 7 days, and then after 30.

Quick check:

1. When is forgetting fastest? Answer: In the first day (Murre & Dros, 2015).
2. How many stations does a Book Palace have? Answer: 5 to 7, one per key idea.
3. Has any study set a Book Palace against rereading? Answer: No, not yet.

How to Structure Your Annual Knowledge Review

The annual review is **a key yearly event** in the Personal Knowledge System. Think of it as a check of your knowledge. You are not studying here. It works like a yearly check-up at the doctor. You check what you have stored, what has kept its value and what has faded.

The annual review



It works like a yearly check-up at the doctor.

You also look for links across the year that were hard to spot then. The blocks below add up to **210 minutes**, about 3.5 hours. In my view, it gives you a clear picture of your own knowledge.

Block	Length	What to do	What it gives you
Block 1	30 minutes	Walk your Annual Review Palace, a Memory Palace with one station per book you read this year, added year by year. Check that you can recall each book's core idea.	A list of what you kept
Block 2	30 minutes	Look at your Anki statistics. Find the decks where you forget cards most often. These are your knowledge gaps, so note the top 3 areas.	Your gaps, named
Block 3	45 minutes	Write a summary of your year in learning. Note the themes that ran across your books and fields. Note what surprised you and what changed your mind.	A map of links across fields
Block 4	30 minutes	Check what is out of date, using the approach in the module on keeping knowledge current. Mark old palace stations to replace, and delete old Anki cards.	Knowledge that stays clean and current
Block 5	30 minutes	Plan next year's learning. From your gaps and new themes, pick 3 fields to focus on and 12 books to read.	A learning plan for next year
Block 6	30 minutes	Update your main connection notes. Name the most important change in your thinking this year, and store it.	An updated knowledge system
Final walk	15 minutes	Walk your updated Annual Review Palace, with the new year's stations added. This walk covers your whole year of learning in 15 minutes.	Everything joined together

The Annual Review Palace is **a map of how your thinking has grown**. A bookshelf or reading log holds the books themselves. This palace holds what each book gave your thinking. That might be a framework you now use, or an idea that joined two others.



A bookshelf of the year's books beside a reading log.

The palace has one station per book. At 20 to 40 books a year, five years gives you **100 to 200 stations**. Walking them lets you retrace years of growth in your thinking.

Five years of stations

One station per book — 20 to 40 books a year — 100 to 200 stations in five years

The palace has one station per book.

Key idea:

One yearly review of about 3.5 hours and one station per book give you a clear picture of your own knowledge.

> **Exercise:**
> 7.10, The Annual Knowledge Review Protocol. Follow these six steps.

1. Book a 3 to 4 hour slot in December or January. Treat it as a fixed yearly commitment.
2. If you do not yet have an Annual Review Palace, create one. Choose a route you walk often. Give each year one landmark of its own. Give each book one station between landmarks.
3. Work through Blocks 1 to 6 in order. Do not skip Block 3, the summary of your year. In my view, the year's value takes shape here.
4. If you change your Anki deck settings, know what each one does. The Starting Ease setting applies only to new cards as they first graduate. It does not change cards you already have. With the FSRS scheduler, ease options are hidden. Desired Retention is then the main control. A shorter Maximum Interval means more reviews.

5. Write one sentence on the most important thing you learned this year. Store it as the last station in this year's part of the palace.
6. Set a calendar reminder for the same review in 12 months. The system keeps building only if you keep it going.

Quick check:

1. How long do the review blocks add up to? Answer: 210 minutes, about 3.5 hours.
2. At 20 to 40 books a year, how many stations will you have after five years? Answer: 100 to 200.
3. When should you book the review? Answer: A 3 to 4 hour slot in December or January.

The Complete Book Retention System: From First Page to Lasting Knowledge

Everything above comes together here in **one start-to-finish protocol**, a fixed set of steps you follow each time. It helps you keep each nonfiction book you read. It is like a pilot's checklist before every flight. Use it as a reference card, and pin it near where you read.

Follow it for every book until it becomes automatic. By its own table, it takes **about 45 to 60 minutes** per book. Of that, 30 to 40 minutes fall on the day you finish. Once it is a habit, that time should feel like the real work of reading.

Stage	Action	Time	Result
Before	Skim the table of contents. Write your 3 reading questions, and guess the main argument.	5 minutes	A clear aim for reading
During	Mark one thing per chapter, the most important idea. No more.	As you go	Active reading
After, day 0 (the day you finish the book)	List your 5 to 7 ideas. Build the Book Palace. Store each idea as a vivid, moving image.	15 to 20 minutes	The palace is built
After, day 0	Make 5 to 10 Anki cards for single facts, figures and definitions from the book.	5 to 10 minutes	The facts are stored
After, day 0	Write 3 Connection Notes that link the book's ideas to what you already know.	5 minutes	The book is linked in
Day 1 to 2	Walk the Book Palace. Rebuild any station that feels vague.	5 to 10 minutes	A first check
Day 7	Walk it again. Add the book to your Annual Review Palace, summed up in one sentence.	5 minutes	The book joins your long-term store
Day 30	Walk it once more, and check how much you recall. Keep reviewing from time to time after this.	5 minutes	A firmer memory
Yearly	Walk your Annual Review Palace, where this book is now 1 station. Check that you recall its core idea.	1 minute	The book stays in view

Use this protocol on every book for a year. You will end with a palace that holds the ideas of **20 to 40 books**. The aim is to recall core arguments when needed. You also want to link ideas across fields.

Key idea:

Use the same steps for every book and walk it on day 1 to 2, day 7 and day 30, and each book stays in view.

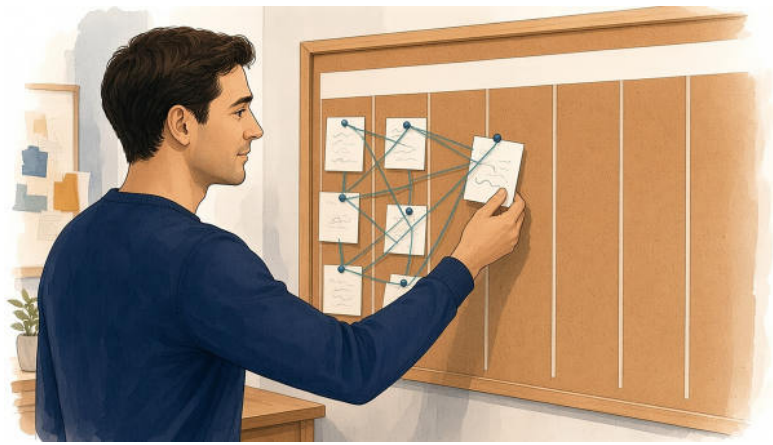
In my view, this needs **no rare feat of memory**. It comes from a well-designed system, used week after week. The techniques alone can give striking one-off results. I hold that a system used steadily changes how you learn.

Quick check:

1. How much of the 45 to 60 minutes falls on the day you finish? Answer: 30 to 40 minutes.
2. When is the first walk of the Book Palace after you finish? Answer: Day 1 to 2.
3. How many books will your palace hold after a year? Answer: The ideas of 20 to 40 books.

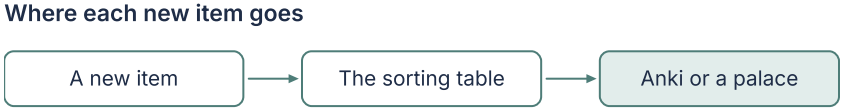
Building Your Complete Personal Knowledge System in One Week

This seven-day plan builds the full Personal Knowledge System **from scratch**. Each day adds one part. By day seven, you will have a working system ready for any new knowledge.



A seven-day plan on a wall, with one new part added each day.

You still decide **where each new item goes**. The sorting table in the Anki and palace section helps. The system can keep growing for years.



The sorting table in the Anki and palace section helps.

> **Exercise:**
> 7.11, The Seven-Day Knowledge System Build. Follow these seven steps.

1. Day 1, structure. Name your 3 main fields of knowledge. For each one, choose a palace location and create an Anki deck. Write the 5 most important questions you have about that field.
2. Day 2, what you already know. List every book you read in the last year. For each one, write the idea you remember most clearly. Count them. This is your starting count.
3. Day 3, storing a book. Choose the book from Day 2 you value most. Build its Book Palace today. Use 5 to 7 stations with vivid images, and walk it three times.
4. Day 4, linking Anki. Make sure each of your 3 fields has at least 20 active Anki cards. Add cross-references from palace stations to the matching cards.
5. Day 5, a mental model palace. List the 10 frameworks, mental models or decision rules you use most. Build a Mental Model Palace for them, and walk it.

6. Day 6, the Annual Review Palace. Create the route, and make this year its first section. Build one station for each book you stored this week. Walk the whole route.

7. Day 7, review the system. Hold a 1-hour mini annual review. Ask what themes link your three fields. Ask what the week's most important idea was. Store that idea. Then book a 20-minute slot on the same day each week, for upkeep, the regular care that keeps something working.

The system takes seven days to build, then **steady care** from then on. That care is the practice. It is like a garden, where planting takes a week but weeding never stops. It means weekly palace walks, daily Anki review and storing each book you finish. It also means the annual review that lets it all add up.

Steady care

The idea		What it is like
Building the system	≈	Planting a garden in a week
Keeping it going	≈	Weeding that never stops

It means weekly palace walks, daily Anki review and storing each book you finish.

The weekly slot covers this system's upkeep. Any blueprint you follow has **its own routine on top**. In my view, the system grows more useful each year. Each new field adds to it.

Key idea:

Seven days to build, weekly care and a yearly review give you a system that grows more useful each year, in my view.

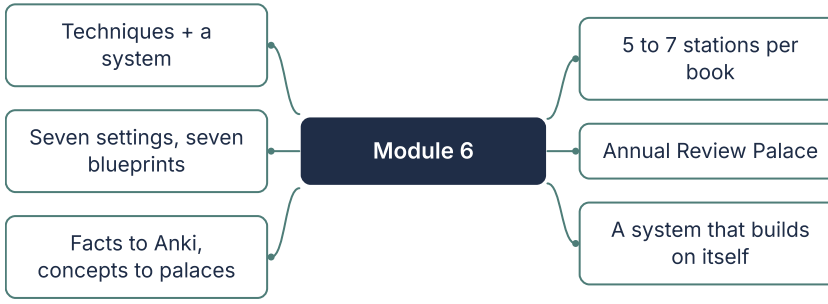
Quick check:

1. How long is the day 7 mini annual review? Answer: 1 hour.
2. By day 4, how many active Anki cards should each field have? Answer: At least 20.
3. How long is the weekly upkeep slot? Answer: 20 minutes.

Module 7 Key Takeaways

> **Key Concept:**
>
> Module 7 Key Takeaways
>
> In my model, mastering techniques and building a system are separate skills. The system decides whether the techniques give lasting results.
>
> There are seven settings and seven blueprints. Each one maps the tools, layers and weekly routine for that setting.
>
> The rule for joining Anki and the palace is simple. Facts go to Anki, concepts go to palaces, and cross-references link the two.
>
> Each nonfiction book gets a palace of 5 to 7 stations. It also gets 5 to 10 Anki cards and 3 connection notes. By my own table, this takes 45 to 60 minutes per book.
>
> The Annual Review Palace is a map of your thinking that you can walk. The full yearly review takes about 3.5 hours.
>
> In my view, the system keeps building on itself. Each year adds links, so new learning has more to connect to.

Module 6 at a glance



In my view, the system keeps building on itself.

Module 8: Overcoming Memory Challenges

BEFORE YOU TRY TO fix a memory problem, **find which part is failing**. It works like a car repair. A good mechanic finds the broken part before fixing anything. The overview table links common symptoms to likely causes. It also gives a first step for each.

Find the broken part first

The idea	What it is like
Find which part of memory is failing	A good mechanic finds the broken part before fixing anything

Before you try to fix a memory problem, find which part is failing.

Everyone forgets. The key question is **why you forget**, and whether the cause can be fixed. Many memory lapses come from strategy, attention or lifestyle. These can often be changed.



Some memory problems have **medical causes** (National Institute on Aging, n.d.). Examples include thyroid problems, medication side effects, depression and low vitamin B12.



A person reads the side effects listed on a medicine box.

This module shows **how to work out what is going wrong**. It then gives steps aimed at each cause. It also looks at ageing and memory.

A major 2024 report looked at **14 risk factors that can be changed**. Risk factors are things that make a problem more likely. It estimated they account for about 45% of dementia cases (Livingston et al., 2024). Dementia is an illness of the brain that harms memory and thinking enough to get in the way of daily life. In theory, nearly half of cases could be prevented or delayed. Still, some of these links may be only partly cause and effect.

Risk factors that can be changed

14 risk factors that can be changed → About 45% of dementia cases (Livingston et al., 2024)

Key idea:

Find why you forget, then aim a step at that cause. Many causes can often be changed.

Module Overview

- Find your own patterns of memory failure.
- Use targeted steps for short-term, long-term and working memory problems.
- Understand how stress and sleep affect memory.
- Build an evidence-based plan to keep your memory working well through life.
- Understand how ageing affects memory, and what you can do about it now.

Module Overview



Find why you forget, then aim a step at that cause.

Common Memory Problems

Diagnosing Your Memory Failures

To fix a memory problem, you first need to **name it clearly**. "I have a bad memory" is a complaint. It does not yet say what is wrong. So ask which memory system is failing, when it fails and why.

Symptom	Likely cause	Memory system affected	First step
You forget things right after hearing them	Too little attention while taking them in, or distraction	Short-term memory (the memory that holds a few items for a short time) and working memory (short-term memory that also works on what it holds)	Do one thing at a time. Give new information your full attention before you act on anything else.
You study but cannot recall it in exams	Passive revision with no self-testing, and too much rereading	Storing in long-term memory (the store that keeps what you know for days, years or life), and getting it back out	Switch to self-testing now. Rereading feels like learning, but it helps less.
You remember faces but not names	Names are labels with no meaning or picture of their own	Memory for events and for facts	Use the name in the conversation straight away. Make an image that links the name to a feature of the face.
You forget where you put things	You put them down on autopilot, without noticing	Memory for events	Say what you are doing out loud: "I am putting my keys on the kitchen counter." This makes you notice the act.
Your mind goes blank under pressure	Short bursts of stress can weaken the front of the brain, which helps with recall	Recall under stress	Practise recall in advance, which can protect memory under stress. Slow breathing may help you calm down, but it has not been tested on recall.
You remember old things better than new ones	Taking longer to learn new things is usually a normal part of ageing	Forming new memories of events	Use planned memory strategies, and see the sections on ageing for what the evidence supports.

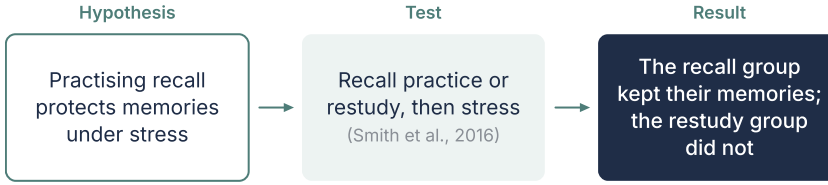
The table gives you **a starting point** for any memory difficulty. Two links in it rest on research.

The first is that **stress can block recall** of things you know. It works like a safe with a stuck lock. The papers are still inside, but the door will

not open. Stress hormones can weaken the front of the brain within minutes (Arnsten, 2009).

The second link is the fix. In one study, some people had practised recall and others had only restudied. Under stress, **the recall group kept their memories**, but the restudy group did not (Smith et al., 2016). So if your mind goes blank under pressure, practise recall in advance.

Recall practice under stress



In one study, some people had practised recall and others had only restudied.

The slower learning of new things is **common with age**. The National Institute on Aging (n.d.) says this is usually normal ageing. Serious memory problems are different. The sections on ageing explain when to see a doctor.

> **Science Says:**
> How well you take information in shapes how well you keep it. Self-testing helps people remember more over days than rereading does (Roediger & Karpicke, 2006).

Many everyday lapses **start when information goes in**. This step is called encoding. These are often the easiest kind to fix.



A person tests herself with cards, with her notes closed.

The HALT Encoding Check

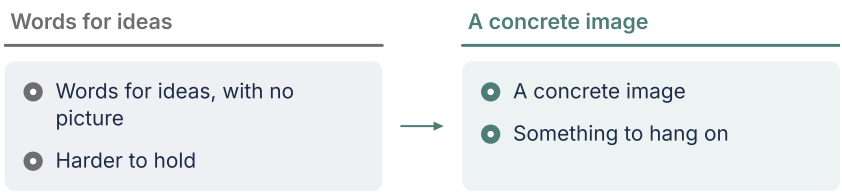
HALT is **a quick four-question check**. You run it before you treat any new information as stored. It works on the input end of memory. It is like checking that a parcel is sealed and labelled before you post it.

H: Have I given this my full attention? Perhaps you were doing two things at once, or your mind was wandering. Then the memory may never have formed. Attention comes first.

A: Have I associated it with something I already know? A fact with no links to other knowledge is fragile. Tie it to something you know well.

L: Have I linked it to a bright image or a detail from the senses? Words for ideas, with no picture, are harder to hold. A concrete image gives the memory something to hang on.

L: a bright picture



Link it to a bright image or a detail from the senses.

T: Have I tested my encoding? Recall the information once, soon after you take it in. Self-testing is one of the best-supported ways to strengthen memory (Roediger & Karpicke, 2006).

Use HALT for **anything that truly matters**. Examples are a name, a task, a key detail, an instruction or a decision. It takes only a few seconds. In my view, those seconds are some of the best effort you can spend.

Key idea:

HALT = four quick questions before you treat anything as stored: full attention, a link to what you know, a bright picture and a quick test.

The first exercise uses the table and HALT over a week of real life. It shows you **your own patterns of failure**. Every plan to improve memory starts there.

> **Exercise:**
> 8.1, Memory Failure Audit. Follow these four steps.

1. For the next 7 days, keep a Memory Failure Log in your journal. Each time you forget something, note three things. What did you forget? When did you need it? What were you doing when you took it in?
2. After 7 days, review your log. Look for patterns. Check whether failures cluster in one area, such as names, tasks or study.
3. Match each pattern to the table above. This gives you a plan aimed at your own problems.
4. Use the first steps for your top two patterns for the next 14 days. Log your results.

Memory Failure Audit



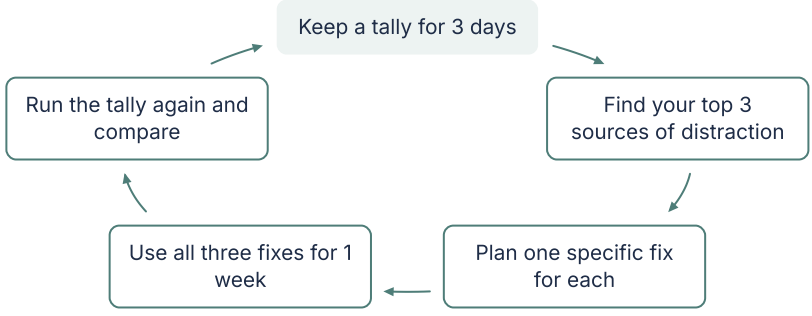
This gives you a plan aimed at your own problems.

The audit shows what fails. The Attention Audit shows **when it fails**. It finds the moments when split attention stops information from reaching memory at all.

> **Exercise:**
> 8.2, The Attention Audit. Follow these five steps.

1. For 3 days, keep a tally. Mark each time you catch yourself not fully attending. This might be in a conversation, lecture or meeting, or while reading.
2. For each one, note the situation and what distracted you. It might be a thought, your phone, background noise or tiredness. Estimate roughly what share of the conversation you missed.
3. After 3 days, work out your average share of attention in each setting. Note where your attention holds best, and where it breaks up most.
4. Find your top 3 sources of distraction. Plan one specific fix for each. For example, put your phone face down in conversations. Write an agenda before each meeting, so you know what to attend to. Do a 2-minute breathing exercise before you study.
5. Use all three fixes for 1 week. Then run the tally again and compare.

The Attention Audit



Note where your attention holds best, and where it breaks up most.

Yi-Yuan Tang, Michael Posner and colleagues tested **a short training** (Tang et al., 2007). People did a mind-body practice for 20 minutes a day, for 5 days. Compared with relaxation training, they showed better attention scores.

Anxiety, tiredness and a stress hormone were all lower in this group. Change can start **within days**.

Attention failures happen before storing. Stress failures **happen at recall**. The information is there, but stress gets in the way of bringing it up. The next exercise lets you test this on yourself.

Where each failure happens



The information is there, but stress gets in the way of bringing it up.

> **Exercise:**
> 8.3, The Stress and Memory Performance Test. Follow these five steps.

1. Phase 1, baseline. Study a list of 20 random words for 2 minutes in normal conditions. Recall them after 10 minutes, and write down your score.
2. Phase 2, stress. Study a different list of 20 words. Just before you recall them, spend 2 minutes thinking about a real worry. Then recall the list.
3. Phase 3, recovery. Study a third list of 20 words. Before you recall it, spend 2 minutes breathing slowly from the belly. Breathe in for 4 counts, hold for 4 and breathe out for 6. Then recall the list.

4. Compare your three scores. See whether thinking about a worry lowered your score, and whether slow breathing changed it.
5. This is a personal test with one person and three lists. It cannot prove a cause. Still, it shows you how stress may affect your own recall.

Slow breathing in Phase 3

Breathe in	Hold	Breathe out
4 counts	4 counts	6 counts

Breathe slowly from the belly for 2 minutes before you recall.

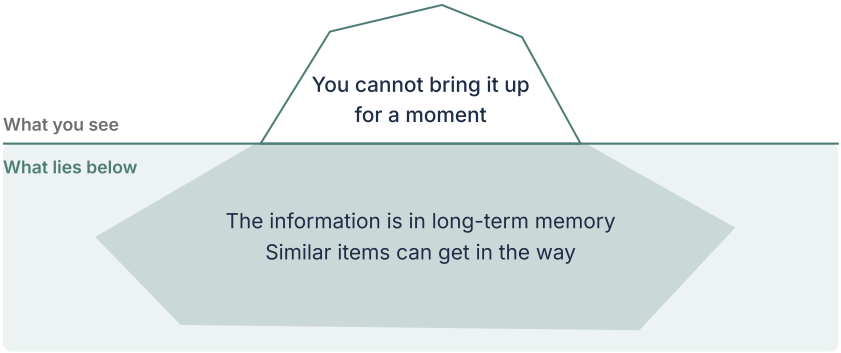
A different kind of recall failure is **the tip-of-the-tongue state**. The information is in long-term memory, but for a moment you cannot bring it up. Similar items can get in the way. The next protocol gives you a set of cues to try.

> Exercise:
> 8.4, The Tip-of-the-Tongue Resolution Protocol. Follow these five steps.

1. In a tip-of-the-tongue state, you know that you know something but cannot recall it. It is frustrating, but it also shows you how recall works.
2. Next time it happens, do not strain harder. Straining makes you tense, and that can make recall harder. Work through the cues below in order.
3. Cue 1, the first letter. Ask what letter the word starts with. Even an unsure guess can bring the answer.

4. Cue 2, the setting. Ask where you last met this word or name. Recall who was there and what you were doing. Going back to the setting in your mind can help.
5. Cue 3, the category. Ask what kind of thing it is and what it is like. Going through nearby words can lead you to the missing one.
6. Cue 4, let it go. Stop searching. The answer often comes back later, once you stop trying.

The tip-of-the-tongue state



Burke and colleagues asked adults to keep **tip-of-the-tongue diaries** for four weeks (Burke et al., 1991). Names were the largest group of targets, mostly of people not seen lately. Older adults had more of these moments.

The researchers blamed **weaker links between a word and its sound**. Rare use, no recent use and ageing all weakened those links. The name-face method in the techniques module is built for this.

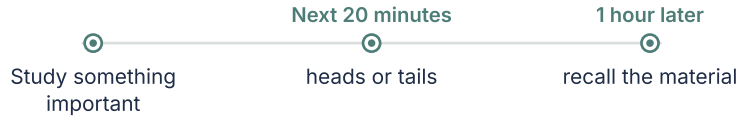
Interference happens when **similar memories compete** during recall. New information can disrupt what you have only just learned. It works

like wet paint, which smudges if something brushes it too soon. This is called retroactive interference.

> Exercise:
>
> 8.5, The Interference Reduction Experiment. Follow these six steps.

1. Retroactive interference means new information getting in the way of memories you have just formed. It is a common cause of forgetting that people rarely notice.
2. This week, test it yourself. After you study something important, flip a coin. It decides what you do for the next 20 minutes.
3. Heads means high interference. For 20 minutes, take in new words and ideas. Read articles, watch the news or have a complex conversation.
4. Tails means low interference. For 20 minutes, do something with few words. Take a gentle walk, stretch lightly or rest without talking.
5. Recall the material 1 hour later. Repeat the test several times, and compare your scores.
6. Notice whether quiet rest helps you. In one study, people heard a story and then rested quietly for 10 minutes (Dewar et al., 2012). Others played a spot-the-difference game. The resters recalled more, both soon after and a week later.

When to recall



Repeat the test several times, and compare your scores.

With these tools in place, you can **take the longer view**. Memory can be kept and built through life. That goes beyond fixing problems as they come.

Quick check:

1. What can stress hormones do to the front of the brain? Answer: They can weaken it within minutes, and that part helps with recall (Arnsten, 2009).
2. Under stress, which group kept their memories? Answer: The people who had practised recall. The restudy group did not (Smith et al., 2016).
3. What do the four HALT questions ask about? Answer: Full attention, a link to something you already know, a bright picture and a quick test.

Memory and Ageing

How Ageing Affects Memory

Ageing and memory have **a more mixed and more hopeful story** than many people think. Some parts of memory do change with age. But the changes are not the same for everyone, and **some risks can be lowered**.

Many of the steps that help are **open to anyone, at any age**. You can start today.

A mixed and hopeful story

Mixed	Hopeful
⊕ Some parts of memory do change with age	⊖ Some risks can be lowered
⊕ The changes are not the same for everyone	⊖ Many steps are open to anyone, at any age

Ageing and memory have a more mixed and more hopeful story than many people think.

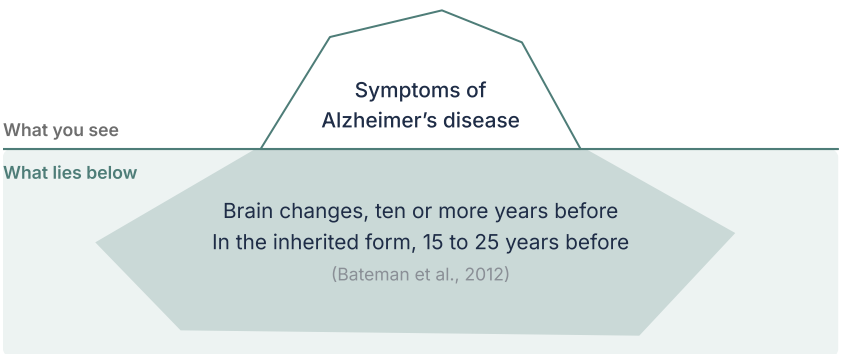
What changes with age
You may not recall information as well, or as quickly.
Needing more time to learn new things is usually normal with age.
Holding several things in mind at once may get somewhat harder.
Memory for recent events is more open to change than settled knowledge.
Forming new memories is more affected than keeping old ones.
Different abilities peak at different ages. Some do not peak until the 40s or later.

The National Institute on Aging (n.d.) lists **the first two changes as usual**. A study of nearly 50,000 people online looked at many abilities (Hartshorne & Germine, 2015).

The abilities **rose and fell at different times**. Some peaked around the end of school, and some in the 30s. Others peaked in the 40s or later.

Alzheimer's disease is a brain illness that can cause dementia, harming memory and thinking over time. In it, brain changes may start **ten or more years before symptoms**. This comes from the National Institute on Aging (n.d.). In the inherited form, some changes showed up 15 to 25 years before expected symptoms (Bateman et al., 2012).

Before symptoms



This comes from the National Institute on Aging (n.d.).

The 2024 Lancet Commission, a large group of experts whose report sets out what raises and lowers dementia risk, found **14 risk factors for dementia** that can be changed (Livingston et al., 2024). Together, they account for an estimated 45% of cases.

In theory, removing them all could **prevent or delay nearly half** of dementia cases. This is about whole groups of people. It does not promise that any one person will avoid dementia. The report adds that some links may be only partly cause and effect.

The 14 factors are less education early in life, **hearing loss** and high LDL cholesterol. They also include depression, head injury, physical inactivity, diabetes and smoking. The rest are high blood pressure, obesity, heavy drinking and social isolation. Air pollution and untreated vision loss complete the list.

Key idea:

With risk factors you can change and steps open to anyone, some risks can be lowered.

When to See a Doctor

Some memory changes are normal with age. Others are **a reason to get checked**. The table below gives examples from the National Institute on Aging (n.d.).

Normal ageing	Possible dementia
Now and then making a poor choice	Often making poor choices and judgments
Missing one monthly payment	Struggling to manage monthly bills
Forgetting the day, then recalling it later	Losing track of the date or the season
Now and then forgetting a word	Finding it hard to hold a conversation
Losing things now and then	Often misplacing things and not finding them

Serious memory problems can make **driving, phoning or getting home hard**. Some causes are treatable, such as thyroid problems, depression and low vitamin B12. Medication side effects are another. The NIA also urges caution about supplements and brain games sold as dementia prevention.

The Alzheimer's Association (n.d.) gives **10 warning signs**. If you notice any of them, it advises seeing your doctor. In its own words, the signs are:

- memory loss that disrupts daily life
- challenges in planning or solving problems
- difficulty completing familiar tasks
- confusion with time or place
- trouble understanding visual images and spatial relationships
- new problems with words in speaking or writing
- misplacing things and losing the ability to retrace steps
- decreased or poor judgment
- withdrawal from work or social activities
- changes in mood and personality

⚠ **Caution:** Sudden problems are an emergency. Sudden confusion, or sudden trouble speaking or understanding speech, can signal a stroke (Centers for Disease Control and Prevention, 2026). Call 9-1-1 right away.

The audit below shows **where you stand** on these risk factors. It turns the research into steps for your own life.



The audit shows where you stand on these risk factors.

> **Exercise:**
> 8.6, The Ageing Brain Risk Audit. Follow these five steps.

1. Review the 14 risk factors listed above.
2. Rate yourself honestly on each one. Low risk means it does not apply or is well managed. Medium risk means it is present but manageable. High risk means it is present and you are not yet dealing with it.
3. Pick your top 1 or 2 high or medium risk factors.
4. For each one, write one specific action you could take this week. Make it a single action, not a resolution. You might book a blood pressure check or a hearing test. Or you might walk for 20 minutes today.
5. Take that action this week. Come back to this exercise in one month and audit yourself again.

The Ageing Brain Risk Audit



Make it a single action, not a resolution.

Exercise can **change the brain**. In a trial, 120 older adults did a year of aerobic exercise or stretching (Erickson et al., 2011). Aerobic exercise gets your heart and breathing going, such as brisk walking.

In the exercise group, **the hippocampus grew by 2%**. The hippocampus is a brain area key to memory. The authors said this reversed 1 to 2 years of age-related loss. In the stretching group, it shrank.

Cognitive reserve, a store of strength against decline in the brain, **builds up over years**. It works like the padding in a helmet. A bigger cushion lets you cope with a loss before it shows. The next exercise turns it into a steady practice.

> **Exercise:**
> 8.7, The Cognitive Reserve Builder. Follow these five steps.

1. Cognitive reserve is the brain's toughness. It is its ability to cope with damage before symptoms appear. It is built by hard mental work through life. The Lancet Commission lists less early education

as a risk factor. It also links mentally demanding work to lower risk (Livingston et al., 2024).

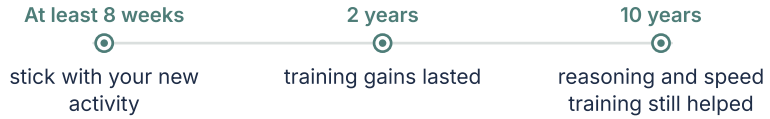
2. This week, start a mentally demanding activity that is new or rare for you. You could learn an instrument or a new language. You could take an online course in an unfamiliar subject, or learn chess or Go. You could take up a complex craft, such as woodworking or coding. Or you could join a book group.

3. It must be truly new to you, beyond more of what you already do well. It must also keep stretching you as you improve.

4. Stick with it for at least 8 weeks. In a large trial of older adults, training gains lasted 2 years (Ball et al., 2002). At 10 years, reasoning and speed training still helped those skills (Rebok et al., 2014). Memory training no longer helped memory.

5. Track your progress. Each week, note what you found hard and what became easier.

How long gains last (Ball et al., 2002; Rebok et al., 2014)



At 10 years, memory training no longer helped memory.

Quick check:

1. How many dementia risk factors that can be changed did the 2024 Lancet Commission find? Answer: 14, which together account for an estimated 45% of cases (Livingston et al., 2024).
2. What happened to the hippocampus after a year of aerobic exercise? Answer: It grew by 2% in the exercise group, and it shrank in the stretching group (Erickson et al., 2011).
3. What should you do about sudden confusion or sudden trouble speaking? Answer: Call 9-1-1 right away, as it can signal a stroke.

Techniques to Maintain Memory with Age

Some things can be changed and some cannot. Knowing which is which helps you **spend your effort well**.

The table below sets out **the main options**. It shows what the evidence says and how to put each one into practice. It also says what to expect.

Option	Evidence	How to do it	What to expect
Aerobic exercise	In a trial with 120 older adults, a year of aerobic exercise grew the hippocampus by 2%. That reversed about 1 to 2 years of age-related loss (Erickson et al., 2011). A review of 18 studies found fitness training helped thinking skills, most of all for planning and control (Colcombe & Kramer, 2003).	30 minutes of moderate aerobic activity, such as brisk walking, swimming or cycling, 5 days a week	A possible gain in hippocampus size and in some thinking skills
Mental training	In a large trial, reasoning training cut reported problems with daily tasks over 5 years. Memory and speed training had no clear effect on this (Willis et al., 2006). At 10 years, memory training no longer helped memory (Rebok et al., 2014).	Learn new skills, such as an instrument or a language	Gains mostly in the skills you train
Social life	A review found that an active, socially connected life in later years is linked with protection against dementia (Fratiglioni et al., 2004).	Regular social activities, group learning, discussion groups and community life	A possible lower dementia risk
Good sleep	In 20 healthy adults, one night without sleep raised a protein tied to Alzheimer's, called beta-amyloid, in parts of the brain (Shokri-Kojori et al., 2018).	7 to 9 hours of regular sleep, a fixed sleep and wake schedule, and a dark, cool bedroom	Better-stored memories
MIND diet	MIND mixes the Mediterranean and DASH diets. In one long-term study, people who followed it most closely had a 53% lower rate of Alzheimer's (Morris et al., 2015). The study only observed people, though. It did not put them into groups, so it was an observational study. A 3-year trial found no clear benefit to thinking over a control diet (Barnes et al., 2023).	Leafy greens daily, berries 3 times a week, fish twice a week, olive oil and little processed food	Unclear. The trial found no clear benefit.
Mindfulness (paying attention to what is happening right now, without judging it)	In a small study, an 8-week mindfulness course raised grey matter (the parts of the brain packed with nerve cells) in part of the hippocampus (Hölzel et al., 2011). There were 16 people in the course and 17 on a waiting list.	10 to 20 minutes of mindfulness meditation daily, yoga, tai chi or time in nature	A possible change in brain structure. Effects on memory were not tested.

These options form **the evidence base**. The weekly protocol below turns them into a routine. It fits around work and home life.

Key idea:

Exercise, new skills, friends and sleep make up a weekly brain health plan. The table shows how strong the evidence is for each part.

From evidence to routine



The weekly protocol below turns them into a routine.

> Exercise:
> 8.8, The Brain Health Weekly Protocol. Follow these seven steps.

1. Use the table above to design a 7-day brain health plan. Make it suit your current life. Then follow it.
2. Aerobic exercise. Book 30-minute sessions on at least 4 of the 7 days. Walk, cycle, swim or jog. Doing it steadily matters more than the type.
3. Mental challenge. Spend 15 minutes a day on a new skill that keeps getting harder. Take care with brain games sold as a way to prevent dementia. The National Institute on Aging (n.d.) urges caution about them. The 2024 Lancet Commission looked at computer brain training (Livingston et al., 2024). It found only weak evidence of short-term gains, and none of lasting gains.

4. Social life. Plan at least 2 meaningful social contacts this week. It could be a dinner or a group activity. Or you could call a friend you have not spoken to lately.
5. Sleep. Set a steady bedtime and wake time. Aim for 7 to 9 hours. Put screens away for 30 minutes before bed.
6. Mindfulness. Spend 10 minutes a day on focused breathing or guided meditation. Morning or evening both work.
7. At the end of the week, rate your memory from 1 to 10. Compare it with your starting score from the practical exercises module.



Spend 10 minutes a day on focused breathing or guided meditation.

The FINGER trial ran **a two-year programme** for 1,260 older adults (Ngandu et al., 2015). All were at risk of decline. It had four parts: diet, exercise, mental training and checks on heart risks.



Older adults take part in a two-year health programme together.

Thinking scores **rose slightly more** with the programme than without it. The gap was small, but the statistics showed it was real.

The FINGER trial



Thinking scores rose slightly more with the programme than without it.

A larger trial has since followed. US POINTER enrolled 2,111 adults and compared a structured programme with a self-guided one (Baker et al., 2025). The structured group did **slightly better**.

A healthy brain gives memory its base. Sleep helps decide **whether each day's learning is stored** for the long term. It is like pressing save before you close a file. The sleep audit below shows which parts of your own sleep matter most.

> Exercise:
> 8.9, The Sleep Architecture Audit. Follow these six steps.

1. Different stages of sleep seem to support different kinds of memory. Deep sleep and dreaming sleep both play a part. The details are more complex than a simple split.
2. For 7 nights, keep a sleep log. Note your bedtime, roughly how long you took to fall asleep and any waking. Also note your wake time and how well you slept, from 1 to 10.
3. Also note any alcohol you drank, any exercise and any screen use before bed. Note how warm your bedroom was. Alcohol delays

dreaming sleep at all doses (Ebrahim et al., 2013). In most of the studies reviewed, moderate and high doses also cut total dreaming sleep. A review found evening exercise was generally fine for sleep (Stutz et al., 2019). Hard exercise ending within an hour of bed might be the exception.

4. After 7 nights, look for patterns. Find the nights you slept best, and see what they had in common.
5. Make one change based on what your own log shows. Choose a specific change, not a general resolution.
6. Check whether your memory exercise scores track the previous night's sleep. This is only a personal check, so it cannot prove a cause.

Before bed

	Alcohol	Evening exercise
Effect on sleep	Delays dreaming sleep at all doses (Ebrahim et al., 2013)	Generally fine for sleep (Stutz et al., 2019)

Hard exercise ending within an hour of bed might be the exception.

Sleep shapes how memories are stored. **Stress is the other major body-based threat** to memory. The next practice works on how you recover from it.

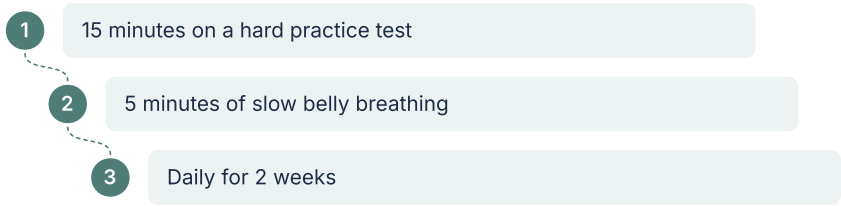
> **Exercise:**
> 8.10, The Stress Inoculation Practice. Follow these five steps.

1. Long-term stress can harm the brain areas used for thinking (Lupien et al., 2009). The effects depend on when stress happens

and for how long. Much of the evidence on brain structure comes from animals. In my view, mild stress followed by recovery may help you cope better. This idea is called **stress inoculation**. It works like a vaccine, where a small dose trains you to cope with the real thing.

2. This week, take on some mild mental stress on purpose. Do a hard practice test on a topic you only partly know. Spend 15 minutes on it, and accept the discomfort of not knowing.
3. Straight after, spend 5 minutes breathing slowly from the belly. Breathe in for 4 counts, hold for 7 and breathe out for 8. Repeat this 4 to 6 times.
4. Notice how you feel before and after.
5. Practise this daily for 2 weeks, after tests and after any other stressful moment. The aim is to calm down faster after stress. Slow breathing may help you feel calmer. No study has tested this method on memory.

Stress inoculation practice



Slow breathing may help you feel calmer.

Quick check:

1. In the FINGER trial, how did thinking scores change? Answer: They rose slightly more with the programme than without it. The gap was small (Ngandu et al., 2015).
2. What did the 3-year MIND diet trial find? Answer: No clear benefit to thinking over a control diet (Barnes et al., 2023).
3. What does alcohol do to dreaming sleep? Answer: It delays dreaming sleep at all doses (Ebrahim et al., 2013).

Targeted Steps for Specific Memory Problems

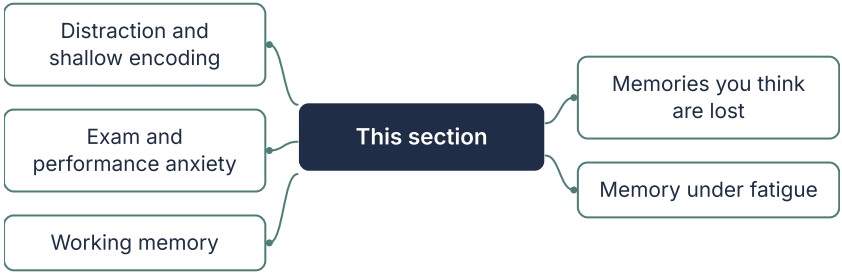
The table at the start of this module named **common memory failures and their causes**. This section goes further. It gives detailed steps for five common memory problems.

For each one, you will find **what goes wrong** and the evidence for each approach. Each also comes with a structured exercise.

Key idea:

What goes wrong, the evidence and an exercise make one targeted step for each problem.

Five common memory problems



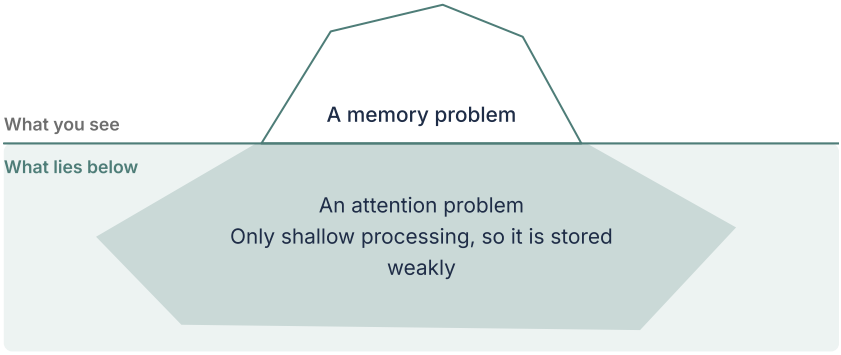
Each comes with a structured exercise.

Overcoming Distraction and Shallow Encoding

A COMMON CAUSE OF MEMORY failure is **divided attention while you take information in**. Often the memory itself is working fine.

Information may arrive while you are multitasking, thinking of something else or on autopilot. Then it gets only **shallow processing** and is stored weakly. It is like pouring water into a cup while you look away. Much of it misses the cup. This looks like a memory problem, but it starts as an attention problem. The fix is to stop accepting distracted input in the first place.

It starts as an attention problem



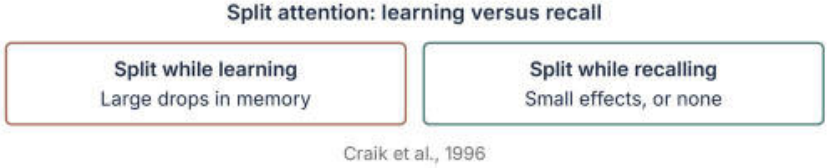
Often the memory itself is working fine.

> Definition:
>
> **SHALLOW PROCESSING:** taking in only the surface of information, so it is stored weakly.



A person on autopilot hears new information while looking at a phone.

Craik and colleagues compared splitting attention while learning with splitting it while recalling (Craik et al., 1996). Split attention during learning caused **large drops in memory**. Split attention during recall had small effects, or none.

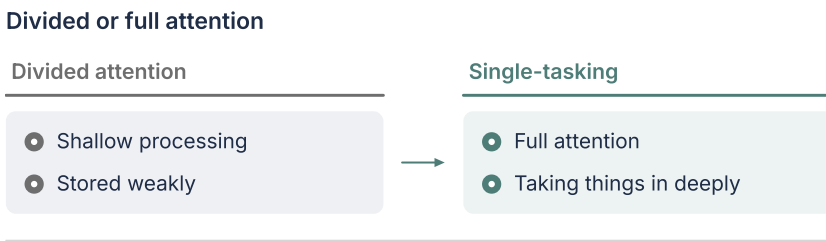


The fix is **the same at every age**. Give full attention whenever something needs to be remembered.

Key idea:

With split attention while learning, information gets only shallow processing and is stored weakly.

> **Key Concept:**
> In my view, divided attention is a frequent cause of poor learning today. It is also one you can change.



Divided attention is one cause you can change.

The Single-Tasking Protocol tackles it head on. It **rebuilds the focus** that constant partial attention has worn away.

> **Exercise:**
> 8.11, The Single-Tasking Protocol. Follow these five steps.

1. For one full working day, do one thing at a time. When you are doing something, do only that. Play no music with lyrics in the background, and keep your phone off the desk. Keep email closed in meetings, and stay off social media while you eat.
2. This will feel uncomfortable. The discomfort shows how used you have become to splitting your attention.
3. Before any conversation you need to remember, put your phone away and face the speaker. Make eye contact. Repeat back what you hear in your own words. Each of these steps keeps your attention on the speaker.

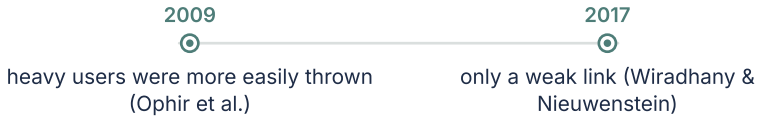
4. At day's end, think about how well you recall its events, talks and facts. Compare this with a typical day of multitasking.

5. Keep the protocol going for a full week. See whether single-tasking starts to feel more natural than split attention.

Many people believe **they multitask well**. Ophir and colleagues compared heavy and light users of many media at once (Ophir et al., 2009). The heavy users were more easily thrown by irrelevant things, and worse at switching tasks.

Two later replications (repeats of the study, to see whether the result held) and a review of studies found **only a weak link** (Wiradhany & Nieuwenstein, 2017). After correcting for small studies, the link was no longer reliable. Even so, splitting attention while learning does harm memory, as Craik's work shows.

Do heavy multitaskers do worse?



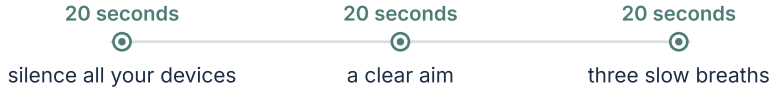
After correcting for small studies, the link was no longer reliable.

Single-tasking sets up the conditions for **taking things in deeply**. The Pre-Encoding Preparation Ritual builds on it. It is a short routine to prepare yourself before each important learning session.

> Exercise:
> 8.12, The Pre-Encoding Preparation Ritual. Follow these five steps.

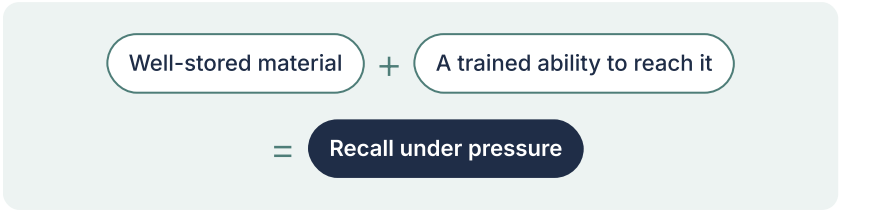
1. Before a lecture, meeting or talk you need to remember, spend 60 seconds getting ready.
2. Step 1, 20 seconds. Put down or silence all your devices. Turn your body toward the source of information.
3. Step 2, 20 seconds. Ask yourself, "What do I most need to remember from this?" Setting a clear aim helps you notice what matters.
4. Step 3, 20 seconds. Take three slow, deep breaths to settle yourself.
5. These 60 seconds cost nothing. Longer mindfulness training has shown benefits. In one randomised study, students took a 2-week mindfulness course (Mrazek et al., 2013). A randomised study puts people into groups by chance, so the groups can be fairly compared. Their working memory and reading test scores improved, and their minds wandered less.

Getting ready in 60 seconds



Preparation helps you take information in. Recall under pressure is **a different challenge**. It needs well-stored material. It also needs a trained ability to reach it when stress works against you.

Recall under pressure



Quick check:

1. When does split attention hurt memory most? Answer: While you learn. Split attention during recall had small effects, or none (Craik et al., 1996).
2. What did the later review find about heavy media multitaskers? Answer: Only a weak link, and it was no longer reliable after correcting for small studies (Wiradhany & Nieuwenstein, 2017).
3. How long does the Pre-Encoding Preparation Ritual take? Answer: 60 seconds, in three steps of 20 seconds.

Conquering Exam and Performance Anxiety

SOMETIMES YOU KNOW MATERIAL well in private study but **go blank in the exam**. This is one of the most upsetting memory problems. Its cause is physical, not moral.

Known at home, gone in the exam

	In private study	In the exam
The material	Known well	Goes blank

This is one of the most upsetting memory problems.



A student goes blank in an exam, though she knew the material at home.

Even mild stress you cannot control can quickly **weaken the brain's front area** (Arnsten, 2009). That area helps with recall on purpose.

The material is **still stored**. For a while, though, you cannot reach it. The answer is to train recall itself. Simply studying harder is not the answer.

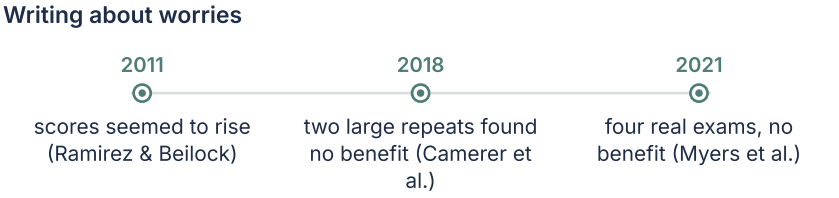
In one study, people learned material by testing themselves or by restudying it (Smith et al., 2016). A day later, **stress harmed memory only in the restudy group**.

Key idea:

In one study, memory held up under stress after self-testing before the exam.

> **Science Says:**
> Writing about worries is a popular tip for exam anxiety, but the evidence is mixed. In one 2011 study, students wrote briefly about test worries just before an exam (Ramirez & Beilock, 2011). Their scores seemed to rise, most of all for anxious students.

Two large repeats of the lab study **found no benefit** (Camerer et al., 2018). A classroom study across four real exams found no such benefit (Myers et al., 2021). Anxiety did not fall, and scores did not rise. For now, self-testing has firmer support.



Anxiety did not fall, and scores did not rise.

The Stress-Inoculated Retrieval System

First, **train under pressure**. Do not test yourself only when you are comfortable. Practise recall standing, against a timer, in front of someone or after 10 jumping jacks. In my view, this gets you used to recalling under pressure.



A student practises recall standing up, against a timer.

Second, **load the context in advance**. Before an exam or big presentation, recall where you studied on purpose. Picture the room, the time of day and any sounds or smells. Memory is often better when the setting at recall matches the setting at learning (Godden & Baddeley, 1975). This is called the setting effect. The setting works like a bookmark. Being back in the same place helps you open to the right page.

The setting effect

The idea		What it is like
Recalling where you studied	≈	A bookmark that helps you open to the right page

Load the context in advance.

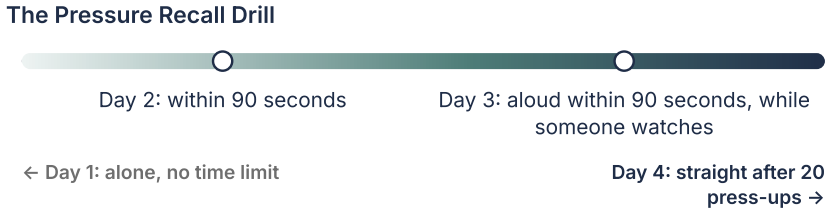
Third, **pause and breathe**. If you go blank, try not to panic further. Take one slow breath: in for 4 counts, hold for 7 and out for 8. This may help you settle, though it has not been tested on recall.

Fourth, **script the worst case**. Before any big event, write a plan for what might go wrong. Use the form "If I blank on X, I will do Y". In my view, a backup plan eases worry beforehand.

Pressure training makes **high-stakes recall feel normal**. The Pressure Recall Drill builds this step by step.

> Exercise:
>
> 8.13, The Pressure Recall Drill. Follow these seven steps.

1. Study a list of 20 items for 3 minutes in normal conditions.
2. Over four separate days, recall it under four conditions that get steadily more stressful.
3. Day 1. Recall alone, with no time limit. Write down your score.
4. Day 2. Recall within 90 seconds. Write down your score.
5. Day 3. Recall aloud within 90 seconds, while another person watches you. Write down your score.
6. Day 4. Recall straight after doing 20 press-ups, adding physical stress to the task. Write down your score.
7. Compare your scores. If they drop from Day 1 to Day 3, keep practising under pressure. Aim for your Day 3 score to match your Day 1 score. This drill is my own, and no study has tested it.



Aim for your Day 3 score to match your Day 1 score.

Sometimes you learned something well but **cannot reach it in a new setting**. The recall setting is too unlike the place where you learned. The Contextual Retrieval Anchor gives you more than one setting to draw on.

> Exercise:
> 8.14, The Contextual Retrieval Anchor. Follow these five steps.

1. Choose material you are studying for a test, presentation or exam.
2. Study each main topic in two or three different places and positions. You might sit at your desk, stand in the kitchen or walk in the garden.
3. Vary the senses too. Sometimes study with music and sometimes in silence. Sometimes have a specific scent nearby, such as a candle or coffee.
4. At the exam or event, you will then have several anchors to draw on. The exam room may be unlike your study room. Even so, some of the settings you used may partly match it.
5. Godden and Baddeley (1975) showed the **setting effect** with divers. Divers who learned words underwater recalled them better underwater than on land. The reverse was also true. Studying in

more than one place is a known approach (Smith, Glenberg, & Bjork, 1978). You cannot always control where you recall, but you can vary where you study.

Vary the senses

- [x] Sometimes study with music
- [x] Sometimes in silence
- [x] Sometimes with a specific scent nearby

You will then have several anchors to draw on.

Context anchors make **recall more reliable**. Working memory, your mental space for holding things in mind, can also limit you.

Quick check on the system

1 If you go blank, how should you breathe?

2 What form should a worst-case plan use?

Answers

1 In for 4 counts, hold for 7 and out for 8 2 If I blank on X, I will do Y

Context anchors make recall more reliable.

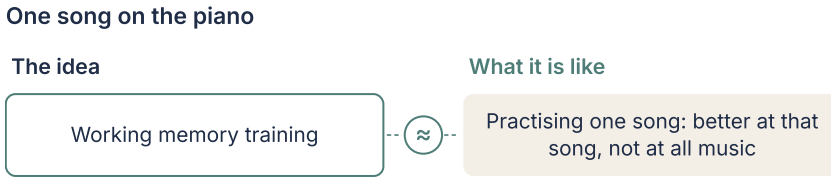
Quick check:

1. In the self-testing study, whose memory did stress harm? Answer: Only the restudy group's. The self-testing group held up (Smith et al., 2016).
2. Did writing about worries help in later tests? Answer: No. Two large repeats of the lab study found no benefit (Camerer et al., 2018), and neither did a classroom study (Myers et al., 2021).
3. What did the divers show? Answer: Words learned underwater were recalled better underwater than on land, and the reverse was also true (Godden & Baddeley, 1975).

Making the Most of Working Memory

Beyond taking information in and getting it out, there is **a third limit**. That limit is working memory. It is the mental workspace where you hold and handle information in the moment. It plays a part in learning, reasoning and performance.

Training can improve **how you do on working memory tasks**. The open question is whether those gains spread to other skills. The evidence so far says they mostly do not. It is like practising one song on the piano. You get better at that song, which does not make you better at all music.



The evidence so far says the gains mostly do not spread.

Klingberg and colleagues ran **a trial of working memory training** (Klingberg et al., 2005). The 53 children in it had ADHD and were 7 to 12 years old. ADHD is a condition where a person often struggles to keep attention, or is restless and acts without thinking, or both. It shows up in more than one place and gets in the way of daily life. Training improved an untrained working memory task. It also showed effects on other measures, including reasoning.



Children aged 7 to 12 do working memory training in a trial.

Later reviews **told a different story**. One pooled 87 publications (Melby-Lervåg et al., 2016). People did get better, for a while, at tasks like the ones they trained. It found no convincing evidence of gains in broader ability, reading or arithmetic.



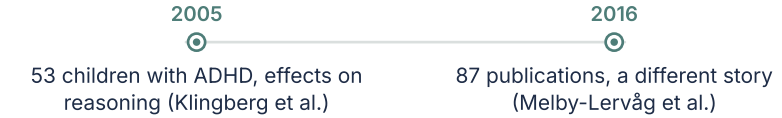
Melby-Lervåg et al., 2016

> **Science Says:**
> Working memory training mostly makes you better at the tasks you train. Treat the programme below as practice for those tasks. It is unlikely to raise your intelligence.

Key idea:

Working memory training brings gains on the trained tasks, but mostly not beyond them.

Working memory training studies



It is unlikely to raise your intelligence.

A second route **works from the other side**. You can cut needless demands on working memory. That frees room for the tasks that need it. The Working Memory Expansion Programme comes first.

> Exercise:
>
> 8.15, The Working Memory Expansion Programme. Follow these six steps.

1. This is a 4-week training plan that gets harder each week.
2. Week 1, digit span, the number of digits you can hold at once. Each day, have someone read you random digits at 1 per second. A digit span app also works. Recall them in order. Start with 5 digits. Add one digit each time you get 3 right in a row. Track your best span each day.
3. Week 2, backwards span. Do the same, but recall the digits in reverse order. Now you must work with the digits as well as hold them. That demands much more of working memory.

4. Week 3, dual task. Hold a 5-digit string in mind while you read a short paragraph aloud. At the end of the paragraph, recall the digits. Add 1 digit each time you succeed twice.
5. Week 4, complex span. Read a sentence and judge whether it is true or false. Then hold its last word in mind. After 4 or 5 sentences, recall all the last words in order. This is the reading span task, a standard working memory measure (Daneman & Carpenter, 1980).
6. Track your scores each day, and plot them each week. Expect to improve on these tasks. Do not expect the gains to spread much beyond them.

The Working Memory Expansion Programme



Expect to improve on these tasks, not much beyond them.

Often, working memory failures come less from small size and **more from overload**. Cognitive load is how much work your working memory is doing at one time. Too much information competes for the same small space. It is like a small plate at a buffet. Pile on too much food and some falls off. The Cognitive Load Reduction System eases that load.

> **Exercise:**
> 8.16, The Cognitive Load Reduction System. Follow these five steps.

1. The aim is an outside system that handles routine load. Your working memory is then free for what matters.
2. Step 1, move the trivial out of your head. Put any recurring task, appointment or commitment into a system you trust. A calendar, task manager or note app will do. Once it is captured, you no longer need to hold it in mind.
3. Step 2, chunk before you start. Before a complex task, spend 2 minutes on paper. Sort the relevant information into 3 to 5 chunks. Having the structure on paper eases the load during the task.
4. Step 3, cut distractions around you. Close browser tabs you are not using. Silence notifications. Clear your desk.
5. Step 4, offload on purpose. Write down what you are thinking about. In my view, getting thoughts onto paper frees working memory for new information. That is one reason active note-taking can help, as opposed to copying word for word.

The Cognitive Load Reduction System

- [x] Move the trivial out of your head
- [x] Chunk before you start
- [x] Cut distractions around you
- [x] Offload on purpose

Your working memory is then free for what matters.

David Allen's book Getting Things Done is about **capturing unfinished tasks**. You put them in an outside system you trust.

Lab studies **point the same way**. Goals left open led to unwanted thoughts and poorer work on other tasks (Masicampo & Baumeister, 2011). Making a specific plan for the goal removed these effects.

Easing the load **gives you room to think**. Sometimes, though, the problem is material that has faded a long way. Relearning can bring much of it back.

Quick check:

1. What did the review of 87 publications find? Answer: People got better for a while at tasks like the ones they trained. It found no convincing evidence of gains in broader ability, reading or arithmetic (Melby-Lervåg et al., 2016).
2. In the lab studies, what removed the effects of goals left open? Answer: Making a specific plan for the goal (Masicampo & Baumeister, 2011).
3. In Week 1 of the programme, when do you add a digit? Answer: Each time you get 3 right in a row.

Recovering Memories You Think Are Lost

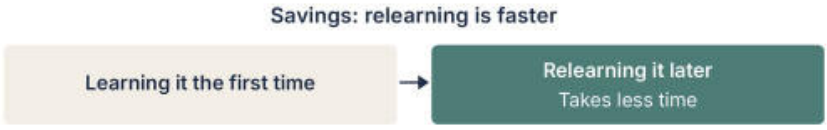
You may have forgotten something **you once knew well**. It might be a language you studied for years, a skill or a course. It can feel like a permanent loss. Often, though, much of it is still there.

Lost or still there?

It can feel like	Often
A permanent loss	Much of it is still there

It might be a language you studied for years, a skill or a course.

Ebbinghaus measured this as **savings** (Ebbinghaus, 1885). Relearning material you once knew takes less time than learning it the first time. It is like a song you once knew by heart. A few plays bring it back faster than learning a new one. A modern repeat of his work found the same (Murre & Dros, 2015). Savings is measured by behaviour, as the time saved in relearning.



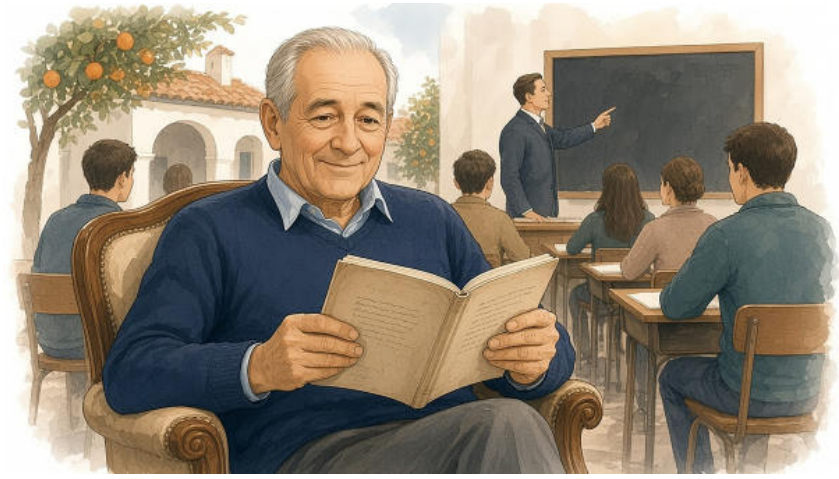
Ebbinghaus, 1885; Murre & Dros, 2015

> Definition:
>
> **SAVINGS:** relearning something faster than it took to learn the first time.

Key idea:

First learning time minus relearning time = savings.

Languages **can last a long time**. One study tested 733 people on school Spanish, learned up to 50 years earlier (Bahrick, 1984). Their memory fell for the first 3 to 6 years. Then it held steady for as long as 30 years.



An older adult recalls Spanish words learned at school long ago.

Large parts were **still there after 50 years**, even without use. How much they kept depended on how well they first learned it.

School Spanish (Bahrick, 1984)

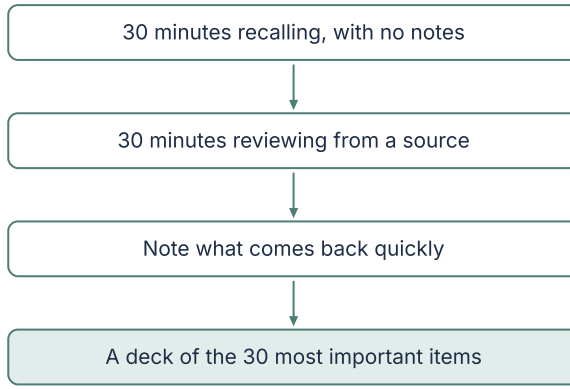


Large parts were still there after 50 years, even without use.

> **Exercise:**
> 8.17, The Relearning Sprint. Follow these five steps.

1. Choose a subject, language or skill you once studied. You should not have used it for 2 years or more. Pick one you feel you have largely lost.
2. Spend 30 minutes recalling everything you can, with no notes or books. Write or say whatever comes to mind. Do not judge how patchy it is.
3. Now spend 30 minutes reviewing the same material from a source. A textbook, notes or course materials all work. Note what comes back quickly and what feels truly new.
4. The material that came back quickly may not have been lost at all. Seeing or hearing it again was enough to bring it back. This is savings at work.
5. Build a spaced repetition deck (cards you review after longer and longer gaps) of the 30 most important items from the subject. Review them over the next 3 weeks. Notice how quickly you regain your old level, compared with how long it first took.

The Relearning Sprint



What came back quickly may not have been lost at all.

Relearning shows **how much remains** after you seem to have forgotten. A language you once studied is a good place to test this.

> Exercise:
> 8.18, The Forgotten Language Reactivation. Follow these six steps.

1. Use this if you feel you have lost most of a language you once studied. It shows how much may still be there.
2. Day 1. Without any aids, write every word you can remember in the language. Do not strain. Write whatever comes up, then count the words.
3. Day 2. Spend 20 minutes listening to the language at native speed. A news broadcast, a podcast or a film will do. Do not try to understand it. Just listen, and notice roughly what share of words feel familiar.

4. Day 3. Learn 20 new words with the Keyword Method, linking each new word to a familiar word that sounds like it, through a bright picture. Notice whether storing them feels faster than it would for a complete beginner.

5. Week 2. Start a daily 15-minute Anki review (Anki is a flashcard app that uses spaced repetition), using an existing word deck for your language. Notice whether words you could not recall in week 1 start coming back.

6. In my view, relearning a language is a clear example of savings. It can also be a strong reason to keep studying.

The Forgotten Language Reactivation

When	What you do
Day 1	Write every word you can remember, then count them
Day 2	20 minutes listening at native speed
Day 3	Learn 20 new words with the Keyword Method
Week 2	A daily 15-minute Anki review

It shows how much of a language may still be there.

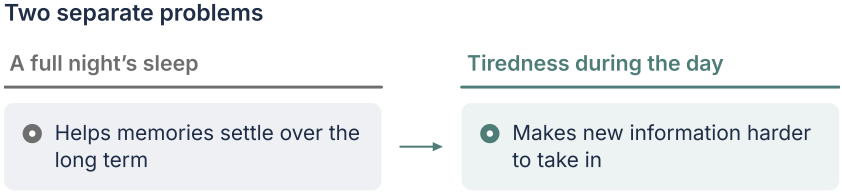
Tiredness is **another common threat** to memory. Even when you cannot avoid it, you can protect your memory.

Quick check:

1. What is savings? Answer: Relearning material you once knew takes less time than learning it the first time (Ebbinghaus, 1885).
2. In the school Spanish study, what happened after the first 3 to 6 years? Answer: Memory stopped falling and held for as long as 30 years (Bahrick, 1984).
3. What did how much people kept depend on? Answer: How well they first learned it.

Managing Memory Under Fatigue

A full night's sleep helps memories **settle over the long term**. Tiredness during the day is a separate problem. It makes new information harder to take in. Still, you can do something about it.



Lack of sleep **harms memory**. It is like a camera with a smudged lens. It still takes pictures, but they come out blurry. The hippocampus is a brain area key to forming memories.

In one study, people went **a night without sleep** (Yoo et al., 2007). Their hippocampus was less active as they stored new memories. They also kept less of what they learned.

Tiredness **can rival alcohol**. One study kept people awake for 17 to 19 hours (Williamson & Feyer, 2000). On some tests, they did as badly as at 0.05% blood alcohol (how much alcohol is in your blood, given as a percent), or worse.

Still, many people **run on too little sleep**. They lean on caffeine and willpower, or accept poor performance as normal.

Key idea:

In one study, after a night without sleep, the hippocampus was less active and people kept less.

Below are steps to **protect memory when you cannot avoid tiredness**. A short nap uses sleep to give you a quick boost. A study schedule built around your own alertness takes the wider view.

Two steps against tiredness

	A short nap	A study schedule
What it does	Gives you a quick boost	Takes the wider view, built around your own alertness

Both protect memory when you cannot avoid tiredness.



A tired person takes a short nap.

> **Exercise:**
> 8.19, The Memory-Protective Power Nap Protocol. Follow these four steps.

1. Naps can help learning. In one study, people napped for 60 to 90 minutes, with deep and dreaming sleep (Mednick et al., 2003). The nap helped them learn a visual skill. It gave about the same gain as a night of sleep. The task was spotting fine visual patterns, not general memory.
2. To try a short nap, set an alarm for 25 minutes. That allows about 5 minutes to fall asleep and 20 minutes of sleep. Lie down somewhere comfortable and dark.
3. Try the nap on 3 days in a row this week. Before each nap, and 30 minutes after waking, test yourself on 15 random words. Compare your scores from before and after.
4. See whether your recall is better after the nap. This is a personal test, so it cannot prove a cause.



To try a short nap, set an alarm for 25 minutes.

NASA studied naps in **21 commercial long-haul airline pilots** (Rosekind et al., 1994). The 12 in the rest group had a planned 40-minute rest in the cockpit. They slept for about 26 minutes of it. The rest went with sharper alertness and performance on landing.

> **Exercise:**
> 8.20, The Fatigue-Aware Study Schedule. Follow these five steps.

1. Not all mental work suits the same time of day. Insight problems need a sudden new view of the problem. In one study, people solved them better when they were less alert (Wieth & Zacks, 2011). Time of day had no consistent effect on step-by-step problems. In my view, detailed work such as memorising suits your peak hours.
2. This week, rate your alertness from 1 to 10 every hour, from waking to sleeping. After 3 days, plot your alertness curve.
3. Move your most memory-heavy study or work into your peak hours. Keep routine or admin tasks for your low points.
4. If you must study when your alertness is low, keep sessions to 15 minutes. Do more self-testing than new learning. Add movement, such as standing, writing by hand or reading aloud.
5. Track whether matching tasks to your alertness helps you. Compare your recall on weeks with and without the new schedule.

Insight or step by step

	Insight problems	Step-by-step problems
Time of day	Solved better when less alert	No consistent effect

Wieth and Zacks (2011) found this in one study.

Quick check:

1. How did 17 to 19 hours awake compare with alcohol? Answer: On some tests, people did as badly as at 0.05% blood alcohol, or worse (Williamson & Feyer, 2000).
2. What should you set the alarm to for a short nap? Answer: 25 minutes, which allows about 5 minutes to fall asleep and 20 minutes of sleep.
3. When did people solve insight problems better? Answer: When they were less alert (Wieth & Zacks, 2011).

Memory failures are **signs to read**. They are not sentences to serve. Many of them can be traced to specific causes that you can work on.

Key Concept:

Module 8 Key Takeaways

Attention is the gateway to memory. You cannot remember what you did not fully attend to.

Stress can affect memory, depending on when it happens and how long it lasts. Learning to manage stress is part of looking after memory.

Ageing does not doom memory. Age remains the biggest known risk for dementia. Still, some risk factors can be changed, such as inactivity, hearing loss and social isolation.

You can start looking after your brain now, at any age.

Use the checklist below to **track your work** through Module 8.

Exercise: Module 8 Completion Checklist. Fixing Memory Failures and Protecting Memory for the Long Term	
Core ideas to remember	
[ ]	Attention is the gateway to memory. You cannot remember what you did not attend to.
[ ]	Many everyday memory lapses start when information goes in.
[ ]	Stress can affect memory, depending on its timing and how long it lasts.
[ ]	Tip-of-the-tongue states are blocks in recall. Use the cue protocol.
[ ]	Ageing does not doom memory. Some risk factors can be changed.
[ ]	The Lancet Commission links early education, mentally demanding work, exercise and social contact to dementia risk.

[ ]	Splitting attention while learning harms memory. It is one you can change.
[ ]	Start now, at any age.
Foundational exercises to do first	
[ ]	Exercise 8.1, Memory Failure Audit, to find your own failure patterns
[ ]	Exercise 8.2, The Attention Audit, to see how often your attention breaks up
[ ]	Exercise 8.6, Ageing Brain Risk Audit, to find risk factors you can change
All exercises	
[ ]	Exercise 8.1, Memory Failure Audit
[ ]	Exercise 8.2, The Attention Audit
[ ]	Exercise 8.3, Stress and Memory Performance Test
[ ]	Exercise 8.4, Tip-of-the-Tongue Resolution Protocol
[ ]	Exercise 8.5, Interference Reduction Experiment
[ ]	Exercise 8.6, Ageing Brain Risk Audit
[ ]	Exercise 8.7, Cognitive Reserve Builder
[ ]	Exercise 8.8, Brain Health Weekly Protocol
[ ]	Exercise 8.9, Sleep Architecture Audit
[ ]	Exercise 8.10, Stress Inoculation Practice
[ ]	Exercise 8.11, Single-Tasking Protocol
[ ]	Exercise 8.12, Pre-Encoding Preparation Ritual
[ ]	Exercise 8.13, Pressure Recall Drill
[ ]	Exercise 8.14, Contextual Retrieval Anchor
[ ]	Exercise 8.15, Working Memory Expansion Programme
[ ]	Exercise 8.16, Cognitive Load Reduction System
[ ]	Exercise 8.17, Relearning Sprint

[ ]	Exercise 8.18, Forgotten Language Reactivation
[ ]	Exercise 8.19, Memory-Protective Power Nap Protocol
[ ]	Exercise 8.20, Fatigue-Aware Study Schedule
Daily practice habits	
[ ]	Single-task during your most important learning sessions.
[ ]	Run the Pre-Encoding Preparation Ritual before each study session.
[ ]	Run the HALT check before you learn anything you need to keep: full attention, a link to what you know, a bright picture and a quick test.
[ ]	Do one Pressure Recall Drill a week.
Actions to take this week	
[ ]	Do your Memory Failure Audit over the next 7 days.
[ ]	Do the Ageing Brain Risk Audit, and name your top 2 risk factors.
[ ]	Put the Brain Health Weekly Protocol in your calendar.
[ ]	Run the Stress and Memory Performance Test to see how stress affects your own recall.
[ ]	Set one single-tasking rule this week, such as keeping your phone away while you study.

Overcoming memory challenges takes **careful diagnosis, targeted steps and patient practice**. Heroic effort is not needed. The module on tools and resources comes next. It covers outside tools that extend your memory system beyond the brain alone.

Module 9: Tools and Resources

Key Concept:

Module Overview

People in the ancient world trained memory with their minds alone. Today you can also use apps, study platforms and practice software. This module looks at the tools with the best support. It also covers the study habits with the strongest evidence.

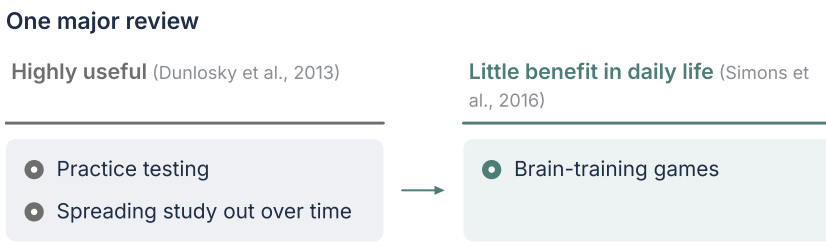
THIS MODULE SORTS MEMORY tools by **type, main use and cost**. It is like a spice rack with a label on each jar. You can then pick tools that suit your goals.

Sorting the tools



This module sorts memory tools by type, main use and cost.

One major review rated **only two study techniques** as highly useful (Dunlosky et al., 2013). These were practice testing, which means quizzing yourself on what you studied, and spreading study out over time. Brain-training games, apps that turn memory and focus tasks into games, help on the trained tasks. Yet they show little benefit in daily life (Simons et al., 2016).



Brain-training games help on the trained tasks.

Key idea:

The right tool and a well-tested study habit give you memory gains you can use. Brain games alone give gains mostly on the games.

In This Module

- Learn the main types of memory apps and tools.
- Learn how to use digital tools well.
- Learn the two study habits that one review rated highest.

Digital Tools and Apps

DIGITAL TOOLS FOR MEMORY training have grown a great deal. Finding a tool is no longer the hard part. It is like a shop with a hundred kinds of hammer. **Choosing the right one** is harder.



Finding a tool is no longer the hard part.

The overview that follows **links each type of tool** to the jobs it suits. Use it to find tools that match what you are training now.

> Definition:
>
> **DIGITAL TOOL:** an app or program on a phone or computer.

Key idea:

A tool matched to the job you are training now is a tool that helps.

Quick check:

1. What is now the hard part? Answer: Choosing the right tool. Finding one is easy.
2. What does the overview link each type of tool to? Answer: The jobs it suits.

The Best Tools for Memory Training

THE TABLE LISTS COMMON tools by type, main use and cost. I give no formal method for choosing them. Treat the table as **a map**. It is like a town map, which shows where things are. It does not rank them.

Dual n-back findings



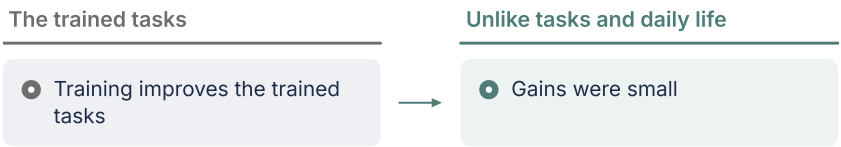
An early study reported gains in fluid intelligence, the ability to solve new problems (Jaeggi et al., 2008).

Tool	Type	Best For	Key Feature	Cost
Anki	Spaced-repetition flashcards	Long-term recall of facts; languages; medical study	Choice of two schedulers (SM-2-based or FSRS), the part of the app that decides when each card comes back; shared decks	Free on computer, web and Android; iPhone app $24.99
Dual n-back	Working-memory task where you track two streams and spot items that match the one from N steps back	Practising a hard memory task	Gains mostly on similar tasks	Free versions exist
Lumosity	Brain-training games	Tracking scores over time	Lab tasks adapted into games; progress tracking	Free, with in-app purchases
Elevate	Language and thinking games	Reading, writing, speaking, memory and maths	40+ games; performance tracking	Free: one 3-game workout a day; full: $39.99/yr or $9.99/mo
Readwise	Reading review	Keeping ideas from books and articles	Daily review of saved passages; separate flashcard feature	30-day free trial, then from $5.59/mo billed yearly
RemNote	Notes plus flashcards	Students and knowledge workers	Notes and cards in one app; AI cards with limits	Free; Pro $8/mo; Pro with AI $18/mo (billed yearly)

Prices are **US list prices** from each maker's site or app store. They may change after publication.

Brain-training apps **need care**. A major review found that training improves the trained tasks (Simons et al., 2016). Gains on unlike tasks and in daily life were small.

Brain-training apps need care



Simons et al., 2016.

In dual n-back, you spot items that match one shown a few steps back. An early study reported gains in **fluid intelligence**, the ability to solve new problems (Jaeggi et al., 2008).



A person watches a screen, spotting items that match one a few steps back.

Later work found gains **only on similar tasks** (Harrison et al., 2013). A meta-analysis found no convincing gains in intelligence (Melby-Lervåg et al., 2016).

A trial by Lumosity's maker found small gains on its own tests (Hardy et al., 2015). In 2016, the Federal Trade Commission charged Lumos Labs over its claims. The company settled for **$2 million**. The agency said claims about work, school and ageing lacked support (Federal Trade Commission, 2016).

Lumos Labs



The company settled for $2 million.

A scheduler **decides when each card comes back**. Since version 23.10, Anki has offered two. One is based on the older SM-2 method, and the other is FSRS. Anki does not call either one “optimal”.



Flashcards come back on a schedule in a review app.

Readwise picks saved passages for its daily review **partly by chance**. Its spaced repetition sits in a separate feature called Mastery. RemNote can turn notes into cards with AI. Each plan limits how often you can do this.

Comparing Spaced-Repetition Apps

This table lists **features only** and does not rank the apps. Spacing helps retention in general. The best gap grows with how long you need to remember (Cepeda et al., 2006).

App	How it schedules	Platforms and notes	Cost
Anki	SM-2-based (older) or FSRS	Windows, macOS, Linux, web, Android, iPhone; add-ons; shared decks	Free except the iPhone app ($24.99)
RemNote	SM-2 by default; FSRS in beta	Notes and cards together; PDF notes; exam scheduler	Free plan; paid plans add more
Mochi	Spaced repetition	Markdown notes and cards; desktop, mobile and web	Free, no sign-up; paid Pro adds sync and AI
Brainscape	You rate confidence from 1 to 5	Cards return sooner when confidence is low	Own cards free; paid Pro plan
Readwise	Saved passages by weighted chance; Mastery cards	Built around passages you save while reading	30-day free trial, then paid
Quizlet Learn	Adapts to your past answers	Question types include multiple choice and written answers	Price not checked

A tool helps most when you pair it with study methods that have **strong evidence**. On its own, the tool does little.

Key idea:

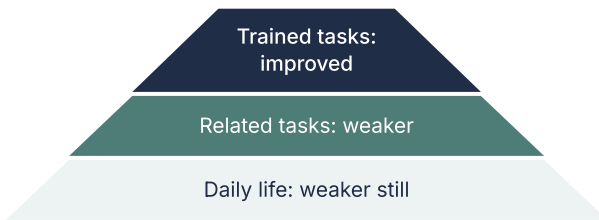
Brain-training games bring gains mostly on the trained tasks. A spaced-repetition app and study methods with strong evidence bring lasting recall.

Quick check:

1. What did the Federal Trade Commission do in 2016? Answer: It charged Lumos Labs over its claims, and the company settled for $2 million (Federal Trade Commission, 2016).
2. What did later work on dual n-back find? Answer: Gains only on similar tasks (Harrison et al., 2013).
3. Since which version has Anki offered two schedulers? Answer: Version 23.10.

How to Use Digital Tools Well

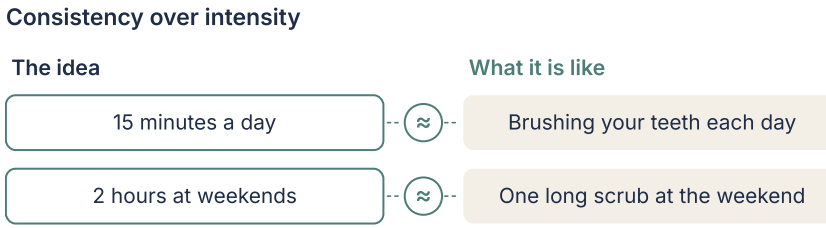
Reviews of brain training give **a mixed picture**. Training improves the trained tasks (Simons et al., 2016). The evidence for gains on related tasks is weaker. It is weaker still for daily life, and many studies had serious flaws.



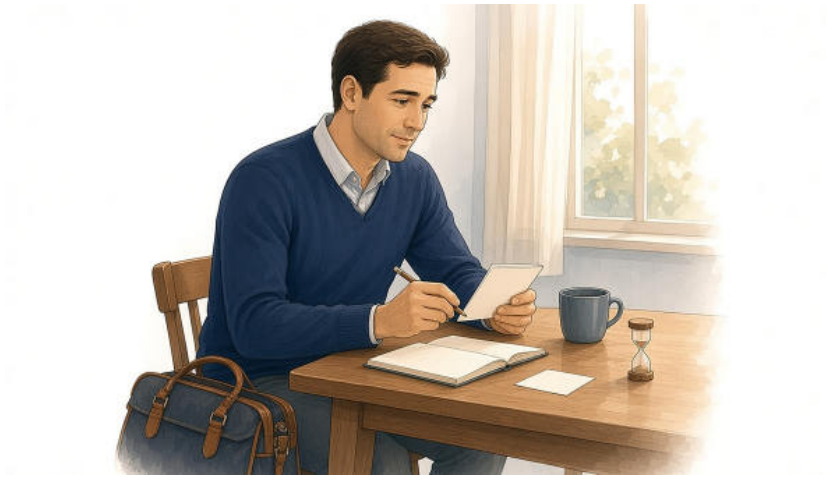
Training improves the trained tasks (Simons et al., 2016).

A common mistake is to treat these apps as games to dip into. I suggest **four principles** instead. They are my own guide. They have not been tested as rules.

Consistency over intensity. I suggest 15 minutes a day, in place of 2 hours at weekends. It is like brushing your teeth each day, which beats one long scrub at the weekend. No study has compared these plans, but spaced study beats cramming for word recall (Cepeda et al., 2006).



It is like brushing your teeth each day, which beats one long scrub at the weekend.

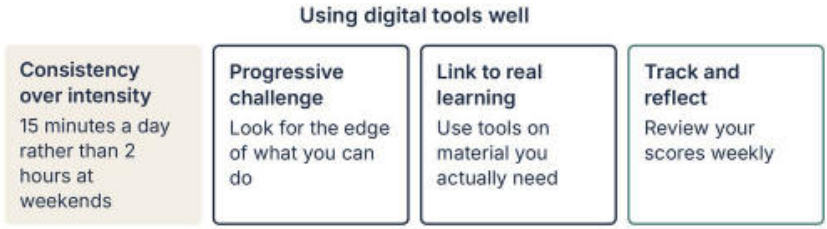


A person does 15 minutes of memory practice on a weekday.

Progressive challenge. Once an exercise feels easy, it stops stretching you. Look for the edge of what you can do now.

Link to real learning. Use tools on material you actually need, such as your real study notes in Anki. Its makers say it gives more time to hard cards.

Track and reflect. Most apps show your scores, so review them weekly. Note progress, look into plateaus, stretches where your scores stop going up, and adjust your approach.



Key idea:

Short daily practice, harder steps over time, real material and a weekly look at your scores make tools that help, in my view.

Quick check:

1. What does brain training improve, by the reviews (Simons et al., 2016)? Answer: The trained tasks. Evidence for related tasks is weaker, and weaker still for daily life.
2. How much daily practice does my guide suggest? Answer: 15 minutes a day, in place of 2 hours at weekends.
3. How often should you review your app scores? Answer: Weekly.

Study Techniques and Strategies

Study Habits That Work

Study methods have been **tested much more** than most memory tools. The results surprise many learners. Knowing them helps you spend study time well.

One major review rated **10 common study methods** (Dunlosky et al., 2013). It judged how much each one helps, across different learners, tasks and materials. Yet the authors note that most students say they reread and underline.

How the review rated 10 methods



It judged how much each one helps, across different learners, tasks and materials.

The review rated **two methods high**: practice testing and distributed practice. Practice testing means quizzing yourself, in place of reading again. Distributed practice means spreading study sessions out over time.

Habits and ratings

What most students do	What the review rated high
Reread	Practice testing
Underline	Distributed practice

Practice testing means quizzing yourself, in place of reading again.

Three methods were **rated moderate**. They are interleaved practice, self-explanation and elaborative interrogation. Interleaving mixes problem types within one session. Self-explanation means telling yourself how a new fact links to what you know. Elaborative interrogation means asking why a fact is true.

Five were **rated low**. They include summarising, underlining and rereading. The others were the keyword mnemonic and imagery for text. The keyword mnemonic links a new word to a familiar word that sounds alike.

A survey of **177 students** found a similar pattern (Karpicke et al., 2009). Most of them reread their notes or textbook. Few tested themselves.



A student reads her notes again and does not test herself.

The better-rated methods tend to **feel harder**. It is like kneading dough, where harder work makes better bread. In my view, that helps explain why fewer learners use them.

Compare **your own habits** with the table below. It lists the four methods the review rated highest. Only the first two received a high rating.

Technique	Review Rating	Why It Helps	How to Use It
Practice testing (active recall)	High	Recalling builds memory more than reading again. Many studies find that testing helps retention (Rowland, 2014).	After studying, close the material. Write or say all you can recall. Use flashcards, practice questions and self-quizzes.
Distributed practice (spaced repetition)	High	Spreading study over time gives memory time to settle between sessions.	Cover each topic several times over days and weeks. Avoid one long session.
Interleaved practice	Moderate	Mixing problem types in one session builds more flexible knowledge. The evidence is still limited.	Mix related problem types within one subject. Avoid doing all of one type first.
Elaborative interrogation	Moderate	Asking "Why is this true?" links new facts to what you already know.	For each key fact, explain why it is true. Keep asking "why" until you reach what you know.

Both top methods got **the same rating**. Neither is ranked above the other.

The review noted that interleaving had **only begun** to be studied closely. Most of that work mixed problems within one subject.

One meta-analysis compared testing with studying again (Rowland, 2014). Testing helped people recall more. **Recalling answers** helped more than picking them out from a list.

Key idea:

Testing yourself and spaced study are the two top-rated methods. Rereading, underlining and cramming give little lasting gain.

Study Habits to Drop

Some habits **feel like they help** but give little lasting gain. If you keep them, they take time from the methods that work.

Rereading feels like it helps but adds little to long-term memory. In one study, students who restudied did better after 5 minutes (Roediger & Karpicke, 2006). After 2 days and after a week, students who had been tested recalled much more. Restudying also made students feel more confident.



Rereading feels like it helps but adds little to long-term memory.

Underlining can feel like real effort. The review rated it low, as it did not reliably improve results (Dunlosky et al., 2013).

Summarising may help you understand a text. On its own, though, the review rated it low for lasting memory. Follow it with self-testing.

Habits to drop



On its own, though, the review rated it low for lasting memory.

Cramming can give good recall soon after. Spread-out study wins on later tests (Cepeda et al., 2006). The best gap between sessions grows with how long you need to remember.

Working Differently

In my view, better study means working **in a new way**. It does not mean working harder. Most of the habits to drop take less effort than the ones that replace them. They feel more productive because they are more comfortable.

The high-rated methods are the ones earlier modules built up. Retrieval practice, pulling facts back out of your head, and spacing run through

the whole programme. This section adds **the evidence rating** behind them.

Quick check:

1. How many common study methods did the review rate (Dunlosky et al., 2013)? Answer: 10. It rated two of them high.
2. What did most of the 177 students in the survey do (Karpicke et al., 2009)? Answer: They reread their notes or textbook. Few tested themselves.
3. When did students who restudied do better (Roediger & Karpicke, 2006)? Answer: After 5 minutes. After 2 days and after a week, the tested students did far better.

Memory in the Age of Artificial Intelligence

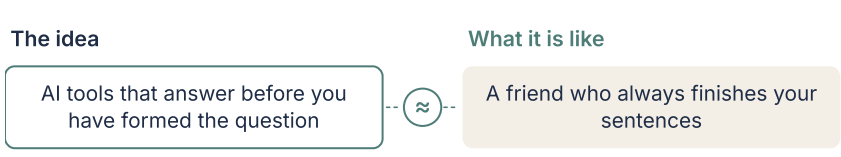
One **everyday technology** may be changing how people think. It works through convenience. No drug or surgery is involved.

Large language models are AI systems that reply and write in plain words. ChatGPT, Grok, Claude and Gemini are examples.



A person types a question to an AI chatbot on a laptop.

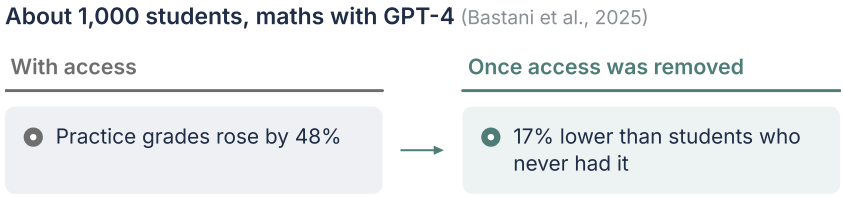
These AI tools answer **before you have fully formed** the question. They draft before you sort your thoughts. It is like a friend who always finishes your sentences. They supply facts before you try to recall them.



They draft before you sort your thoughts.

My concern is that this ease may weaken the skills a strong memory needs. The evidence so far is early. In one field study, about 1,000 high-school students practised maths with GPT-4 (Bastani et al., 2025). Their practice grades rose by **48%**.

Once access was removed, they scored **17% lower** than students who never had it. Students who used a tutor version with built-in limits mostly escaped this drop.



In one field study, about 1,000 high-school students practised maths with GPT-4 (Bastani et al., 2025).

Surveys also link heavy AI use with weaker critical thinking, which is checking claims and reasons for yourself before you accept them (Lee et al., 2025; Gerlich, 2025). Such surveys show a link but **cannot show cause**.

AI is not the problem in itself. **How you use it** matters. Used one way, it can weaken learning, and used another, it can support it.

Key idea:

Fast AI answers with no effort of your own lead to weaker skills, in my view. With AI that has built-in limits, most of the drop was avoided.

Quick check:

1. By how much did practice grades rise with GPT-4 (Bastani et al., 2025)? Answer: By 48%.
2. How did those students do once access was removed? Answer: 17% lower than students who never had it.
3. What can surveys of AI use show? Answer: A link. They cannot show cause.

What Happens When You Hand Thinking to AI

An idea from earlier chapters is that **the brain keeps what it uses**. It is like a tool left out in the rain, which rusts when nobody uses it. Some evidence fits this idea. London taxi drivers had a larger rear hippocampus (a part of the brain that helps store memories and find your way) than people in a control group (Maguire et al., 2000). The longer they had driven, the larger it tended to be.

The brain keeps what it uses

The idea		What it is like
A skill nobody uses	≈	A tool left out in the rain, which rusts

London taxi drivers had a larger rear hippocampus than people in a control group (Maguire et al., 2000).



A London taxi driver studies a street map of the city.

That study compared groups at **one point in time**. It cannot show that driving caused the change. No study has shown that using AI to answer questions shrinks any brain structure.

My concern is about practice. If AI answers a question you could have recalled, you **lose a chance to practise**. Recalling builds memory more than reading again (Rowland, 2014). The effort of recall seems to be part of why testing helps.

I argue that these skipped chances **add up over months and years**. No study has measured that build-up yet. Still, the risk is worth taking seriously.

The Google Effect

One study looked at what happens when people **expect to keep access** to facts (Sparrow et al., 2011). They recalled the facts less well. They recalled better where to find them.

Expecting to keep access (Sparrow et al., 2011)

	Recall
The facts	Less well
Where to find them	Better

They recalled the facts less well.

The authors called the Internet a main form of "**transactive memory**". This means memory held outside ourselves, such as in other people or on devices. The study did not measure how hard people tried to store the facts.

A large replication project later repeated one of its experiments, to see whether the result held (Camerer et al., 2018). That experiment tested whether computer words came to mind faster after hard questions. It **did not replicate**. Nobody retested the recall experiment itself in that project.

In my view, AI goes further than search. It **creates answers** as well as storing them. This idea has not yet been tested directly.

> Science Says:
>
> **Search and the feeling of knowing.** In nine experiments, people who searched online for explanations then rated their own knowledge higher (Fisher et al., 2015). They mixed up access to facts with their own understanding. The studies looked at search engines, before modern AI tools.

Earlier work named a related "**illusion of explanatory depth**" (Rozenblit & Keil, 2002). The phrase describes people thinking they understand how things work better than they do.

Search and the feeling of knowing

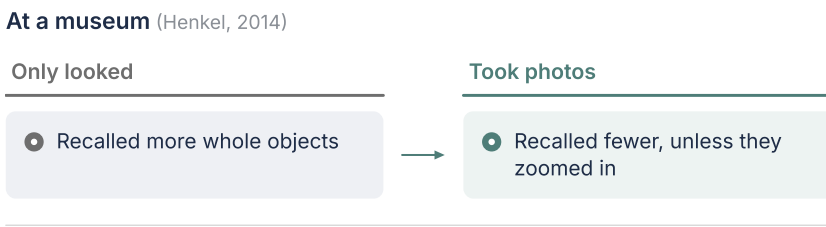


In nine experiments (Fisher et al., 2015).

GPS and spatial memory. Drivers who had used GPS more over their lives had worse spatial memory without it (Dahmani & Bohbot, 2020). Thirteen of them were tested again after 3 years. More GPS use went with a steeper decline, though the sample was small.

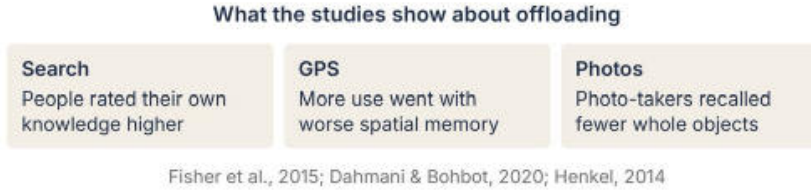
In a brain-scan study, people found their way through a **virtual London** (Javadi et al., 2017). The hippocampus tracked the street layout when they planned their own routes. That response was absent when they were told which way to go.

Photos and memory. At a museum, photo-takers recalled fewer whole objects than people who only looked (Henkel, 2014). Zooming in on part of an object removed the effect. The study measured later memory. It did not measure working memory.



The study measured later memory.

Offloading. Researchers call this pattern cognitive offloading (Risko & Gilbert, 2016). It means using an action or tool to cut the mental work of a task.



Possible Effects of Heavy AI Use

I list **seven areas** I believe heavy AI use may affect. No study has tested these effects as stated. The closest evidence comes from a few recent studies.

The maths field study found a drop after AI access ended (Bastani et al., 2025). Among **319 office workers**, more trust in AI meant less critical thinking (Lee et al., 2025). Among 666 people, more AI use went with lower critical-thinking scores (Gerlich, 2025). Both surveys show links only.

In a brain-wave study, essay writers using AI showed weaker brain links (Kosmyna et al., 2025). They also struggled to quote their own essays. The study had **54 people**. It is not yet peer reviewed, and others have criticised it.

Area	Possible effect (my view, untested)
Working memory	Holding several ideas at once less often may weaken this skill.
Critical thinking	Letting AI judge information may leave you better at accepting conclusions than testing them.
Sustained attention	Fast answers may make long, unclear problems feel harder to stay with.
Creative links	New ideas draw on stored knowledge, so facts never learned cannot feed them.
Metacognition (knowing what you know and what you do not)	Easy access may make you think you know more than you do.
Patience with questions	Always having an answer one prompt away may make open questions harder to bear.
Language	Letting AI write for you may reduce practice at finding words and structure.

The risk lies in **specific habits of use**. Most of these habits can be spotted and changed.

Key idea:

Skipped recall and handed-off thinking mean fewer chances to practise, in my view. No study has yet measured the build-up.

Quick check:

1. What did the study of London taxi drivers find (Maguire et al., 2000)? Answer: They had a larger rear hippocampus than a control group. The study cannot show that driving caused it.
2. What happened when people expected to keep access to facts (Sparrow et al., 2011)? Answer: They recalled the facts less well and recalled better where to find them.
3. What did more lifetime GPS use go with (Dahmani & Bohbot, 2020)? Answer: Worse spatial memory without GPS.

The Five Danger Patterns of AI Dependence

Heavy reliance on AI rarely starts all at once. In my view, it grows from **small choices** that each seem sensible. Over time they add up to a habit of handing off mental work. It is like taking a lift every day until the stairs feel steep. Most people notice it late.

How reliance grows

The idea		What it is like
Small sensible choices	≈	Taking a lift every day until the stairs feel steep

Over time they add up to a habit of handing off mental work.

I describe **five common patterns**. Each one comes with a warning sign that it is becoming a habit. These patterns are my own model. The costs are my view unless a study is named.

Danger Pattern 1: Immediate Retrieval Bypass

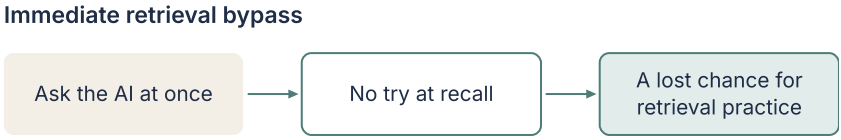
What it looks like. You want to remember a fact, a name or an idea. You do not try to recall it. You ask the AI at once.



A person stops trying to recall a name and asks an AI instead.

Why it feels sensible. The AI is faster and often right. Struggling to remember seems like wasted time.

The cost. Each skipped try is a lost chance for retrieval practice, which means recalling from memory. A major review rated it among the two most useful study methods (Dunlosky et al., 2013). No study has yet measured how skipped recall adds up.



A major review rated it among the two most useful study methods (Dunlosky et al., 2013).

Testing yourself **does help memory** more than studying again (Rowland, 2014). The effort of recalling seems to be part of why it works.

The warning sign. You no longer try to recall things you once knew well. Not knowing something right away has become hard to bear.

The first pattern **keeps facts from settling** in memory. The second lets them in but skips the work of thinking them through.

Danger Pattern 2: Thinking Delegation

What it looks like. You face a decision, an analysis or a plan. You describe it to the AI and follow its answer. You skip working it through first.

Why it feels sensible. The AI's analysis is quick and thorough. Your own thinking would be slower and might miss things.

The cost. I argue that reasoning skills weaken when you rarely use them. One field study gave high-school students free use of GPT-4 for maths practice (Bastani et al., 2025).

Their practice grades rose by **48%**. Once access ended, they did 17% worse than students who never had it. A tutor version with built-in limits mostly avoided that drop. Long-term effects in adults remain untested.

The warning sign. Reasoning through a hard problem without AI feels uncomfortable. It felt easier before you started relying on AI.

The third pattern leaves the thinking to you. It **skips the effort** that makes learning last.

Danger Pattern 3: Passive Learning Acceptance

What it looks like. You ask the AI to explain something and read the answer. It makes sense, so you move on without testing yourself or asking questions.

Why it feels sensible. The explanation was clear and you understood it. There seems to be nothing more to do.

The cost. Understanding something in the moment differs from storing it for later. One review rated rereading low for lasting memory (Dunlosky et al., 2013).



The cost. Understanding something in the moment differs from storing it for later.

Easy access to answers can also make people **overrate what they know** (Fisher et al., 2015). In those studies, people searched the Internet. They did not ask an AI. I suggest that reading AI answers passively works in a similar way.

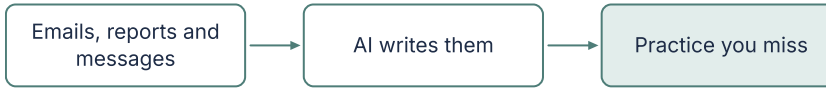
The warning sign. You often feel you have learned something. A few days later, you cannot recall it or use it.

Passive reading **feels like learning**, yet little of it lasts without recall. The fourth pattern applies the same risk to writing.

Danger Pattern 4: Writing and Language Outsourcing

What it looks like. You use AI to write emails, reports or messages you once wrote yourself. You may also use it to start because a blank page feels too hard.

Writing and language outsourcing



You use AI to write emails, reports or messages you once wrote yourself.

Why it feels sensible. The AI writes faster and often more smoothly. Your time seems better spent elsewhere.

The cost. Writing asks a lot of the mind at once. You must find words, build sentences, order ideas and check your own thinking.

In one early study, AI-aided essay writers showed **weaker brain links** (Kosmyna et al., 2025). They also struggled to recall their own essays. In my view, each piece of writing you hand off is practice you miss. That study is not yet peer reviewed and has been criticised.

The warning sign. Writing from scratch feels harder than it used to. The slow start before ideas flow has become harder to tolerate.

Language is one of the **main tools of thought**. The fifth pattern goes further and affects how much you trust your own conclusions.

Danger Pattern 5: Epistemic Dependency

Epistemic means relating to knowledge and belief. This pattern is about **trusting your own judgement**.

What it looks like. You rarely form views or make judgements on your own. You check with the AI first, and its answer largely shapes your view.

Why it feels sensible. The AI draws on a vast amount of information. Checking seems safer than risking being wrong.

The cost. Forming a real opinion takes work. You gather evidence, weigh claims, live with doubt and reach a tentative view.

Among **319 office workers**, more trust in AI went with less critical thinking (Lee et al., 2025). The survey shows a link. It does not show a cause.

The warning sign. You feel uneasy taking a position on a hard question before asking an AI. Your own earlier views start to seem weak.

One shared feature



The warning sign. You feel uneasy taking a position on a hard question before asking an AI.

All five patterns share **one feature**. They hand off mental work that I believe the brain needs to keep doing. The counter-plan builds deliberate mental effort into every day.

Key idea:

Five small habits of handing off mental work leave you with skills that weaken from lack of use, in my view.

Quick check:

1. How did students do once GPT-4 access ended (Bastani et al., 2025)? Answer: 17% worse than students who never had it.
2. What does epistemic mean? Answer: Relating to knowledge and belief.
3. What is the warning sign of the first pattern? Answer: You no longer try to recall things you once knew well.

Keeping Your Memory in Shape: The Daily Fitness Plan

THE ANSWER TO over-reliance on AI is not to avoid it. My answer is to use it **on purpose**, with a clear structure. Let AI support your thinking without taking it over. What matters most is the role AI plays: a helper or a crutch.

The role AI plays

	What AI does
A helper	Supports your thinking
A crutch	Takes your thinking over

Let AI support your thinking without taking it over.

There is some evidence for this view. One field study gave students a GPT-4 tutor **built not to hand over answers** (Bastani et al., 2025). They mostly avoided the learning loss seen with an open chatbot.

The plan rests on one simple idea. You cannot keep a muscle strong by **watching others use it**. Memory works the same way, in my view. AI can be part of your routine, but you must do the work yourself.

The plan is **short by design**. You can keep it up while still using AI fully. Its aim is a mind that can still work well without these tools.

The timings are my own. **No study has tested the whole plan**. Some parts rest on findings about recall.

Key idea:

Put your own effort first and AI second, and your mind still works well without AI, in my view.

The daily plan

- Morning recall, 10 minutes
- 3-attempt rule
- Struggle window, 20 minutes
- Free writing, 10 minutes
- No-AI summary
- Weekly palace check

Some parts rest on findings about recall.

The Daily Cognitive Fitness Plan

Morning recall (10 minutes). Before you open any AI tool, spend 10 minutes recalling. Write down all you remember about your current topic, without looking anything up. Treat it as a warm-up for your mind.



Before opening any AI tool, a person writes down all they recall.

The 3-attempt rule. Before asking AI a factual question, make three real tries at the answer yourself. You can recall it or reason it out, then check with the AI. Close it, and write the answer in your own words from memory.



A person writes three tries at an answer before asking the AI.

The struggle window (20 minutes). Begin any hard task, such as writing or analysis, with 20 minutes of solo work. Only then open an AI tool. In my view, this effort is what trains reasoning and memory.

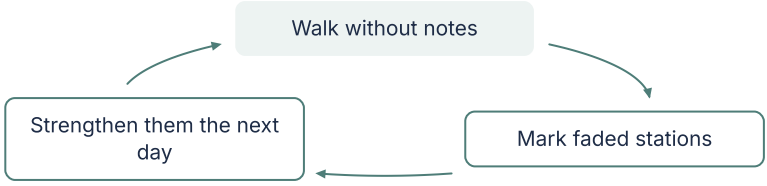
Daily free writing (10 minutes, no AI). Write for 10 minutes each day on any topic. It might be a reflection, an opinion or an analysis. Do it without any AI help.

The no-AI summary. After a learning session that used AI, close the tool. Write a summary of what you learned, fully from memory. If you cannot, go back, study again and retry.

Recalling after study helps memory more than restudying does (Roediger & Karpicke, 2006). The summary works as a test of what you have learned.

Weekly memory palace check. Once a week, walk through your active memory palaces without notes. Mark any stations that have faded, as these are your weak points. The next day, strengthen them with the methods from the techniques module.

Weekly memory palace check



Mark any stations that have faded, as these are your weak points.

My view is that **disuse**, not using something for a long time, makes those memories fade. AI itself is not the cause. The daily plan builds the habit. A swap table then gives a quick choice for each moment.

Quick check:

1. How long is morning recall? Answer: 10 minutes, before you open any AI tool.
2. How many tries do you make before asking AI a factual question? Answer: Three.
3. How long is the struggle window? Answer: 20 minutes of solo work.

The Swap Table: Trading Passive AI Habits for Active Ones

Each time you reach for AI, **you face a choice**. One path is quick and takes no effort. The other is slower and asks a little work of you. It is like doing a sum in your head first, then checking it on a calculator. The table links common situations to both options.

In my view, **choosing the active path** again and again keeps your mind stronger. No study has shown brain growth or shrinkage from these choices. The timings in the table are my own suggestions.

Situation	Passive Default	Active Alternative
Need to remember a fact	Ask the AI at once	Try to recall for 60 seconds first. If you cannot, ask the AI and check its answer. Then close it and write the answer from memory.
Need to write an email or document	Ask AI to draft it, then edit lightly	Write the first draft yourself. Then use AI to review or improve it.

Need to understand an idea	Ask AI to explain it and read passively	Explain it in your own words first, even badly. Use AI to fill gaps. Then close it and write a summary.
Need to solve a problem or decide	Describe it to AI and follow its advice	Spend 20 minutes reasoning on your own. Then use AI to test your reasoning.
Cannot remember someone's name	Ask AI or search at once	Try to recall it for 30 seconds. Use linked clues. Search only if you are fully stuck.
Need ideas	Ask AI for a list	Make your own list first, even a short one. Then use AI to add to it.
Studying new material	Ask AI to summarise and explain	Work with the original material first. Then ask AI to question you, Socratic style, in a way that makes you think a thing through.
Reviewing what you learned	Ask AI for the key points	Write what you recall first. Use AI only to find gaps.
Need to form an opinion	Ask AI what to think and adopt its view	Form a first view on your own. Use AI to challenge it.
Need to organise your thoughts	Describe them to AI and use its structure	Outline on your own first, even roughly. AI can then tidy the structure.

A tutor built not to give away answers **did less harm** than an open chatbot (Bastani et al., 2025). AI can also state false facts with confidence (Ji et al., 2023). Always check facts it gives you.

Key idea:

Try it yourself first, then use AI to check or add, for a stronger mind over time, in my view.

Quick check:

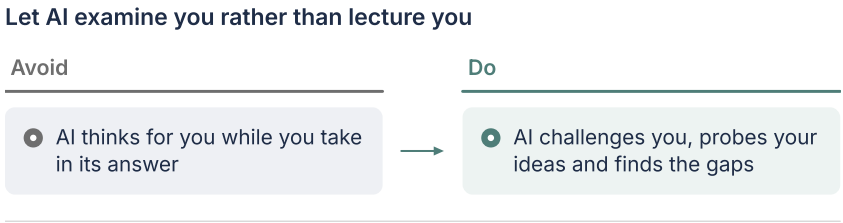
1. How long should you try to recall a fact before you ask AI? Answer: 60 seconds.
2. How long should you reason alone on a problem first? Answer: 20 minutes.
3. Why should you always check facts from AI? Answer: It can state false facts with confidence (Ji et al., 2023).

Seven Principles for Healthy AI Use

These principles do not limit how much you use AI. They change **how you use it**. The aim is for AI to add to your thinking. It should not replace it. Used this way, each session with AI can build your skills, with no drain on them.

Principle 1, attempt before access. Checking your memory against AI now and then does little harm. The risk comes from never trying to recall. Try to recall what you may know before asking AI, since trying is itself practice.

Principle 2, let AI examine you rather than lecture you. Give the AI your own thinking. Ask it to challenge you, probe your ideas and find the gaps. Avoid asking it to think for you while you simply take in its answer.



Give the AI your own thinking.

There is **some support** for this. In one field study, a tutor built not to give away answers did little harm (Bastani et al., 2025). An open chatbot lowered later maths grades. The study measured grades only, so wider effects remain unknown.

Principle 3, keep a no-AI zone for core skills. Pick the two or three skills that matter most in your work and life. Examples include writing, analysis, decision-making or a field of knowledge. I suggest doing these without AI at least three times a week.

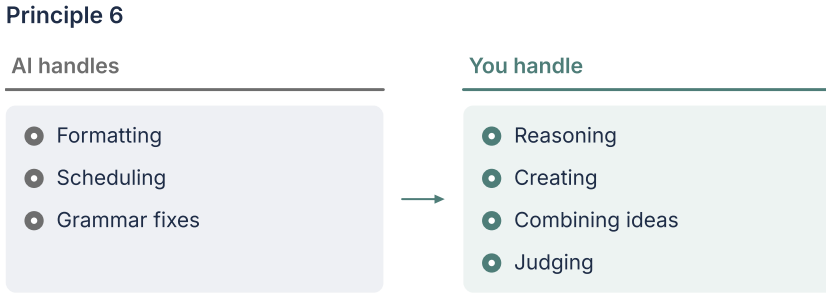
Principle 4, close the AI before you try to learn. Avoid memorising something while the AI is still open. Study, close the tool, then recall. People recall facts less well when they expect to keep access to them (Sparrow et al., 2011).

That study did not measure effort or AI use. One of its other experiments also **failed to replicate** (Camerer et al., 2018).

Principle 5, test yourself on everything the AI taught you. Learning from AI without testing yourself may be much like rereading. A major review rated rereading low and practice testing high (Dunlosky et al., 2013). No study has compared AI explanations with rereading directly.

After each session, **write down what you recall**. Ask yourself what you learned and what you can rebuild from memory now. Note what has already gone.

Principle 6, use AI to raise the floor rather than lower the ceiling. Let AI handle routine, repetitive tasks, such as formatting, scheduling and grammar fixes. Save your own effort for the harder work of reasoning, creating, combining ideas and judging.



Note what has already gone.

The mistake is **the reverse**. People use AI for the hard parts and do the easy ones. AI can state false facts with confidence (Ji et al., 2023). Always check any facts it gives you.

Principle 7, track your independence over time. I suggest a monthly 30-minute hard task with no AI. It might be writing, analysis, memorising or problem-solving. Compare how it feels with what you recall from six months earlier.

Seven principles for healthy AI use

1. Attempt before access
2. Let AI examine you rather than lecture you
3. Keep a no-AI zone for core skills
4. Close the AI before you try to learn
5. Test yourself on everything the AI taught you
6. Use AI to raise the floor rather than lower the ceiling
7. Track your independence over time

If it feels harder, treat that as **an early warning**. If it feels as hard but goes more smoothly, your fitness is holding. If it feels easier, your training is working.

The Core Principle

Every plan and warning in this module rests on one idea. It is like a microphone, which makes any voice louder, good or bad. In my view, AI **magnifies** whatever habits its user brings to it.

Some people treat AI as **scaffolding**, a short-term support that later steps aside. For them, it can be a great help.

Others treat it as **a stand-in** for their own thinking. Over time, I argue, AI then acts like a crutch. The skills it replaces grow weaker.

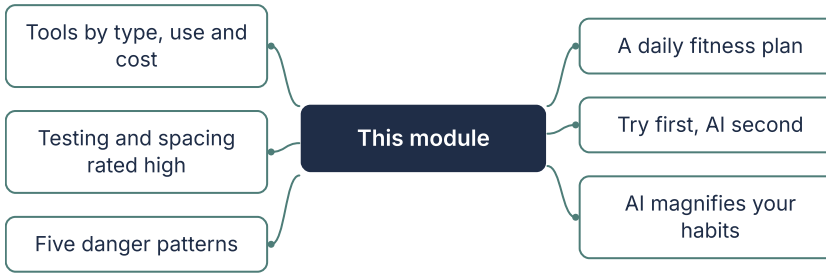
My view is that a trained memory **matters more** in an age of AI. When everyone can look up the same facts, access alone sets no one apart. What counts is how deeply you think and what you remember. Those skills grow only through your own effort.

Key idea:

Try first, test yourself and keep core skills free of AI, and AI adds to your thinking, in my view.

Train your memory and use AI wisely. Keep the thinking that makes you **hard to replace**. The lifestyle factors that shape the brain itself come next.

This module at a glance



Keep the thinking that makes you hard to replace.

Quick check:

1. How often should you use your core skills without AI? Answer: At least three times a week.
2. What did a tutor built not to give away answers do (Bastani et al., 2025)? Answer: Little harm. An open chatbot lowered later maths grades.
3. What monthly check do I suggest? Answer: A 30-minute hard task with no AI, compared with what you recall from six months earlier.

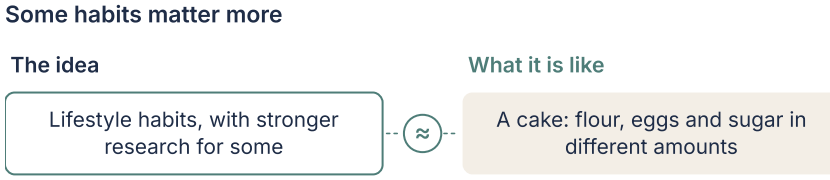
Module 10: Memory and Lifestyle

Key Concept:

Module Overview

Your brain is part of your body. It responds to how you treat that body. Food, exercise, sleep and stress all affect it. This module turns what we know about them into daily habits.

LIFESTYLE AFFECTS MEMORY. BUT **the research is stronger for some habits** than for others. It is like a cake, which needs flour, eggs and sugar in different amounts. Sleep after learning helps memories settle (Diekelmann & Born, 2010).



It is like a cake, which needs flour, eggs and sugar in different amounts.

In one review, regular exercise **did little** for short-term memory (Roig et al., 2013). Its effect on long-term memory was not significant. Significant means big enough that it is not likely to be luck. In healthy older people, fish-oil pills gave no gain in thinking skills (Sydenham et al., 2012).

Sleep, exercise and fish-oil pills: what the research shows

Habit	Effect on memory
Sleep after learning	Helps memories settle
Regular exercise	Did little for short-term memory
Fish-oil pills, healthy older people	No gain in thinking skills

Its effect on long-term memory was not significant.

> Definition:
>
> **LIFESTYLE:** how you live each day. It is how you eat, move, sleep and deal with stress.

Key idea:

Sleep after learning gives clear help for memory. Regular exercise gives little gain. Fish-oil pills in healthy older people give no gain.

In This Module

- Learn what the research says about food and memory.
- Build an exercise routine with memory in mind.

- Learn sleep habits that help memory.
- Learn ways to manage stress.

Four daily habits



Learn sleep habits that help memory.

Nutrition and Memory

The Brain-Food Connection

THE BRAIN MAKES UP about 2% of body weight. Yet it uses **about 20%** of the body's energy (Raichle & Gusnard, 2002). It is like a small engine that burns a lot of fuel. It is a demanding organ, and food is part of its fuel.

The brain: about 2% of body weight, about 20% of its energy



Raichle & Gusnard, 2002.

Many nutrients, parts of food that the body needs, such as vitamins or fats, are thought to support memory. The evidence, though, is **weaker than often claimed**.

US health agencies have reviewed the trials of single-nutrient pills. For healthy adults, most trials found **no gain in thinking**. This held for omega-3, vitamin B12, folate and choline (NIH ODS, n.d.).

The table below lists common nutrients, their food sources and what the evidence shows. A pill may show **no memory benefit**. The food can still belong in a healthy diet.

Nutrient	Food Sources	Proposed Role	What the Evidence Shows
Omega-3 fats (DHA/EPA)	Salmon, mackerel, sardines, herring; walnuts and flaxseeds (ALA)	DHA is a key part of brain cell membranes	Pills showed no memory gain in healthy adults (Mazereeuw et al., 2012; Sydenham et al., 2012)
Flavonoids (polyphenols), a kind of plant chemical	Blueberries, dark chocolate (70%+), green tea	May affect brain growth factors and blood flow	Evidence is mostly from animal studies (Gómez-Pinilla, 2008)
Vitamin K and folate	Spinach, kale, broccoli, Brussels sprouts, asparagus	Folate lowers homocysteine, a blood marker	Most trials show folic acid pills do not affect thinking or dementia; no official source found for vitamin K
B vitamins (B6, B12, B9)	Eggs, lean meat, fish, legumes, whole grains, fortified cereals	Help keep nerves healthy and lower homocysteine	Trials show no gain in thinking from B12 pills in older adults
Choline	Eggs (especially yolks), liver, fish, soy, broccoli	Needed to make acetylcholine, a chemical messenger	Supplements gave no clear gain in thinking in healthy adults
Magnesium	Dark leafy greens, nuts, seeds, legumes, dark chocolate	Involved in nerve signalling	No official source found linking it to memory
Probiotics (gut bacteria)	Yoghurt, kefir, kimchi, sauerkraut, miso, kombucha	Gut bacteria help make serotonin in the gut (shown in mice)	No memory effect shown (Yano et al., 2015)

What the Trials Show

Omega-3 fats. DHA is a key part of brain cell membranes. That fact is the reason for hoping fish oil helps memory. Officials say these pills do not help healthy older adults think (NIH ODS, n.d.).



A plate of fish beside a bottle of fish-oil pills.

The same holds for people with Alzheimer's disease, compared with a placebo, or dummy pill. In one large trial, **3,501 older adults** took fish oil daily for 5 years. It had no significant effect on thinking.

Folate and vitamin B12. Folic acid pills lower homocysteine, a marker in the blood. Yet most trials found no effect on thinking or dementia. B12 pills, alone or with folic acid, also showed no gain in older adults.

Choline. The body needs choline to make acetylcholine, a chemical messenger in the brain. A 2015 review covered 13 studies of choline pills.

In healthy adults, it found no clear gain in thinking. For dementia, a 2003 review of lecithin, a choline source, also found **no clear benefit**.

Diet as a whole. One review of food and the brain is often cited (Gómez-Pinilla, 2008). A lack of omega-3 harmed learning and memory in rodents. The findings on flavonoids also came mostly from animals.

Diet as a whole

In rodents	In humans
A lack of omega-3 harmed memory	→ No single food lifted memory

One review of food and the brain is often cited (Gómez-Pinilla, 2008).

The review linked a **Western diet** to falling omega-3 intake and obesity. Again, most of that evidence came from animals. No human study in the review showed a single food lifting memory within weeks.

These trials **tested pills**. The table above lists foods instead. Food sources may still matter for health in general.

Vitamin K and magnesium. No official source links either one to better memory. Both still come in foods that the MIND diet, an eating plan that mixes the Mediterranean and DASH diets, favours.

Gut bacteria. Much of the body's serotonin, a chemical messenger, is made in the gut. A mouse study showed that gut bacteria help control this (Yano et al., 2015). It did not test memory or say what share of serotonin the gut makes.

> **Exercise:**
> 10.1, Brain-Nutrient Mapping. Follow these five steps.

1. Review the nutrient table above. For each of the 7 nutrients, note whether you eat it each week.
2. Draw a grid with the 7 nutrients as rows and the 7 days as columns. Tick each cell where you ate a good source.

3. After one week, count your ticks. Use the total as a picture of your eating habits. It is not a measure of your memory.
4. Find your two biggest gaps, the nutrients you eat least often. Look up one meal or snack that covers both.
5. Add that meal or snack the following week and repeat the grid. Note any changes you notice in how you feel.

Oily fish is a good food, but fish oil pills have **weak support**. A review of 10 trials found no effect on memory as a whole (Mazereeuw et al., 2012). Small gains showed up only in people with mild thinking problems. Working memory and delayed recall showed no benefit in any group.

Healthy people showed no such gains. A Cochrane review (a careful review that pools the results of trials) of **3 trials** also found no benefit in healthy older people (Sydenham et al., 2012).

Fish-oil pill reviews

Review	Trials	Finding
Mazereeuw et al., 2012	10	No effect on memory as a whole
Sydenham et al., 2012	3	No benefit in healthy older people

Healthy people showed no such gains.

The MIND Diet

The MIND diet was developed at **Rush University** (Morris et al., 2015). Its name stands for Mediterranean-DASH Intervention for Neurodegenerative Delay. It combines two eating patterns, the Mediterranean and DASH diets.

One study followed 923 adults aged 58 to 98 for about 4.5 years (Morris et al., 2015). Those who followed the diet most closely had **about half the rate** of Alzheimer's disease. Those in the middle group had about a third lower risk than the lowest group.

That study observed people. It did not assign a diet, so it was an observational study. It shows **a link** but cannot prove the diet caused the lower risk. A companion study found slower decline in people who followed the diet closely (Morris et al., 2015). The gap was like being 7.5 years younger.

A later randomised trial tested the diet directly in 604 older adults over 3 years (Barnes et al., 2023). It found **no significant difference** in thinking compared with a control diet. Both groups also cut calories slightly.

Food Group	MIND Target	Notes
Green leafy vegetables	6 or more servings a week	Source of vitamin K, folate and lutein
Other vegetables	At least 1 serving a day	
Berries	2 or more servings a week	
Nuts	5 or more servings a week	
Olive oil	Main cooking oil	
Whole grains	3 or more servings a day	
Fish	1 or more servings a week	
Beans and legumes	More than 3 servings a week	
Poultry	2 or more servings a week	
Wine	1 glass a day	Part of the original scoring; see the alcohol note below

Red meat	Fewer than 4 servings a week	Limit
Butter and margarine	Less than 1 tablespoon a day	Limit
Cheese	Less than 1 serving a week	Limit
Pastries and sweets	Fewer than 5 servings a week	Limit
Fried or fast food	Less than 1 serving a week	Limit

The MIND scoring has **10 food groups to favour** and 5 to limit. Each target above comes from the original scoring (Morris et al., 2015). The fish target is modest, at one serving a week.

A note on alcohol. Wine is part of the published MIND scoring. Other evidence urges caution, though. The World Health Organization says there is no safe level of drinking for health (World Health Organization, 2023).

A UK study followed 550 adults for 30 years (Topiwala et al., 2017). Light drinkers showed no brain benefit over non-drinkers. Drinking 14 to 21 units weekly went with **triple the odds** of hippocampal shrinkage.

The study was observational, so it shows **links only**. I treat wine as optional and do not suggest starting to drink.

> **Exercise:**
> 10.2, The MIND Diet Transition Plan. Follow these five steps.

1. Change your diet over six weeks, in three phases. Do not change it all at once. I prefer gradual change because sudden overhauls are hard to keep up.
2. Weeks 1 and 2, add before you take away. Add one MIND food to each meal without removing anything. Try blueberries at breakfast and spinach at lunch. Have walnuts as a snack and salmon or sardines at one dinner.
3. Weeks 3 and 4, crowd out. As the new foods become habits, check your food log. Note which limit-list foods, such as red meat and pastries, you now eat less.
4. Weeks 5 and 6, swap. Make planned swaps for the gaps that remain. Try whole-grain bread for white and olive oil for butter. Swap crisps for nuts, and sugary desserts for dark chocolate with berries.
5. After six weeks, score yourself against the MIND targets again. Compare your memory exercise scores from the start and the end.

Six weeks, three phases



After six weeks, score yourself against the MIND targets again.

> Exercise:
> 10.3, The 7-Day Brain Diet Audit. Follow these five steps.

1. For 7 days, keep a food log. Record everything you eat and drink.
2. At the end of the week, score each day against the MIND targets above.
3. Find the 3 biggest gaps in your current diet.
4. In week 2, make one change for each gap. You might add blueberries to breakfast or switch to whole-grain bread. You could also add one fish meal a week.
5. Notice whether your energy, focus or memory seem different by the end of week 2.

A week of records can show which food groups you **often miss**. It can also show which habits push out the foods on the MIND list.

A week of records



> **Exercise:**
> 10.4, The Food and Focus Diary. Follow these five steps.

1. For 14 days, keep a combined food and memory log. Each day, record what you ate and one memory exercise score. Rate your focus and energy from 1 to 10 at three points in the day.
2. After 14 days, look for patterns. Do your best memory days follow certain meals? Do your scores drop after particular lunches?
3. Treat any pattern as a clue. It is not proof. Many things besides food change from day to day.
4. Use what you find to plan when and what you eat before study.
5. Repeat the diary later if your routine changes.

> **Exercise:**
> 10.5, The Hydration Test. Follow these five steps.

1. Mild dehydration can affect thinking. One review looked at losing 2% of body weight in water (Adan, 2012). It impaired attention, movement speed and immediate memory. Working memory and long-term memory held up better.
2. On day 1, do your usual morning memory exercise after your normal routine. For example, study 20 random words for 2 minutes, then recall them.
3. On day 2, drink 500 ml of water in the 30 minutes before testing. Record both scores.

4. Repeat this over 5 pairs of days, hydrated and not. Compare your average scores for the two kinds of day.

5. US guidance sets total water at about 3.7 litres a day for men (National Academies, 2004). For women, it is about 2.7 litres. This includes water from food, and most comes from drinks. For most healthy people, thirst is a good guide.

The brain and heart are about **73% water** (U.S. Geological Survey, n.d.). Even so, the guidance above treats thirst as the main signal for most people.

> Exercise:
>
> 10.6, The Pre-Study Meal Plan. Follow these five steps.

1. Plan a meal or snack to eat before a 90-minute study session.

2. Include a slow-release carbohydrate, such as oats, whole-grain bread or sweet potato. Add a source of choline or omega-3, such as eggs, smoked salmon or walnuts. Add a flavonoid source, such as blueberries or green tea. Drink water with the meal.

3. Avoid sugary foods and heavy, fatty meals before study. Avoid alcohol too. Heavy drinking can stop new memories being stored (NIAAA, n.d.).

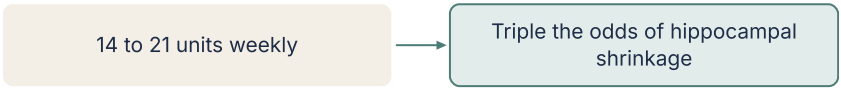
4. Compare your plan with a usual meal, such as a sandwich and crisps. Test each over four sessions. Score a memory exercise at 30 and 90 minutes into each session.

5. Record your results in your memory journal. Keep the meal that gives you the best scores.

In my view, this plan gives the brain **steady fuel** for study. No study has tested the plan itself.

Alcohol and memory. The US alcohol institute explains how blackouts happen (NIAAA, n.d.). A blackout is a stretch of time that the brain did not store, after heavy drinking. Enough alcohol can briefly block the hippocampus, a brain area key to memory, from storing new memories.

Alcohol and the hippocampus



550 adults over 30 years (Topiwala et al., 2017); light drinkers showed no brain benefit over non-drinkers.

Blackouts may be **partial**, with patchy gaps, or total for a stretch of time. They are more likely when blood alcohol rises quickly. Alcohol also delays the first period of dream sleep (Ebrahim et al., 2013).

Key idea:

Single-nutrient pills give mostly no memory gain in healthy adults. The MIND diet has a link with lower risk, while its trial found no benefit.

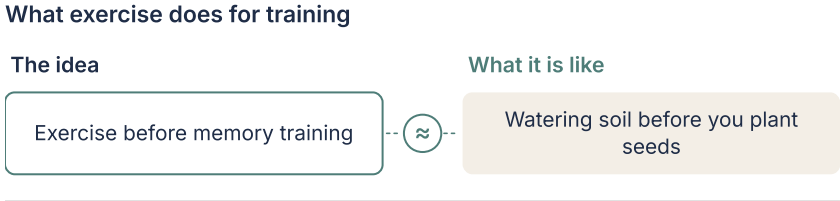
Quick check:

1. What share of the body's energy does the brain use (Raichle & Gusnard, 2002)? Answer: About 20%, though it is about 2% of body weight.
2. What did the 3-year MIND trial find (Barnes et al., 2023)? Answer: No significant difference in thinking compared with a control diet.
3. What does the World Health Organization say about drinking (World Health Organization, 2023)? Answer: There is no safe level of drinking for health.

Physical Activity and Memory

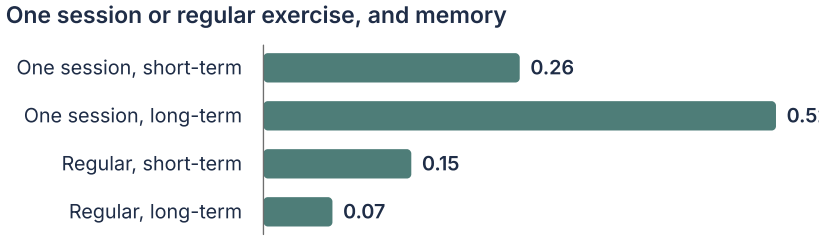
Exercise and the Brain

Exercise is one of the **best-studied** lifestyle factors for memory. In my view, it creates the physical conditions that memory training needs. It is like watering soil before you plant seeds. No study ranks it above every other option, though. The evidence is real, but it is mixed.



A large review pooled studies of aerobic exercise and memory (Roig et al., 2013). Aerobic exercise gets your heart and breathing going, such as brisk walking. A single session of exercise had a **moderate effect** on short-term memory. It had a moderate to large effect on long-term memory.

The review reported these as **effect sizes**. An effect size shows how big a difference is, on a shared scale. For one session, the sizes were 0.26 for short-term memory. For long-term memory, the size was 0.52.



An effect size shows how big a difference is, on a shared scale (Roig et al., 2013).

Regular exercise over weeks or months showed a **different pattern**. Its effect on short-term memory was small. Its effect on long-term memory was too small to be significant. The sizes were 0.15 and 0.07.

Science Says: +2%	**After a year of aerobic training, older adults' hippocampus grew by about 2%. This roughly reversed 1 to 2 years of age-related loss (Erickson et al., 2011).**

The study behind this figure was a trial with **120 older adults** (Erickson et al., 2011). One group did aerobic training for a year, such as brisk walking. Their hippocampus, a key memory area, grew by about 2%. Their spatial memory also improved.



Older adults go brisk walking as part of a year-long exercise trial.

The trial was randomised, so people were assigned to groups **by chance**. This makes it stronger evidence than a study that only observes people.

The table below lists common types of exercise. The timings are my own suggestions. Of its brain claims, **only the aerobic BDNF effect** (BDNF is a protein that helps brain cells grow and connect) has support in the sources checked.

Exercise Type	Proposed Benefit	Suggested Plan	Evidence Note
Aerobic exercise (moderate)	Raises BDNF in the blood; supports blood flow	30–45 minutes, 5 days a week: running, brisk walking, cycling, swimming or dancing	A single session raises blood BDNF (Szuhany et al., 2015)
High-intensity interval training (HIIT)	Short bursts of hard effort	4–6 rounds of 30 seconds hard effort and 90 seconds recovery, 2–3 times a week	Timing claims not checked
Resistance or strength training	Builds muscle; may help sleep	2–3 sessions a week; major muscle groups; gradually heavier loads	Brain and sleep claims not checked
Yoga and tai chi	May lower stress	3–5 sessions a week, 30–60 minutes each	Brain and attention claims not checked

Aerobic exercise. This is activity that keeps your heart rate up for a while, such as brisk walking. It has the best support of the four types. The year-long trial above used this kind of exercise.

Interval training. I suggest short, hard intervals when time is tight. My claims about when the benefit peaks were not checked. The plan itself is a common training format.

Strength training. I link strength work to better sleep. The specific claims about evening sessions and deep sleep were not checked.

Yoga and tai chi. I suggest these to lower stress. My claims about grey matter and hours of better attention were not checked.

> **Science Says:**
> BDNF stands for brain-derived neurotrophic factor. It is a protein that helps brain cells grow and connect. Psychiatrist John Ratey has given it a nickname: "Miracle-Gro for the brain". He wrote about it in his book *Spark* (Ratey & Hagerman, 2008).

A review of **29 studies with 1,111 people** looked at exercise and BDNF (Szuhany et al., 2015). A single session raised BDNF levels in the blood. Regular exercise made that rise larger. Resting BDNF levels rose only slightly.

Exercise and blood BDNF

	Effect size
One session	0.46
Regular exercise	0.59
Resting levels	0.27

Regular exercise made that rise larger (Szuhany et al., 2015).

The effect sizes were **0.46** for one session and 0.59 with regular exercise. For resting levels, the size was 0.27. Studies with more women tended to show smaller effects.

Key idea:

One session of exercise gives moderate help for memory soon after. Regular exercise had small effects in a large review, though a year of it grew the hippocampus by about 2%.

These studies measured BDNF **in the blood**. BDNF inside a living human brain cannot be measured directly.

How long the rise lasts **is unclear**. In one study of 11 trained cyclists, blood BDNF rose during hard exercise (Heyman et al., 2012). It then fell within 15 minutes of rest. The cyclists rode for 60 minutes at a moderate level, then 30 minutes harder.

The study also measured endocannabinoids, natural chemicals tied to mood and reward. It **did not test memory**.

No source checked supports a **fixed window** of 30 to 60 minutes after exercise. Still, studying soon after exercise is a simple habit to try. The exercises below let you test it for yourself.

Study soon after exercise



No source checked supports a fixed window of 30 to 60 minutes after exercise.

> **Exercise:**
> 10.7, The Study-Exercise Plan. Follow these five steps.

1. For the next 14 days, do 20 minutes of brisk walking or other aerobic activity. Do it just before your main study session.
2. While you exercise, preview what you will study. You might listen to an audio review or go over key ideas in your head.
3. Start your study session as soon as you return. Keep the type of material similar across the 14 days, so the scores compare fairly.

4. Each day, rate the quality of your session from 1 to 10. Include focus, recall and understanding.
5. Compare your average score for the first 7 days with the second 7 days. Decide whether to keep the habit.

> **Exercise:**
> 10.8, The Short Hard Workout Before Study. Follow these six steps.

1. HIIT means short bursts of hard effort with rest between them. This exercise tests whether it suits you before a short study session.
2. The plan takes about 12 minutes and needs no equipment. Warm up with 2 minutes of light movement. Then do 6 rounds of 30 seconds all-out and 90 seconds of slow walking. Cool down for 1 to 2 minutes.
3. Start studying within 5 minutes of finishing.
4. For 14 days, alternate this workout with the 20-minute walk from Exercise 10.7. Track your memory scores after each type.
5. Compare the two. Note which one helps more for short sessions and which helps more for long ones.
6. Use whichever works best for you before each kind of session.

One study did look at hard exercise and word learning (Winter et al., 2007). It tested 27 healthy adults. After intense sprints, they learned new vocabulary **20% faster** than after gentle running or rest. That figure is about learning speed. It does not show memory two days later.

Intense sprints and vocabulary learning

20%

faster vocabulary learning after intense sprints than after gentle running or rest

27 healthy adults (Winter et al., 2007); that figure is about learning speed.

The sprints were a **simple running test**. They were not a full HIIT plan. Whether other hard workouts work the same way is not known.

Some people also find it helps to **move while they learn**. The next exercise lets you test this idea. No source checked shows that movement adds a separate kind of memory.

The Movement-Learning Test

	Items	How
Condition A	10	Seated at a desk, with flashcards
Condition B	10	Walking slowly, aloud, with a gesture

The next exercise lets you test this idea.

> **Exercise:**
> 10.9, The Movement-Learning Test. Follow these six steps.

1. This exercise tests whether moving while you study helps you remember.
2. Choose 20 words, key ideas or facts you are learning now. Split them into two groups of similar difficulty.

3. Condition A: study 10 items while seated at a desk, using flashcards.
4. Condition B: study the other 10 items while walking slowly. Say each item aloud and use a gesture to show its meaning.
5. Test yourself on all 20 items 24 hours later. Compare your recall for the two conditions.
6. If Condition B works better for you, try it for a full week of study. Note its effect on recall and on how studying feels.

A month-long plan tests whether regular exercise changes **your own memory scores**. A 30-day test will not show brain growth. It can still show a trend in your scores.

Remember that regular exercise showed **small effects** on memory in the large review (Roig et al., 2013). Treat your results as personal data. They are not a promise.

The 30-word test



Treat your results as personal data.

> Exercise:
> 10.10, The 30-Day Exercise-Memory Challenge. Follow these six steps.

1. Commit to 30 days in a row of aerobic movement.
2. Each day, do at least 20 minutes of walking, cycling, swimming, dancing or similar. Aim to raise your heart rate to 60–70% of its maximum.
3. Exercise within 2 hours of your main memory practice each day.
4. On days 1, 10, 20 and 30, do the practical exercises module's 30-word test. Record your scores.
5. Also note how easily you form images, walk your memory palaces and recall during review.
6. On day 30, compare your scores with day 1. Any change is useful data for planning your routine. A month is short next to the year-long trial, so keep tracking if you continue.

In the year-long trial, the brain change took **a full year** of training (Erickson et al., 2011). Quick results are not the main reason to exercise.

Quick check:

1. What were the effect sizes for one session of exercise (Roig et al., 2013)? Answer: 0.26 for short-term memory and 0.52 for long-term memory.
2. How much did the hippocampus grow after a year of aerobic training (Erickson et al., 2011)? Answer: About 2%.
3. How fast did blood BDNF fall after hard exercise (Heyman et al., 2012)? Answer: Within 15 minutes of rest.

Sleep and Memory

MANY PEOPLE SEE SLEEP as idle time between the real work of learning. Sleep studies point to a different picture (Diekelmann & Born, 2010). Sleep helps turn new learning into **lasting memory**. How much it helps depends on how you learned and when you slept.



Sleep helps turn new learning into lasting memory.

In my view, sleep is among the most **underrated** factors in memory. Memories can also form and last without sleep, though. Sleep is one support for memory. It is not the only one.

What happens overnight. Deep sleep is now called stage N3. During it, the brain replays memories that depend on the hippocampus. It then moves them to the outer layer of the brain for long-term storage (Diekelmann & Born, 2010).



A person in deep sleep at night.

This process is called **system consolidation**. It is like moving notes from a sticky pad into a filing cabinet. Slow brain waves, short bursts called spindles and fast ripples help time it. A review of this field appeared in *Nature* (Stickgold, 2005).

System consolidation

The idea	What it is like
Memories moved into long-term storage	≈ Notes moved from a sticky pad into a filing cabinet

Slow brain waves, short bursts called spindles and fast ripples help time it.

Spindles happen in stage N2 and also in deep sleep. In one study, people who expected a test had **more spindles** during deep sleep (Wilhelm et al., 2011). Those with more spindles remembered more of the facts they had learned.

> Science Says:
>
> **Early and late sleep.** One study of 20 healthy men compared early and late sleep (Plihal & Born, 1997). Recall of word pairs, a test of facts, improved more after early sleep. That part of the night is rich in deep sleep.

Early sleep and late sleep

	Rich in	Improved more
Early sleep	Deep sleep	Word pairs, a test of facts
Late sleep	REM sleep	A drawing skill

20 healthy men (Plihal & Born, 1997).

A drawing skill improved more after **late sleep**, which has more REM sleep. REM stands for rapid eye movement, the stage linked with vivid dreams. A later review placed these findings within a wider model of sleep and learning (Walker & Stickgold, 2004).

Even so, the split is **not strict**. US health guidance says memory storage likely needs both kinds of sleep (NINDS, n.d.). Non-REM sleep includes stages N1 to N3.

The two kinds also **differ in timing**. Deep sleep comes in longer spells in the first half of the night. REM sleep first appears about 90 minutes after you fall asleep.

Through the night



The two kinds also differ in timing.

Sleep loss and new learning. In one brain-scan study, people went a full night without sleep (Yoo et al., 2007). The next day, their hippocampus was much less active while they learned new material. The study reported a clear deficit but gave no single percentage.

The stages of sleep each play a part in this process. Knowing what each stage does helps you **protect a full night** of sleep.

Key idea:

Learning followed by sleep gives memories that last. Deep sleep helped facts and late sleep helped a skill, though the split is not strict.

Quick check:

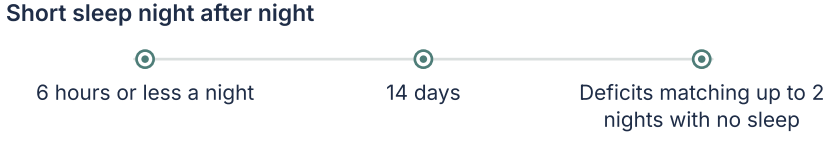
1. Which recall improved more after early sleep (Plihal & Born, 1997)? Answer: Recall of word pairs, a test of facts.
2. When does REM sleep first appear? Answer: About 90 minutes after you fall asleep.
3. What happened to the hippocampus after a night without sleep (Yoo et al., 2007)? Answer: It was much less active while people learned new material.

Sleep and Memory Consolidation

While you sleep, your brain **keeps working**. It replays patterns of activity from the hippocampus into the outer brain. It also strengthens links between brain cells (Diekelmann & Born, 2010). This is how much of the day's learning is kept.

How much sleep helps depends on **how you learned and when you slept**. Sleep supports memory, though memories can also form without it.

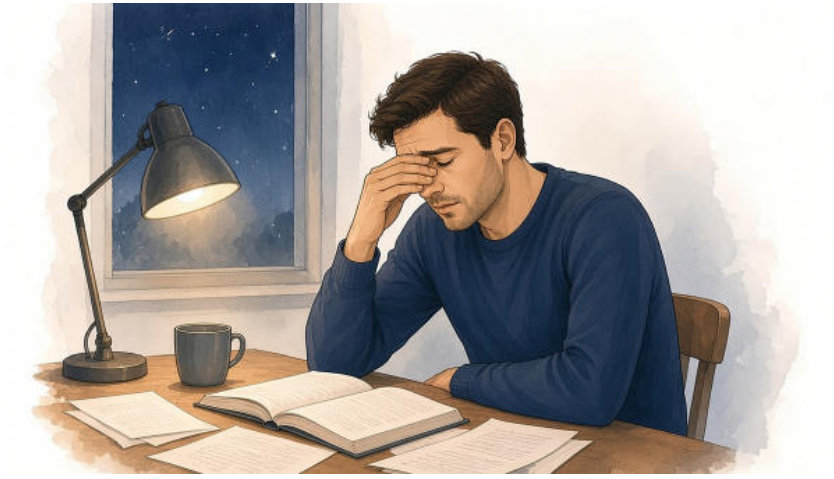
> Science Says:
>
> **Short sleep adds up.** One lab study tested 48 healthy adults aged 21 to 38 (Van Dongen et al., 2003). Some slept 6 hours or less a night for 14 days. By the end, their deficits matched up to 2 nights with no sleep at all.



48 healthy adults (Van Dongen et al., 2003).

The study compared several sleep amounts, including a group kept fully awake. The deficits built up over the two weeks. They did not appear at once. The people involved also seemed **largely unaware** of them. Their own sleepiness ratings did not keep pace with their falling scores.

One night without sleep. A brain-scan study kept people awake for a full night (Yoo et al., 2007). The next day, the hippocampus was less active while they learned new material. The test was of episodic memory, which means memory for events.



A person stays awake all night at a desk.

The study tested a full night awake. It did not test 6 hours of sleep. Its results apply to **total sleep loss**.

Walker's bestseller, *Why We Sleep*, is often quoted on these points (Walker, 2017). The figures above come from the **original studies** instead.

Where the figures come from

	Source
Often quoted	Why We Sleep
Used here	The original studies

Walker's bestseller, Why We Sleep, is often quoted on these points (Walker, 2017).

The Stages of Sleep

Sleep runs in cycles of non-REM and REM stages through the night. The current system has **three non-REM stages**, N1 to N3 (NINDS,

n.d.). Deep sleep used to be split into stages 3 and 4. Experts merged them into one stage, N3, in 2007 (Silber et al., 2007).

Stage	What Happens	Role in Memory
N1 (light non-REM)	The change from waking to sleep; lasts several minutes	No specific memory role confirmed
N2 (light non-REM)	Brain waves slow, with brief bursts of activity called spindles; most of the night is spent here	Spindles help time memory replay
N3 (deep non-REM, slow-wave sleep)	Deep sleep; longer spells in the first half of the night	Replays and moves fact-based memories to long-term storage
REM	First appears about 90 minutes after sleep starts; spells grow longer later in the night	May help firm up memories in the outer brain; late REM-rich sleep helped a motor skill
Whole night	Repeated cycles of all stages	Memory storage most likely needs both non-REM and REM sleep

The table draws on official and primary sources (NINDS, n.d.; Diekelmann & Born, 2010; Plihal & Born, 1997). A few further details are known. The amygdala, an emotion area, is **more active in REM sleep** (NINDS, n.d.).

The stress hormone cortisol runs lower in early sleep than in late sleep (Plihal & Born, 1997). In one study, more deep-sleep spindles went with **better recall** (Wilhelm et al., 2011). This held for material people expected to be tested on.

How much sleep. US sleep experts advise adults to get 7 or more hours a night (Watson et al., 2015). Another US group suggests 7 to 9 hours for adults (Hirshkowitz et al., 2015). For older adults, it suggests 7 to 8 hours.

How much sleep

Who	Advice
Adults (Watson et al., 2015)	7 or more hours
Adults (Hirshkowitz et al., 2015)	7 to 9 hours
Older adults	7 to 8 hours

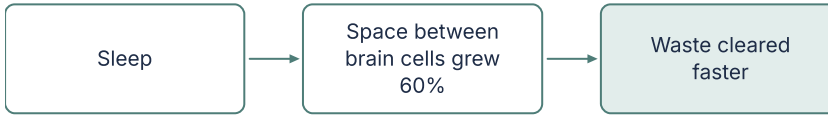
Another US group suggests 7 to 9 hours for adults (Hirshkowitz et al., 2015).

One secondary reference gives rough shares of an adult's night. N1 takes about 5% and N2 about 45%. Deep sleep and REM each take **about a quarter**. The shares change with age.

Clearing Waste During Sleep

Sleep may also help clear waste from the brain. It is like a night cleaning crew that tidies an office after everyone goes home. In 2012, a team described a fluid pathway along brain blood vessels in mice (Iliff et al., 2012). It is now called the **glymphatic system**. It carries fluid through brain tissue and clears waste, including amyloid-beta, a protein that builds up in Alzheimer's disease.

Sleep may help clear waste from the brain



Xie et al., 2013, in mice.

Amyloid-beta is a protein that builds up in Alzheimer's disease. In a 2013 mouse study, space between brain cells grew **60%** in sleep (Xie et al., 2013). Waste, including amyloid, cleared faster as a result.

Clearance increased during sleep but did not happen only then. The same widening was seen under anaesthesia, and **both studies were in mice**.

In humans, one night without sleep raised amyloid in parts of the brain (Shokri-Kojori et al., 2018). The study scanned **20 healthy adults**. It did not show that this builds up over time into dementia.

Key idea:

Short sleep night after night leads to deficits that build up, often unnoticed. 7 or more hours is what US sleep experts advise for adults.

> Exercise:
>
> 10.11, The Pre-Sleep Review. Follow these five steps.

1. This exercise builds a short review habit before bed. Sleep tends to favour memories people expect to need later (Wilhelm et al., 2011).
2. Spend 5 minutes before sleep in a dim room without screens. Recall the 5 most important things you learned that day. Do not read notes first. Then check whether you missed anything.
3. For 3 minutes, walk through any memory palace you updated or built today. Check that each image is clear and in place.
4. For 2 minutes, pick the 3 things you most want to remember from today. Say them aloud once, then let them go.
5. Do this every night for 14 nights, keeping other habits steady. Compare your next-morning recall of the previous day's material on night 1 and night 14.

In one study, sleep helped word-pair recall **only when people knew** a test was coming (Wilhelm et al., 2011). In my view, a review before bed may signal what matters. No study has shown that the review itself tags memories for sleep.

The pre-sleep review

Shown	Not shown
Sleep helped recall when people knew a test was coming	→ The review itself tags memories for sleep

In my view, a review before bed may signal what matters.

> **Exercise:**
>
> 10.12, The Sleep and Memory Log. Follow these five steps.

1. For two weeks, track your sleep and your memory side by side.
2. Each morning on waking, rate your sleep in three ways. Note the hours slept and how often you woke. Rate how deeply you slept from 1 to 10.
3. Then do a 15-word recall test. Study the words for 90 seconds and recall them after 5 minutes. Use a fresh list each morning.

4. After 14 days, plot sleep quality against your test scores. Check whether better nights go with higher scores the next morning.
5. Treat what you find as personal data. Two weeks is a small sample, and other factors also change from day to day.

Quick check:

1. After 14 days of 6 hours of sleep or less, what did people's deficits match (Van Dongen et al., 2003)? Answer: Up to 2 nights with no sleep at all.
2. How much sleep do US sleep experts advise for adults (Watson et al., 2015)? Answer: 7 or more hours a night.
3. In the 2013 mouse study, how much did the space between brain cells grow in sleep (Xie et al., 2013)? Answer: 60%.

Evidence-Based Sleep Habits

Good sleep habits **protect the stages of sleep** that support memory. The table lists common habits, how to use them and what the evidence shows. Some details are my own suggestions and are marked as such.

Habit	How to Use It	What the Evidence Shows
Regular sleep schedule	Go to bed and wake at the same times every day, weekends included. Aim for 7–9 hours.	Adults should get 7 or more hours (Watson et al., 2015); 7–9 hours for adults and 7–8 for older adults (Hirshkowitz et al., 2015)
Dark, cool bedroom	Blackout curtains or an eye mask; a cool room	Light lowers melatonin, a hormone that helps sleep (Chang et al., 2015); exact temperature figures not found in official sources
Caffeine cut-off	Avoid large amounts of caffeine for at least 6 hours before bed	Caffeine 6 hours before bed still disrupted sleep (Drake et al., 2013); average half-life (the time the body takes to clear half a dose) about 5 hours, range 1.5–9.5 (Institute of Medicine, 2001)
Screen cut-off	No screens 60–90 minutes before bed (my suggestion)	Reading on a light-emitting device delayed sleep and the body clock (Chang et al., 2015)
Wind-down routine	A warm bath or shower, light reading, gentle stretching or journaling	A 10-minute warm bath or shower 1–2 hours before bed helped people fall asleep sooner (Haghayegh et al., 2019)
Short nap	10–20 minutes in the early afternoon if tired; set an alarm	A 10-minute nap worked best for alertness (Brooks & Lack, 2006); memory was not tested
Pre-sleep review	Spend 5 minutes recalling the day's key learning before sleep	Sleep favoured memories people expected to need later (Wilhelm et al., 2011)

Caffeine blocks adenosine, a chemical that makes you feel sleepy (NINDS, n.d.). Its **half-life** is the time the body takes to clear half a dose. It is like snow that melts slowly, with some left long after the sun comes out. On average this is about 5 hours, but it varies widely between people.

The blue-light "3 hours" figure comes from a light test (Harvard Health Publishing, n.d.). It exposed people to **6.5 hours of light**. Blue light shifted the body clock about 3 hours; green light, about 1.5. That figure is not a delay caused by evening screen use.

Blue and green light shift the body clock

Light	Body clock shift
Blue	About 3 hours
Green	About 1.5

It exposed people to 6.5 hours of light.

The warm-bath evidence is **limited but positive**. The studies used water of about 40 to 42.5 degrees Celsius. A 10-minute bath was enough when taken 1 to 2 hours before bed.

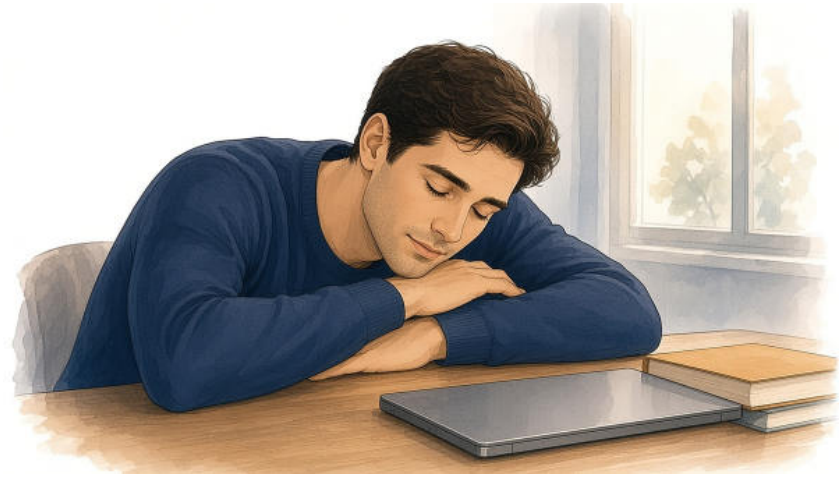


A person relaxes in a warm bath, 1 to 2 hours before bed.

For naps, one study tested 24 young adults after a short night (Brooks & Lack, 2006). The **10-minute nap** gave quick benefits. Benefits from a 20-minute nap appeared only 35 minutes later. A 30-minute nap left people groggy.

Key idea:

Regular hours, a dark, cool room and no caffeine or screens late in the day give sleep that better protects memory, in my view.



A young adult takes a 10-minute nap after a short night.

> Exercise:
> 10.13, The 14-Night Sleep Plan. Follow these six steps.

1. Choose the three habits from the table that you follow least well. These are your main targets.
2. For 14 nights, practise all three together. Leave the others for now, so you can focus.
3. On nights 1 to 7, rate your sleep quality each morning from 1 to 10. Expect some disruption while your body clock adjusts.

4. On nights 8 to 14, keep going as the habits settle. Watch whether your ratings rise.
5. On night 14, compare your average for nights 8 to 14 with your starting rating. Also compare your memory scores with your baseline from the practical exercises module.
6. Use the results to choose which habits to add next month. I hold that adding a few habits at a time makes them last.

The 14-Night Sleep Plan



Quick check:

1. How long before bed did caffeine still disrupt sleep (Drake et al., 2013)? Answer: 6 hours.
2. Which nap length worked best for alertness (Brooks & Lack, 2006)? Answer: 10 minutes. Memory was not tested.
3. When should a warm bath be taken, and for how long? Answer: 1 to 2 hours before bed, for about 10 minutes.

Stress, Cortisol and Memory

In my view, stress is among the **most underrated** factors that affect memory. No study ranks these factors, though. Nutrition and exercise work over weeks and months. Stress can act **much faster**. Even mild stress you cannot control can quickly weaken the brain's planning areas (Arnsten, 2009). The effects of stress hormones, chemicals the body releases under stress, such as cortisol, also depend on their timing and dose (Lupien et al., 2007).



Even mild stress you cannot control can quickly weaken the brain's planning areas (Arnsten, 2009).

Stress **does not always harm** memory. It is like a smoke alarm, which helps in a real fire but gets in the way when it goes off too often. Stress hormones can make the stressful event itself easier to remember (Lupien et al., 2009). Knowing how stress works helps anyone who must think well under pressure.

Stress does not always harm



Stress hormones can make the stressful event itself easier to remember (Lupien et al., 2009).

Key idea:

Stress can have fast effects on memory, for better or worse, depending on timing and dose.

Quick check:

1. How fast can mild stress you cannot control weaken the brain's planning areas (Arnsten, 2009)? Answer: Quickly.
2. What can stress hormones make easier to remember (Lupien et al., 2009)? Answer: The stressful event itself.

How Stress Affects Memory

When you sense a threat, your body's stress system switches on. The threat can be real or imagined, physical or emotional. Your adrenal glands, small glands on top of the kidneys, then release **cortisol, a stress hormone**. It reaches the brain through the blood.

Stress hormones can make the threatening event itself **easier to remember** (Lupien et al., 2009). That may help people recall danger. At the same time, stress can weaken the brain's planning areas in the prefrontal cortex (Arnsten, 2009). This front part of the brain also guides attention.

Stress hormones can help and weaken

Can help	Can harm
Memory for the threatening event	The brain's planning areas

That may help people recall danger.

The effects depend on **timing, dose** and how emotional the material is (Lupien et al., 2007). Stress is no simple on-off switch for memory. Its effect changes with the situation.

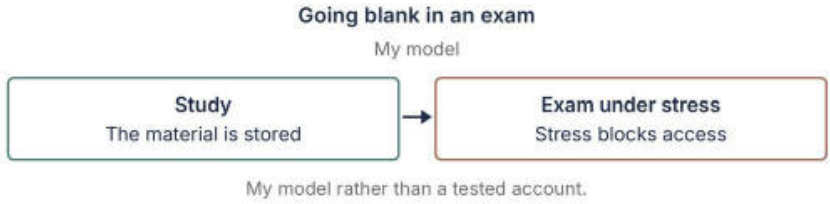
Going blank in an exam. Many students have gone blank in an exam. My view is that the material stays stored, though stress blocks access. This is my model. It is not a tested account.



A student stares at an exam paper, with her mind gone blank.

Related evidence comes from one study of stress and recall (Smith et al., 2016). People who had learned through **retrieval practice** recalled well even after a stressful task. Those who had only restudied did worse under stress.

In my view, managing stress is **part of memory training**. It is not an extra. It affects how easily you can reach what you know.



The Inverted U

Reviews describe an inverted-U link between stress hormones and memory (Lupien et al., 2007). It is like a guitar string, which buzzes when too loose and snaps when too tight. Memory tends to be poorer when levels are very low or very high. It tends to be best at **moderate levels**.

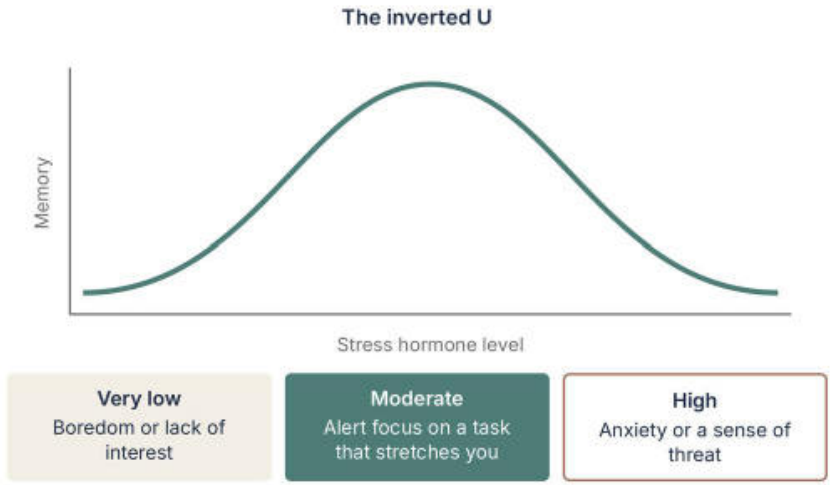


Illustration — not real data

Key idea:

Very low or very high stress goes with poorer memory. With moderate stress, memory tends to be best.

Very low levels may go with **boredom** or lack of interest. Moderate levels may go with alert focus on a task that stretches you. High levels may go with anxiety or a sense of threat.

The aim, then, is to **manage stress**. Removing it is not the goal. I see a task at the edge of your ability as healthy challenge. Constant anxiety is not.

I suggest that my memory methods work best in a **calm, focused state**. Panicked rushing tends to work against them.

The state that suits the methods



I suggest that my memory methods work best in a calm, focused state.

> Science Says:
>
> Long-term stress can affect brain areas involved in thinking and memory (Lupien et al., 2009). The effects depend on when the stress happens and how long it lasts. Much of the evidence on brain structure comes from animal studies.

Even mild stress you cannot control can quickly impair the prefrontal cortex (Arnsten, 2009). That review stressed the **sense of control**. It did not describe a normal busy day.



That review stressed the sense of control.

> **Exercise:**
> 10.14, The Stress Awareness Audit. Follow these four steps.

1. For 7 days, rate your stress each morning, afternoon and evening. Use a scale from 1 to 10. Here 1 means deeply relaxed, 5 means busy but engaged and 10 means overwhelmed.
2. Each time, note what caused your stress level. Record any physical signs, such as a tight chest, shallow breathing or tense muscles. Note whether you were doing any memory work then.
3. After 7 days, work out your daily average. Find the time of day when it is usually highest. Note which situations most often raise it. Count how many hours a day you spend at your own high levels.
4. Use this data to make two changes to your week. Schedule your hardest memory work in your calmest times. Pick one regular stressor that you can reduce, delay or deal with this week.

Knowing your own pattern is a **first step**. It tells you when to study and which stressors to tackle first.

Quick check:

1. Who recalled well even after a stressful task (Smith et al., 2016)? Answer: People who had learned through retrieval practice.
2. At what level of stress hormones does memory tend to be best? Answer: Moderate levels (Lupien et al., 2007).
3. Where does much of the evidence on stress and brain structure come from? Answer: Animal studies.

Evidence-Based Ways to Reduce Stress

Some stress-reduction methods act **within minutes**. They calm the autonomic nervous system, the part that runs without conscious control. It governs things like heart rate and breathing.

I pick **four quick, easy methods**. You can use them before a test, a talk or a study session. Speed matters, as even mild stress you cannot control can quickly impair planning (Arnsten, 2009).

The evidence for them **varies**. Two have direct trial support for lowering stress measures. One has brain-scan findings from a small study. One has no study behind its specific claims.

The evidence for each technique

Technique	Evidence
Cyclic sighing	A trial
Progressive muscle relaxation	A trial
Mindful breathing	A small brain-scan study
The 4-7-8 breath	No study found

Two have direct trial support for lowering stress measures.

Four Quick Techniques

Technique 1, cyclic sighing. Breathe in twice through the nose, first fully and then with a short extra sip. Then breathe out slowly through the mouth.

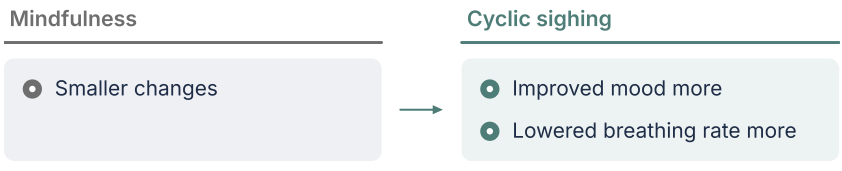


A person breathes in twice through the nose, then out slowly through the mouth.

A team led by Melis Balban tested this in a **remote trial** (Balban et al., 2023). Andrew Huberman was the senior author. For a month, people did 5 minutes a day of one practice. There were three breathing practices and one mindfulness practice.

Cyclic sighing **improved mood more** than mindfulness did. It also lowered breathing rate more, a sign of a calmer body. It is like a car slowing down as you ease off the pedal. Both differences were statistically significant.

Cyclic sighing and mindfulness



One month, 5 minutes a day (Balban et al., 2023).

The study did not test **why cyclic sighing works**. I suggest using it before high-pressure moments. In the trial, people practised at home and were tracked remotely.

Technique 2, the 4-7-8 breath. Breathe in for a count of 4 and hold for 7. Then breathe out for a count of 8.

I suggest **3 to 5 rounds** before an exam or talk. No study was found for its specific effects. Treat it as a routine to try. It is not a proven method.

Technique 3, progressive muscle relaxation. Tense and release each major muscle group in turn, from feet to head. Hold each tension for about 5 seconds before letting go.



Technique 3, progressive muscle relaxation. Tense and release each major muscle group in turn, from feet to head.

Edmund Jacobson developed the method in the **1930s**. I suggest a session of about 10 minutes.

One study tested a short version (Pawlow & Jones, 2002). It compared **46 people** who did the exercise with 15 who sat quietly. The relaxation group had lower heart rate, anxiety, stress ratings and cortisol in saliva afterwards. Saliva testing is a common way to measure this stress hormone.

That study did not test recovery after a stressful event. It measured the effect of **one session** compared with quiet sitting. I suggest daily practice for the best results.

Technique 4, mindful breathing (5 minutes). Sit comfortably. Focus on the feeling of air at the nostrils or the chest rising and falling.

When your mind wanders, and it will, gently **bring it back**. Each return is part of the practice.

One study looked at an **8-week mindfulness course** (Hölzel et al., 2011). The course was Mindfulness-Based Stress Reduction, a structured group programme. It compared 16 people who took it with 17 who were waiting to start.

An 8-week mindfulness course



Mindfulness-Based Stress Reduction (Hölzel et al., 2011).

Those who took the course practised about **27 minutes a day** at home. That came to about 22.6 hours over the 8 weeks.

Afterwards, their grey matter was **denser** in the left hippocampus and some other areas. Grey matter density is a measure of brain tissue in a region. The study was small and did not test protection against stress or memory decline.

In my view, regular practice makes you **less reactive** to stress over time. No source checked shows that these methods change your stress threshold.

Try each technique for **a few days** before you choose. Some people prefer breathing methods, while others find muscle work easier. Keep whichever calms you fastest.

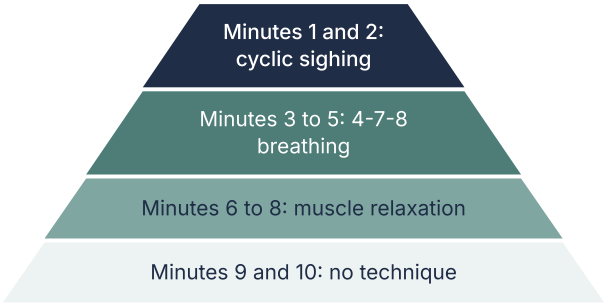
Key idea:

A few minutes of slow breathing or muscle relaxation lowered stress measures in trials. With regular practice, you become less reactive to stress, in my view.

> **Exercise:**
> 10.15, The 10-Minute Daily Stress Plan. Follow these six steps.

1. Do this short routine every morning for 30 days. It combines the four techniques above.
2. Minutes 1 and 2: do 10 rounds of cyclic sighing. Focus only on your breath.
3. Minutes 3 to 5: do 6 rounds of 4-7-8 breathing. Use a phone timer if counting is hard.
4. Minutes 6 to 8: tense and release your feet, legs and stomach. Then do your hands, arms, shoulders and face. Hold each for 5 seconds, then release fully. Go through the groups twice.
5. Minutes 9 and 10: sit without any technique. Notice how your mind feels compared with when you began.
6. Before and after each session, rate your stress and mental clarity from 1 to 10. After 30 days, compare your morning stress rating on day 1 and day 30. If one technique does not suit you, give more time to one that does.

Ten minutes each morning



After 30 days, compare your morning stress rating on day 1 and day 30.

> **Exercise:**
> 10.16, The Stress and Recall Drill. Follow these six steps.

1. This drill tests how well you can recall under pressure. Many people must think clearly in exams, talks or hard conversations.
2. Make a 20-item word list and learn it with a memory palace. Recall it once while calm and record your score.
3. Watch a 3-minute clip that you find tense, such as a dramatic sports finish. Choose something tense. Avoid anything truly upsetting. Then try to recall the list.
4. Spend 3 minutes on cyclic sighing. Then try the recall again.
5. Repeat the three tests, calm, stressed and recovered, once a week for 4 weeks. Use a fresh word list each week. Track whether your stressed and recovered scores move closer to your calm score.
6. The gap between your calm and stressed scores shows how much stress affects your recall. In my view, narrowing that gap is a useful training goal.

Recall practice itself may help here. In one study, people who learned through retrieval practice **held up better** under stress (Smith et al., 2016).

> Exercise:
> 10.17, The Study Space Audit. Follow these five steps.

1. Your surroundings can add low-level stress through clutter, noise, interruptions, poor light and unfinished tasks. This audit helps you find and reduce these sources.
2. Sit where you do most of your memory work. Rate clutter and noise from 1 to 10, where 10 is worst. Count interruptions per hour, and note the light and temperature. Mark every score above 5.
3. Count how many alerts your phone or computer sends per hour while you study. Note how many unread emails or messages you can see. In my view, each one can pull at your attention.
4. For each item scored above 5, make one change this week. You might clear a desk or turn on Do Not Disturb. You could add a lamp, find a quieter room or file old emails.
5. After the changes, rate your space again. Note whether your study sessions feel calmer. Repeat the audit after a month, as clutter and alerts tend to return.

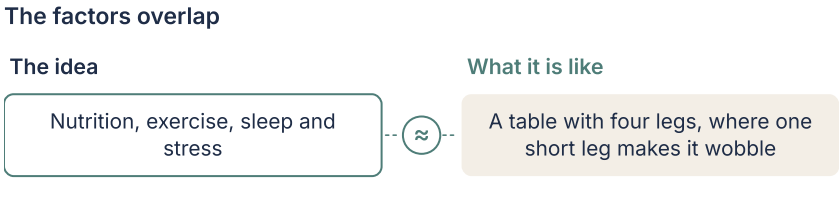
Small changes to your space are **easy to test**. Track your own scores to see whether they help.

Quick check:

1. What did cyclic sighing do better than mindfulness (Balban et al., 2023)? Answer: It improved mood more and lowered breathing rate more.
2. What did the relaxation group show afterwards (Pawlow & Jones, 2002)? Answer: Lower heart rate, anxiety, stress ratings and cortisol in saliva.
3. How long did the mindfulness course group practise at home each day (Hölzel et al., 2011)? Answer: About 27 minutes.

Bringing the Lifestyle Factors Together

Nutrition, exercise, sleep and stress each affect memory in their own way. In daily life, they also **overlap**. It is like a table with four legs, where one short leg makes it wobble. Poor sleep, for example, can make stress harder to manage.



In daily life, they also overlap.

I argue that the four factors **strengthen one another**. No study has tested this kind of combined effect on memory, though. Treat it as my view. It is not a proven result.

What the FINGER trial tested. The FINGER trial is often cited for combined lifestyle change (Ngandu et al., 2015). It followed 1,260 adults at raised risk, aged 60 to 77, for 2 years. Its four parts were diet, exercise, brain training and checks on heart and blood risks.

Sleep and stress were not part of the programme. On a combined thinking score, the programme group improved **slightly more** than the control group, the people who did not get the programme, so the others can be compared with them. Each part was not tested on its own, so their separate effects are unknown.

Change in combined thinking score



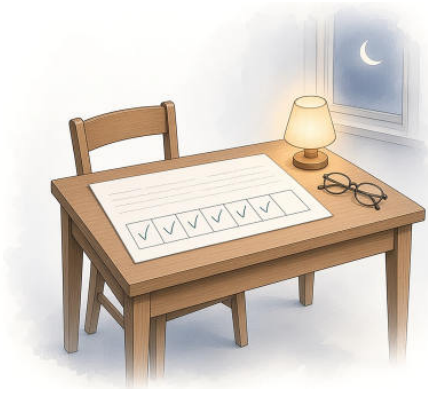
The size of the gain needs care. The programme group's score rose by 0.20, against 0.16 for the control group. That is a **25% larger change**. It is not a 25% gain in thinking.

> ✎ **Exercise:**
> 10.18, The Lifestyle Scorecard. Follow these six steps.

1. Each Sunday, fill in this short weekly scorecard. Score yourself honestly on each of the four factors, using the scale below.
2. Nutrition, 0 to 3. Score 3 if you met the MIND targets on 5 or more days. Score 2 for 3 or 4 days and 1 for 1 or 2 days. Score 0 if you did not track.

3. Exercise, 0 to 3. Score 3 for 4 or more aerobic sessions of 20 minutes or longer. Score 2 for 2 or 3 sessions, 1 for one session and 0 for none.
4. Sleep, 0 to 3. Score 3 for 7 or more hours on a steady schedule, 5 or more nights. Score 2 for 6 to 7 hours on 3 or more nights. Score 1 for an irregular schedule or under 6 hours on most nights. Score 0 for badly broken sleep all week.
5. Stress, 0 to 3. Score 3 if you used a stress-reduction technique every day. Score 2 for 4 to 6 days and 1 for 1 to 3. Score 0 for none.
6. Your weekly total is out of 12. I suggest aiming for 9 or more. Compare it with your memory scores that week. Look for a pattern over 4 weeks.

The 7-hour mark in the sleep score matches **US guidance** for adults (Watson et al., 2015). The scorecard shows where your gaps are. Closing them all for one week is a way to test their effect.



A sleep scorecard with nights of 7 hours or more ticked off.

> Exercise:
> 10.19, The Peak Week. Follow these seven steps.

1. Plan one week in which you follow every lifestyle habit at once. This is a short experiment. It is not a permanent plan.
2. Nutrition: follow the MIND targets for all 7 days. Prepare meals ahead if needed. Avoid processed food, added sugar and alcohol.
3. Exercise: do 30 minutes of aerobic activity daily. Fit it within 2 hours of your memory practice.
4. Sleep: keep a fixed bedtime and wake time. Use the sleep habits from earlier in this module. Aim for 7.5 to 8.5 hours a night.
5. Stress: do the 10-minute morning stress plan each day. Limit news you do not need, and keep one evening free of screens.
6. Memory practice: do your usual 20-minute daily training from the practical exercises module. Do it when you feel most alert.
7. Record your memory scores each day. Compare them with your scores from the past month. Note which habits seemed to matter most for you.

The Peak Week

MIND food, 7 days	30 minutes aerobic daily	7.5 to 8.5 hours of sleep

The Peak Week **leaves out alcohol**. The MIND diet does allow a glass of wine daily. Health bodies give reasons for caution. The World Health

Organization says there is no safe level of drinking for health (World Health Organization, 2023).

Key idea:

Food, exercise, sleep and stress care may work best together, in my view. No study has tested the combined effect.

Quick check:

1. How many adults did the FINGER trial follow, and for how long (Ngandu et al., 2015)? Answer: 1,260 adults, for 2 years.
2. How much did the programme group's score rise, against the control group? Answer: 0.20 against 0.16, a 25% larger change. It is not a 25% gain in thinking.
3. What is the top weekly score on the Lifestyle Scorecard? Answer: 12. I suggest aiming for 9 or more.

Key Concept:

Key Takeaways

Food matters, but single-nutrient pills mostly show no memory gain in healthy adults. The MIND diet is tied to lower Alzheimer's risk, though its trial found no benefit.

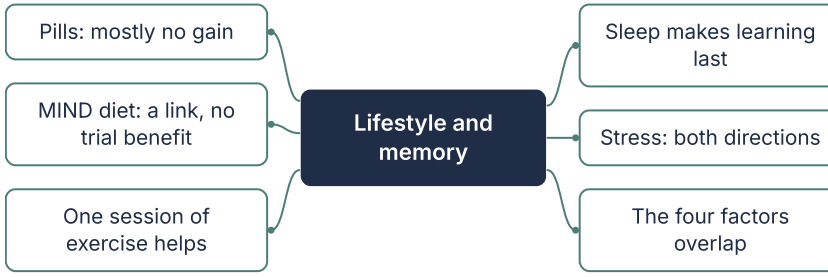
Exercise helps memory, especially a single session before learning. Regular exercise showed small effects in a large review.

Sleep helps turn learning into lasting memory. Cutting sleep for extra study tends to backfire.

Stress affects memory in both directions. Mild stress you cannot control can quickly impair planning and recall.

The four factors overlap in daily life. I hold that they work best together, though this has not been tested.

This module at a glance



The four factors overlap in daily life.

Use the checklist below to **track your work** through Module 10.

Exercise: Module 10 Completion Checklist. Lifestyle Foundations	
Core Ideas	
[ ]	Single-nutrient pills mostly show no memory benefit in healthy adults
[ ]	The MIND diet is tied to lower risk; its randomised trial found no benefit
[ ]	One session of exercise helps memory more clearly than long-term training
[ ]	Sleep supports memory storage; adults need 7 or more hours
[ ]	Sleep increases waste clearance in the brain, shown mainly in mice
[ ]	Stress hormones have an inverted-U link with memory
[ ]	The four factors overlap; the combined effect is my view
Exercises to Do First	
[ ]	Exercise 10.1, Brain-Nutrient Mapping
[ ]	Exercise 10.7, The Study-Exercise Plan
[ ]	Exercise 10.11, The Pre-Sleep Review
[ ]	Exercise 10.14, The Stress Awareness Audit
All Exercises	
[ ]	10.1 Brain-Nutrient Mapping
[ ]	10.2 The MIND Diet Transition Plan
[ ]	10.3 The 7-Day Brain Diet Audit
[ ]	10.4 The Food and Focus Diary
[ ]	10.5 The Hydration Test
[ ]	10.6 The Pre-Study Meal Plan
[ ]	10.7 The Study-Exercise Plan
[ ]	10.8 The Short Hard Workout Before Study
[ ]	10.9 The Movement-Learning Test
[ ]	10.10 The 30-Day Exercise-Memory Challenge

[ ]	10.11 The Pre-Sleep Review
[ ]	10.12 The Sleep and Memory Log
[ ]	10.13 The 14-Night Sleep Plan
[ ]	10.14 The Stress Awareness Audit
[ ]	10.15 The 10-Minute Daily Stress Plan
[ ]	10.16 The Stress and Recall Drill
[ ]	10.17 The Study Space Audit
[ ]	10.18 The Lifestyle Scorecard
[ ]	10.19 The Peak Week
Daily Habits	
[ ]	At least 20 minutes of aerobic exercise on study days, ideally before study
[ ]	The 10-minute daily stress plan each morning
[ ]	The pre-sleep review before bed
[ ]	Drink to thirst; US guidance is about 3.7 litres of total water for men and 2.7 for women
This Week	
[ ]	Start the 7-Day Brain Diet Audit today
[ ]	Schedule exercise before your next 3 study sessions
[ ]	Do the pre-sleep review tonight
[ ]	Keep the sleep and memory log this week
[ ]	Fill in the Lifestyle Scorecard to find your weakest factor

Lifestyle sets the **physical conditions** in which memory methods work. In my view, even strong methods are limited by poor sleep, diet or stress. The module on keeping knowledge current comes next.

Module 11: The Adaptive Memory

> **Key Concept:**
>
> Module Overview
>
> Knowledge changes, and some of what you learned will stop being true. In my view, the risk is less about forgetting. It is more about holding on to what is out of date. Out-of-date knowledge can feel like confidence. This module helps you keep your memory accurate, flexible and up to date.

THE PACE OF CHANGE differs by field, and it is **often slower than headlines suggest**. It is like the sea. The waves on top are fast and noisy, like headlines, but the tide below them moves slowly. One study tracked 17 US clinical guidelines, guides that tell doctors how to treat an illness (Shekelle et al., 2001). About half were out of date within 5.8 years.

The pace of change



One study tracked 17 US clinical guidelines (Shekelle et al., 2001).

A second team looked at systematic reviews, which pool many studies on one question (Shojania et al., 2007). The median time before a review needed updating was **5.5 years**.

How fast guidance ages

Study	Finding
17 US clinical guidelines (Shekelle et al., 2001)	About half out of date within 5.8 years
Systematic reviews (Shojania et al., 2007)	Median 5.5 years before an update

A second team looked at systematic reviews, which pool many studies on one question (Shojania et al., 2007).

This module covers the science of memory updating. It also covers why minds resist change. It then offers **drills, exercises and checklists** to keep your knowledge current.

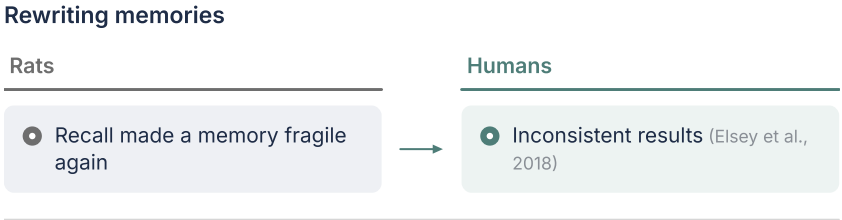
Some of the science comes from animal work. In rats, recalling a fear memory made it **fragile again** for a time (Nader et al., 2000). The memory then needed new protein-building to be stored again.



A rat in a lab cage, part of a study on fear memory.

In humans, the evidence is **less clear**. A critical review found inconsistent results (Elsey et al., 2018). It concluded that this process cannot yet be firmly shown in the human brain.

Claims about rewriting memories therefore **call for care**. The drills in this module do not rely on them.



Claims about rewriting memories therefore call for care.

Key idea:

Holding on to old knowledge is a bigger risk than forgetting, in my view.

In This Module

- Learn why updating memory matters as much as building it.
- Learn why the mind tends to resist updates.
- Learn what is known about how memories and beliefs are updated.
- Build a personal system to track, check and refresh your key knowledge.

- Practise exercises to think flexibly, question what you assume and relearn changed facts.
- Use checklists to keep your knowledge current at work and at home.

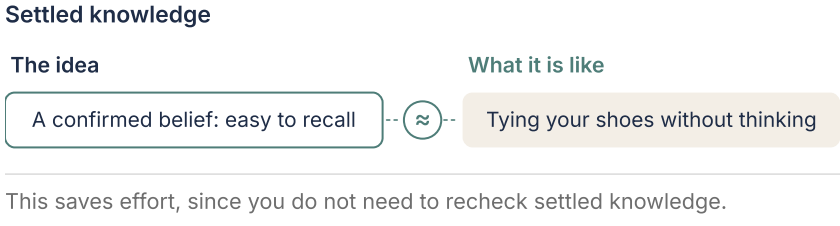
Track, check and refresh



11.1 Why Your Mind Resists the Update

In my view, the mind is built to **guard what it knows**. Animal work shows that the picture is more mixed. In rats, a recalled fear memory became fragile again and had to be stored anew (Nader et al., 2000).

Once a belief is learned and confirmed by experience, it becomes **easy to recall**. It is like tying your shoes, which your hands do without thinking. This saves effort, since you do not need to recheck settled knowledge. It becomes a problem when the facts in a field change.



Belief Perseverance

Belief perseverance means a belief lasts after its evidence has been discredited. In one classic study, people kept first impressions after learning their basis was false (Ross et al., 1975). A debriefing that explained how such impressions form generally removed them.

I have a model for why this happens. A new fact does not erase the old memory. Instead, it adds a **competing one**, and the older, well-practised memory often wins at recall.

Whether recall lets new learning rewrite an old memory in people is **not settled**. One human study updated a fear memory in this way (Schiller et al., 2010). The change lasted at least a year. However, four direct repeats of another often cited human study failed (Hardwicke et al., 2016).

Rewriting in people

Study	Result
Schiller et al., 2010	A fear memory updated; lasted at least a year
Four repeats (Hardwicke et al., 2016)	Failed

The change lasted at least a year.

What the Research Says

A **schema** is a mental framework built from past experience. It shapes how you take in and recall new things. A review by Ghosh and Gilboa (2014) traces how the idea has been defined over time.

Schemas and distortion. Bartlett (1932) asked people to retell a story from an unfamiliar culture. A close repeat of his method found the same pattern (Bergman & Roediger, 1999). People forgot details and bent the story to fit what they knew.



A person retells a story from an unfamiliar culture, leaving out details.

The continued influence effect. People keep using false information after it has been corrected (Johnson & Seifert, 1994). Offering a plausible other cause worked better than simply saying the claim was false. A major review found that retractions often fail to undo false beliefs (Lewandowsky et al., 2012).

Correcting false information

Saying the claim was false		A plausible other cause
Worked less well	→	Worked better

The continued influence effect. People keep using false information after it has been corrected (Johnson & Seifert, 1994).

A meta-analysis pooled **32 studies** (Walter & Tukachinsky, 2020). Corrections reduced the effect of false claims but did not remove it. They worked less well for repeated claims or claims from a trusted source. They also worked less well when the correction came late.

Key idea:

An old belief and a new fact make two competing memories, and the older one often wins at recall, in my view.

The half-life of facts. The writer Samuel Arbesman (2012) made popular the idea that facts have a half-life. In this sense, a half-life is the time until half of a field's findings are revised. His best-known figure, 45 years, comes from cirrhosis and hepatitis research only.

In that field, **60% of 474 findings** were still held true in 2000 (Poynard et al., 2002). Clinical guidelines aged faster. About half were out of date within 5.8 years (Shekelle et al., 2001).

Arbesman's other figures track how long a field's books and papers stay in use. For physics books, that figure is **about 13 years** (Tang, 2008). He warns against comparing fields on such numbers.

Figures behind the half-life idea

Measure	Figure
Cirrhosis and hepatitis findings still held true in 2000	60% of 474
Physics books in use (Tang, 2008)	About 13 years

Arbesman's other figures track how long a field's books and papers stay in use.

Four Habits That Slow Updating

These four habits work **out of sight**. You do not feel a belief going out of date. You simply feel sure.

Habit	What It Does	Why It Feels Normal	What It Costs
Cognitive entrenchment	Deep expertise can reduce flexibility in solving problems and adapting (Dane, 2010). Dane argues that this trade-off can be overcome.	Expertise feels like clarity. Easy recall feels like being right.	Experts may miss a major shift in their field.
Selective recall	In my view, you tend to recall what supports a new claim. People often discount evidence against beliefs they hold firmly (Kaplan et al., 2016).	It feels like careful thought, because you are recalling real knowledge.	Evidence against your view gets too little weight.
The illusory truth effect	Repeated claims feel more true, whether or not they are (Hasher et al., 1977). This held even when people knew the correct answer (Fazio et al., 2015).	Old knowledge feels plainly right. New corrections feel unsure.	Old, often-repeated claims can beat recent corrections.
Update anxiety	Changing your mind can feel like losing face. In one brain-scan study, those who changed their views more had less activity in two emotion-related areas (Kaplan et al., 2016).	Holding a position feels like integrity. Changing it feels like weakness.	People may hold old beliefs for reasons of pride, not evidence.

Your field's pace of change sets **how often to check** what you know. The section on knowledge half-lives looks at this.

How often to check



Quick check:

1. What did a meta-analysis of 32 studies find about corrections (Walter & Tukachinsky, 2020)? Answer: They reduced the effect of false claims but did not remove it.
2. Where does Arbesman's best-known 45-year figure come from? Answer: Cirrhosis and hepatitis research only.
3. What did people do when they retold a story from an unfamiliar culture (Bergman & Roediger, 1999)? Answer: They forgot details and bent the story to fit what they knew.

11.2 The Knowledge Currency System

I TREAT KNOWLEDGE AS **having a currency**. Current knowledge reflects the world now, not when you learned it. It is like money, which loses buying power through inflation. Knowledge can likewise lose its power to explain and predict.



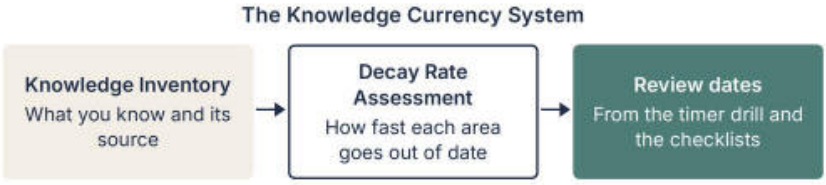
Current knowledge reflects the world now, not when you learned it.

> Definition:
>
> **CURRENCY:** here, how well your knowledge matches the world now.

The **Knowledge Currency System** is my method for keeping key knowledge current. You check it, track it and refresh it. The aim is to catch old beliefs before they cost you.

The system has **three parts**. A Knowledge Inventory records what you know and its source. A Decay Rate Assessment estimates how fast each

area goes out of date. Review dates come from the timer drill and the checklists in this module.



Key idea:

Inventory, decay rates and review dates together make the Knowledge Currency System.

Quick check:

1. What are the three parts of the system? Answer: A Knowledge Inventory, a Decay Rate Assessment, and review dates from the timer drill and the checklists.
2. What is the system's aim? Answer: To catch old beliefs before they cost you.

11.2.1 Your Knowledge Inventory

THE FIRST STEP IS to **map the areas** of knowledge you rely on most. Most people never check what they know. They simply use it.

The map shows which areas you rely on and when you last reviewed each one. It is like checking the dates on the food in your fridge. It also shows how fast each area is changing. Until you have it, updating tends to happen **by chance**, when a contradiction turns up.

Checking the dates

The idea	What it is like
Your map: when each area was last reviewed	≈ The dates on the food in your fridge

It also shows how fast each area is changing.



Labelled folders, each marked with the date it was last reviewed.

> **Exercise:**
> 11.1, The Knowledge Domain Map. Follow these six steps.

1. In your Memory Journal, start a section called “Knowledge Inventory”. Draw 6 columns. Label them Domain (an area of knowledge, such as a field or a skill), Core Beliefs, Source, Year Learned, Last Checked and Decay Rate.
2. List your top 10 work domains. These are the areas where you judge, advise or act on what you believe. Examples include your

field's best practices, your technical skills and your view of your market.

3. For each domain, list 3 to 5 of your firmest beliefs or models. These are the ideas you act on without thinking twice.
4. For each belief, note where it came from. It might be a course, a book, a mentor or your own experience. Then note when you last saw evidence that confirmed or changed it.
5. Give each domain a decay rate of High, Medium or Low. High fits areas that change fast, such as technology, medical guidelines, markets and law. Medium fits areas such as management, finance and science. Low fits slow areas, such as basic maths and historical facts. The next section explains these ratings further.
6. Review the list. Mark in red any High-decay belief older than 3 years. Do the same for any Medium-decay belief older than 7 years. These cut-offs are my suggestion. These beliefs are the ones most likely to be out of date. They may be costing you accuracy without your knowing.

Building the map



For each domain, list 3 to 5 of your firmest beliefs or models.

There is some support for a 3-year check in one field. A study of US clinical guidelines advised checking them **every 3 years** (Shekelle et al., 2001). For other fields, treat the cut-offs as a starting point. No study has tested them.

You may find that many of your firmest work beliefs have **never been checked**. Some may trace back to one source, and this is normal. The value of the exercise is that you can now see them.

Key idea:

Key beliefs, where they came from and when you last checked give you a map of what may be out of date.

Not all knowledge goes out of date at the **same rate**. A fact about Roman history may still be true in fifty years. A fact about a fast-moving technology may not last nearly as long.

One memory, two rates

Roman history	Fast-moving technology
May still be true in fifty years →	May not last nearly as long

Not all knowledge goes out of date at the same rate.



A history book on Rome beside today's newspaper.

Yet both facts sit in the **same long-term memory**. The framework that follows sets out how their rates differ.

Quick check:

1. How often did the study advise checking US clinical guidelines (Shekelle et al., 2001)? Answer: Every 3 years.
2. Which beliefs do you mark in red? Answer: High-decay beliefs older than 3 years and Medium-decay beliefs older than 7 years. These cut-offs are my suggestion and are untested.
3. What are the six columns of the map? Answer: Domain, Core Beliefs, Source, Year Learned, Last Checked and Decay Rate.

11.2.2 The Decay Rate Framework

Not all knowledge ages at the same rate. It is like milk and tinned beans, which go off at very different speeds. Arbesman (2012) notes that bodies of knowledge have **different expiry dates**. He also warns against firm comparisons between fields, because they are measured in different ways.



Arbesman (2012) notes that bodies of knowledge have different expiry dates.

Few fields have measured figures. About half of 17 US clinical guidelines were out of date within 5.8 years (Shekelle et al., 2001). The authors advised checking guidelines every 3 years.



A shelf of clinical guidelines, some marked out of date.

Systematic reviews showed a **similar pace**. The median time before one needed updating was 5.5 years (Shojania et al., 2007). Within 2 years, 23% already needed it.

For most other fields, **no measured half-life** exists. The table gives my suggested review rates as a starting point. Adjust them to how fast your own field moves.

Domain	Measured Rate	Main Cause of Change	Suggested Review
AI and machine learning	None found	New research, new designs and new benchmarks (standard tests used to compare results)	Monthly
Medical and clinical guidelines	About half out of date in 5.8 years (Shekelle et al., 2001)	New trial data, revised protocols and new drugs	Quarterly
Software engineering	None found	New frameworks and retired tools	Quarterly
Business strategy	None found	Market shifts, competition and economic cycles	Twice a year

Law and regulation	None found	New laws, court rulings and rule changes	Quarterly
Nutrition science	None found	New research and revised meta-analyses	Yearly
Core psychology	None found	Failed replications and refined theories	Every 3 to 5 years
Physics and mathematics	None found	Rare major shifts and refined details	Every 10 years or more
Historical facts	None found	New archive finds and new readings	Every 5 to 10 years
Your own field	Varies	Specific to your field	Assess and set

Use the Knowledge Domain Map from the previous section to **sort your own domains**. Then note how often you currently review each one.

Key idea:

Review a fast-changing field often. Review a slow field less often. Most rates in the table are my suggestions, with no measured figure behind them.

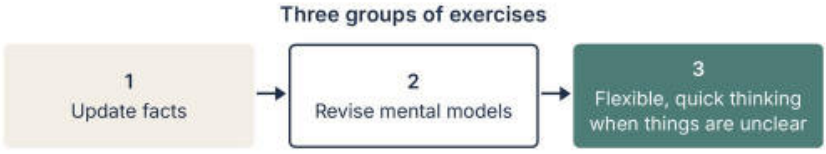
Quick check:

1. What share of systematic reviews needed updating within 2 years (Shojania et al., 2007)? Answer: 23%.
2. What review rate does the table suggest for AI and machine learning? Answer: Monthly, as my suggestion.
3. Why does Arbesman warn against firm comparisons between fields? Answer: Because fields are measured in different ways.

11.3 Exercises for Memory Updating and Mental Flexibility

These exercises aim at a skill that most memory training skips, in my view. That skill is **letting go of old knowledge** and learning the new version well. It is like clearing out a cupboard before you fill it with new things. No study has tested these drills as a set.

The exercises fall into **three groups**. The first updates facts, and the second revises mental models, simple pictures of how something works, used to make decisions. The third builds flexible, quick thinking when things are unclear.



Key idea:

Updating facts, revising models and thinking flexibly are the three groups of drills. No study has tested them as a set.

Quick check:

1. What are the three groups of exercises? Answer: Updating facts, revising mental models, and flexible, quick thinking when things are unclear.
2. Has a study tested these drills as a set? Answer: No.

11.3.1 Factual Update Drills

A FACTUAL UPDATE IS THE **most concrete** kind of upkeep. You find one fact that is now out of date. Then you replace it with the current version. It is like painting over an old sign with a new one. You use the same memory methods you used to learn it.

A factual update



Then you replace it with the current version.

The three drills here **work together**. The Overwrite Drill replaces single beliefs you already know are old. The Contradiction Scan looks for the ones you have not yet spotted. The Half-Life Timer schedules checks before facts go stale.

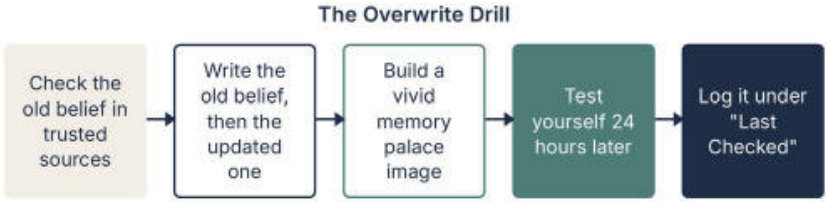
Three factual update drills



The Overwrite Drill replaces single beliefs you already know are old.

> **Exercise:**
>
> 11.2, The Overwrite Drill. Follow these six steps.

1. Choose one belief from your Knowledge Inventory that you marked as likely out of date. Check its current state in two or three trusted sources.
2. In your Memory Journal, write the old belief as one clear sentence. Underline it, then draw one line through it.
3. Write the updated belief just below it, in a different colour if you can. This is the new version you will learn.
4. Build a vivid memory palace image for the updated belief. In my method, the new image replaces the old one. Picture the old belief being torn down. Then picture the new belief being built in its place.
5. Test yourself 24 hours later. Write the updated belief from memory without your notes. If the old belief comes back instead, repeat the drill with a stronger image.
6. Log the update in your Knowledge Inventory, with today's date under "Last Checked".



No study has tested replacement images for correcting beliefs. Standard advice on correcting false claims does support **two parts** of this drill (Lewandowsky et al., 2012). It names the old claim next to the correction. It also gives a clear account of what is true instead.

Crossing out the old belief may do **more than look tidy**. In one study, people wrote down their thoughts (Briñol et al., 2013). Then they tore up the paper and threw it away.



A person writes down a thought, then tears up the paper and throws it away.

Afterwards, they used those thoughts less when making judgements. The effect was stronger for a **physical action** than for an imagined one. However, that study dealt with thoughts about body image.

It did not test the correction of facts or the continued influence effect. It gives only **indirect support** for crossing out an old belief.

> Exercise:
>
> 11.3, The Contradiction Scan. Follow these five steps.

1. Set a timer for 20 minutes. Your only task is to look for evidence against something you believe about your work.
2. Start with the High-decay domains in your Knowledge Inventory. Look for recent meta-analyses that revise past findings. Also look for debates on settled questions and for new rules or guidelines.
3. For each piece of evidence, write a short entry. Use four parts: old belief, new evidence, strength of evidence and your updated position. Rate strength as strong, moderate or early.
4. Do not change a belief because of one early study. Rate the evidence honestly. “Early evidence suggests X” is a fair updated position. The aim is honest thinking. It is not about changing your mind often.
5. Run this scan once a week in your fastest-changing work domain. Over four weeks, you will have reviewed more than 20 of your working beliefs.

Each entry in your Knowledge Inventory

Old belief	New evidence	Strength of evidence	Updated position

Look for recent meta-analyses that revise past findings.

The goal is **calibrated doubt**. This means doubt that matches the strength of the evidence.



The goal is calibrated doubt.

Some of your beliefs are well established and others are provisional. In my view, knowing **which is which** makes you more reliable. Someone equally sure of every belief is less so.

> **Exercise:**
> 11.4, The Half-Life Timer. Follow these five steps.

1. For each key fact you learn, add a "best before" note in your Memory Journal. Examples include a statistic, a guideline, a best practice or a research finding. Use this format: Fact, Date Learned and Review By. Base the review date on the domain's decay rate.
2. Set a repeating calendar reminder for each review date. When it comes, spend 5 minutes checking whether the fact still holds. If it has changed, use the Overwrite Drill. If not, set a new review date.
3. After 3 months, review your timer log. Note which domains produce the most updates. These are the areas where your knowledge drifts most.
4. Start a "Superseded" section in your Memory Journal for beliefs you have replaced. Review it every quarter. A longer list shows that you are keeping your knowledge up to date.
5. Each week, share one replaced belief with a colleague or study partner. Explain what changed and why. In my view, teaching the change helps the new version stick.

A best before note

Fact	Date Learned	Review By
A guideline	When you learned it	Set by the decay rate

Examples include a statistic, a guideline, a best practice or a research finding.

The timer turns a vague aim into a **set routine**. In my view, many people never update because they never plan time for it. A schedule turns that hidden task into one you can see and do.

Key idea:

Name and cross out the old fact, learn the new fact with a vivid image and test it 24 hours later, and you have an update, in my method. No study has tested the image step.

Factual updates are the **surface layer**. The deeper task is revising the models you use to make sense of what happens. The next set of drills covers this.

Quick check:

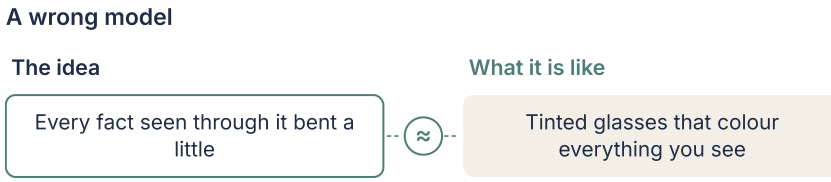
1. When do you test yourself after the Overwrite Drill? Answer: 24 hours later, from memory and without your notes.
2. What did people do with their thoughts in the paper-tearing study (Briñol et al., 2013)? Answer: They wrote them down, tore up the paper and threw it away.
3. How long is the Contradiction Scan? Answer: 20 minutes, with a timer.

11.3.2 Model Revision Exercises

FACTUAL UPDATES FIX SINGLE pieces of information. **Model revisions** go deeper. They change the frameworks, theories and mental models you use. These are the tools you use to make sense of events.

> Definition:
>
> **MODEL REVISION:** a change to a framework or theory you use.

A model is not one fact but a **network of linked beliefs**. When a model is wrong, every fact you view through it is bent a little. It is like a pair of tinted glasses that colours everything you see. Updating a model takes more than the Overwrite Drill. You have to rebuild how the beliefs fit together.



Updating a model takes more than the Overwrite Drill.

The three drills here look at models from **different angles**. The Model Autopsy works backwards from a failed prediction.

The Assumption Inversion tests the models you hold now. The Paradigm Shift Timeline **uses history**. It shows how whole fields have changed their basic models over time.

Three model drills



The Model Autopsy works backwards from a failed prediction.

> **Exercise:**
>
> 11.5, The Model Autopsy. Follow these six steps.

1. Choose one past prediction that turned out badly wrong. It might be a work judgement, a business forecast or a personal decision.
2. Write a model autopsy. Asking why it went wrong is not enough. Ask which mental model produced the prediction, and what hidden assumptions it held. Name the model in one line, such as "I assumed this because I believed that."
3. Find the assumption that failed. Was it an outdated fact or a flawed idea of cause and effect? Was it a lesson taken from a different setting? Was it a blind spot, a part of your own thinking that you cannot see, that you had never examined?
4. Write the revised model in one paragraph. Describe how you now understand the area that produced the wrong prediction. Be precise, because vague revisions do not prevent the same error.

5. Store the revised model at one station of a memory palace. Use an image that links the old model to the reason it failed. Let the image lead on to the new model.
6. Test yourself six months later. Try to recall the revised model and explain why the old one failed. If you can, the update has lasted. If the old model comes back, the new one needs more practice.

Working backwards from a failed prediction



The autopsy studies the model **as well as the outcome**. In my view, many people change what they do after a failure. Yet they never find the model behind it.

After a failed prediction



The autopsy studies the model as well as the outcome.

The same model can then cause the same failure somewhere else. Naming the model gives you **something precise to fix**.

> **Exercise:**
> 11.6, The Assumption Inversion. Follow these six steps.

1. Choose one area where you hold strong beliefs. It might be your field, a personal philosophy or an area of expertise. Write down the 5 assumptions behind your approach to it.
2. For each assumption, write its opposite. If you believe one thing causes another, write that it does not. If you believe one approach is best, write that another one is better.
3. Spend 3 minutes on each reversed assumption. List every case, example or piece of evidence that would support it.
4. Judge honestly. Did you find more support than you expected? Had you been recalling only the evidence that agreed with you?
5. You do not have to change your beliefs after this exercise. You do have to hold them more loosely than before. You are now aware of the evidence against them that you had set aside.
6. Repeat for a different area each week. After a month, you will have checked four of your most important areas of knowledge.

Each reversed assumption



If you believe one thing causes another, write that it does not.

The inversion is **not arguing for the sake of it**. In my view, it exposes a bias that grows when you want one answer. The expertise you have built can make this bias stronger.

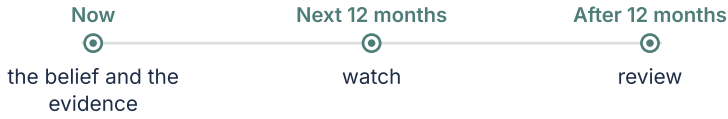
People often **discount evidence** against beliefs they hold firmly (Kaplan et al., 2016). No study has tested this exercise itself.

Fields also change their models over time. A **paradigm shift** is a change in a field's basic model (Kuhn, 1962). The old model is overturned and a new one takes its place.

> Exercise:
>
> 11.7, The Paradigm Shift Timeline. Follow these five steps.

1. Choose a field you work in or study. Look into its history and find 3 major paradigm shifts. These are times when the field's basic model was overturned and replaced.
2. For each shift, answer three questions. How long did the old model last after evidence against it first appeared? What kept it in place, such as institutions, habits of mind or money? Finally, note the people who updated early in each case. What let them change while most people kept the old model?
3. Now apply this to the present. Find one leading model in your field that has loose ends. It may fail to explain some things well. People in the field may tend to dismiss its exceptions. This model is your candidate for the next shift.
4. Write a "Future Correction" entry in your Memory Journal. Name the belief you hold now and the evidence that might overturn it. Then name what you will watch for over the next 12 months.
5. Review the entry after 12 months. Whether or not the model changed, you have kept its limits in view. In my view, this habit makes it easier to update when change does come.

Future Correction

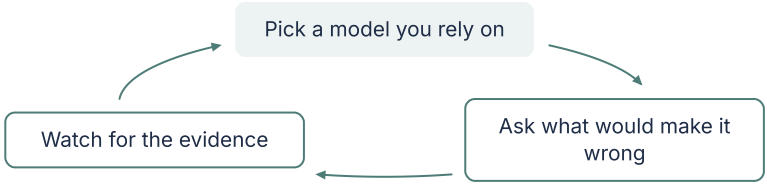


People in the field may tend to dismiss its exceptions.

People caught out by a paradigm shift are not unintelligent. In my view, they simply never asked **one question**. What would have to be true for their model to be wrong?

This drill turns that question into a scheduled practice. You ask it **once a year**, on purpose, about a model you rely on.

Once a year: ask what would make it wrong



This drill turns that question into a scheduled practice.

Key idea:

With a wrong model, every fact seen through it is bent a little. Find the failed assumption and rebuild the model, and you get an update that can last.

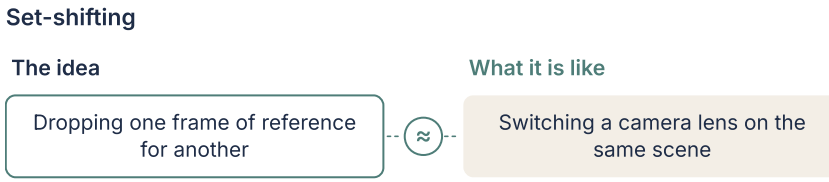
Knowing how fields change helps you stay alert for change in your own. The next set of drills builds flexible thinking **under time pressure** and uncertainty.

Quick check:

1. When do you test yourself on a revised model from the Model Autopsy? Answer: Six months later.
2. How long do you spend on each reversed assumption? Answer: 3 minutes.
3. Which work is cited for the idea of a paradigm shift? Answer: Kuhn (1962).

11.3.3 Flexibility and Speed Drills

The drills so far build accurate models through slow, careful practice. The drills here aim at speed. They target **set-shifting**. This is the ability to drop one frame of reference and take up another. It is like switching a camera lens to see the same scene in a new way. In my view, this matters most for people whose work depends on fast-changing information.



It is like switching a camera lens to see the same scene in a new way.

Model revision gives you accurate frameworks. Flexibility sets **how quickly** you can move between them. I argue that both become more important as fields change faster.

Model revision and flexibility

Model revision	Flexibility
Accurate frameworks	How quickly you move between them

In my view, this matters most for people whose work depends on fast-changing information.

My claim is that flexibility under time pressure can be trained. **Little research** supports this.

In children, meta-analyses found **small to moderate gains** from training thinking skills (Takacs & Kassai, 2019). However, they found no convincing sign that the gains lasted at follow-up. No study has tested these drills in adults. Treat them as practice, not as proven training.

There are **four drills** in this section. The Reframe Sprint practises seeing one situation from several views.



A person looks at one situation from several points of view.

The Rolling News Update Protocol turns your reading into an ongoing source of updates. The Belief Version Log records how your beliefs change. The Structured Uncertainty Drill **puts a number** on how sure you are.

Four flexibility drills



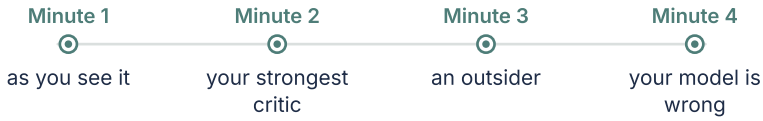
The Rolling News Update Protocol turns your reading into an ongoing source of updates.

> **Exercise:**
> 11.8, The 5-Minute Reframe Sprint. Follow these seven steps.

1. Set a timer for 5 minutes. Choose a current situation at work. It might be a problem, a project, a relationship or a strategy.
2. In minute 1, explain the situation as you see it now.
3. In minute 2, explain it as your strongest critic or rival would. This is someone who thinks the opposite of your approach is right.
4. In minute 3, explain it as a complete outsider with no knowledge of the field.
5. In minute 4, assume your current model is wrong and always has been. Explain how the situation looks from there. Stay with this view for the full minute, even if it feels uncomfortable.

6. In minute 5, write one sentence. Say what the four views showed together that your first view did not.
7. Run this drill 3 times a week on different situations. After 4 weeks, check whether taking an opposing view feels less threatening than before. Notice whether it has become more useful too.

One situation, five minutes



Choose a current situation at work.

You may feel **resistance** in minute 4, when you assume your model is wrong. In my view, this resistance stops people updating when their field changes. Practising it when little is at stake may weaken it when much is.

> **Exercise:**
> 11.9, The Rolling News Update Protocol. Follow these six steps.

1. Choose your top 3 work domains. These are the areas where staying current is most important.
2. For each domain, find 2 good, current sources. These might be journals, newsletters, podcasts or experts. Pick sources at the edge of the field that push back on your views. Avoid feeds chosen for you by an algorithm.
3. Each week, spend 15 minutes per domain in “active update mode”. Read for contradiction, not confirmation. Look for content that challenges, changes or replaces what you believe.

4. For each new finding that goes against your views, take three quick steps. Note it in one sentence in your journal, starting "New evidence suggests". Rate it as strong, moderate or early. Then link it to the belief in your Knowledge Inventory that it affects. These links show which beliefs are under the most pressure.
5. At the end of each month, count how many inventory items your reading touched. If the count is under 3 per domain, your sources may mostly agree with you. Look for sources that disagree with you more.
6. Each quarter, turn your strongest new findings into memory palace updates with the Overwrite Drill. This moves them from your notes into long-term memory.

Each week: read for contradiction



Pick sources at the edge of the field that push back on your views.

Active update mode is a change in **how you read**, not in what you read. You read the same article but ask a different question. Ask what it changes about your beliefs. That is a different question from whether it confirms them.

I hold that this changes **what you remember**. No study has tested this claim.

> **Exercise:**
> 11.10, The Belief Version Log. Follow these six steps.

1. In your Memory Journal, start a “Belief Version Log”. This is a running record of major changes in your thinking.
2. For each entry, record six things. Note the domain, your original belief and your current belief. Then note what changed it, the date and your confidence from 0 to 100%.
3. Aim for at least one real entry a month. It should be a belief you truly held. You should have revised it because of new evidence or experience.
4. After 12 months, review the log. Check your average confidence. Notice whether your revisions match the evidence, or whether they look random. Strong evidence should bring confident revisions, and early evidence should bring cautious ones.
5. Once a quarter, share the log with a colleague or mentor you trust. Ask whether there are beliefs you should be updating but are not. An outside view can find blind spots that your own review misses. Note any belief they name and add it to your inventory.
6. In my view, the log is a record of your intellectual honesty. It shows that you change your mind when the evidence calls for it.

Revisions that match the evidence

Evidence	Revision
Strong	Confident
Early	Cautious

It should be a belief you truly held.

Changing your mind often is not the same as being flexible. In my view, agile thinkers change their minds at the **right rate**. They update firmly when evidence is strong and hold loose positions when it is weak.



In my view, agile thinkers change their minds at the right rate.

They also know **which of their beliefs** is which. The log makes this balance visible over time.

> Exercise:
>
> 11.11, The Structured Uncertainty Drill. Follow these six steps.

1. Choose 10 beliefs from your Knowledge Inventory. For each, write how sure you are that it is still accurate. Use a scale from 0 to 100%.
2. Sort each belief into one of four zones. Established (85–100%) is core knowledge you would stake your name on. Working (60–84%) is your best current model, used with its limits in mind.
3. Provisional (40–59%) is truly uncertain and held lightly. Suspect (below 40%) is marked for checking first. The zones show at a glance where to spend your checking time.
4. Lower each Established belief in a High-decay domain by 15 points. Skip this if you checked it in the last 12 months. This step accounts for knowledge going out of date.

5. Focus your next round of checks on the Suspect zone. In my view, these beliefs are the most likely to cause hidden errors. They can affect your thinking and decisions without your noticing.
6. Run the full 10-belief drill each month and track your average over time. If it stays above 80%, I suggest you may be overconfident.

These zones and cut-offs are **my own rules**. No study has tested them. Treat the numbers as a guide. Adjust them as you learn how well your confidence matches your results.



The aim is to know which beliefs you **hold firmly** and which you hold loosely. Then you can act on that difference.

Research on forecasting points the **same way**. It comes from a large forecasting project.

In their book, Tetlock and Gardner (2015) name the strongest predictor of becoming a "superforecaster". They called it **perpetual beta**, a lasting dedication to updating your beliefs and improving yourself. The phrase borrows from software, where a beta version is still being tested.



They called it perpetual beta.

For forecasters, it means a lasting dedication to updating beliefs and to self-improvement. As quoted in a review, it was about **three times** as strong as intelligence. Intelligence was the next best predictor.

Calibration means how well your confidence matches how often you are right. It is sometimes named as the best predictor of good forecasting. In fact, it is part of how forecasts are scored.

A peer-reviewed account of the same project gave **four reasons** for these forecasters' success (Mellers et al., 2015). These were thinking ability and style, and skills for the task. The others were motivation and a rich learning setting.

Why superforecasters succeeded (Mellers et al., 2015)



A peer-reviewed account of the same project gave four reasons for these forecasters' success (Mellers et al., 2015).

Key idea:

Firm beliefs where evidence is strong and loose ones where it is weak make up calibrated thinking. Treat the drills as practice, not as proven training.

The eleven exercises work best as a **steady habit**. They work less well as an occasional effort. The checklists that follow turn them into a regular routine.

Three groups of drills

Updating facts	Revising models	Flexible thinking

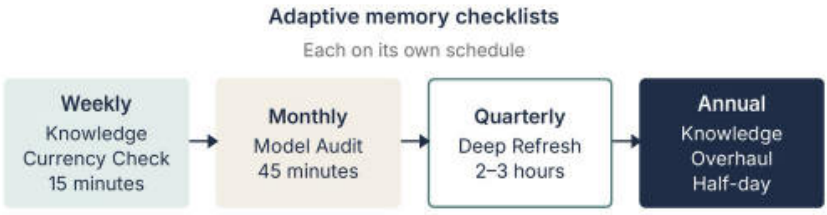
They work less well as an occasional effort.

Quick check:

1. What did meta-analyses of thinking-skills training in children find (Takacs & Kassai, 2019)? Answer: Small to moderate gains, but no convincing sign that the gains lasted at follow-up.
2. What did Tetlock and Gardner (2015) name the strongest predictor of becoming a superforecaster? Answer: Perpetual beta.
3. What does calibration mean? Answer: How well your confidence matches how often you are right.

11.4 Adaptive Memory Checklists

These checklists are for **regular use**. Reading them once is not enough. It is like servicing a car on a schedule, before it breaks down. Keep them in your Memory Journal and work through each on its schedule. They turn the ideas in this module into steady habits you repeat.



Key idea:

A checklist and a fixed schedule turn the ideas in this module into regular habits.

Quick check:

1. Where should you keep the checklists? Answer: In your Memory Journal.
2. How should you work through them? Answer: Each one on its own schedule.

11.4.1 The Weekly Knowledge Currency Check (15 minutes)

The exercises in this module work best as part of a steady routine. The four checklists set out that routine at **four levels**: weekly, monthly, quarterly and yearly. Each level covers a different scope of review.

The shorter checks deal with single facts and recent events. The longer ones look at whole domains and at the system itself. Together, they spread the work of staying current **across the year**.

The weekly check **keeps the system running**. It is like a quick weekly tidy that stops mess piling up. It deals with single beliefs and recent events. It also keeps your other drills fed with new material.

The weekly check



It deals with single beliefs and recent events.

Key idea:

15 minutes every Monday and one belief checked keep the system running, week by week.

The weekly check has seven items. The whole check should take **about 15 minutes**.



A person works through a seven-item checklist on a Monday morning.

Exercise: Weekly Checklist. Work through these seven items every Monday morning.	
[ ]	Find one belief I acted on last week without checking it first. Was it still current?
[ ]	Check one item in my Knowledge Inventory that is overdue for review. Use the Decay Rate Framework.
[ ]	Scan one good source in my fastest-changing work domain. Look for anything that contradicts or updates what I know.
[ ]	Write one entry in my Rolling News Update log. Do this even if it confirms a belief and changes nothing.
[ ]	Ask whether anything last week went against an assumption I hold. If so, note it. If nothing comes to mind, I am probably not looking hard enough (my suggestion).
[ ]	Keep any belief that looks out of date for the monthly audit. There, I can run a full Overwrite Drill on it.
[ ]	Rate my knowledge currency this week. Am I more up to date than last week, the same or further behind?

The weekly check deals with single facts. Some changes only show up over a **longer span**. Trends and gaps can build up slowly, week by week.

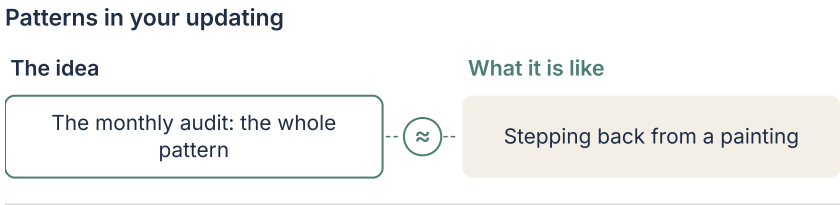
The monthly audit looks for these. It also reviews the **deeper assumptions** behind your models.

Quick check:

1. When and for how long do you run the weekly check? Answer: Every Monday morning, for about 15 minutes.
2. What happens to a belief that looks out of date? Answer: Keep it for the monthly audit, where you can run a full Overwrite Drill on it.

11.4.2 The Monthly Model Audit (45 minutes)

The weekly check keeps single beliefs current. The monthly audit looks at **patterns in your updating**. It is like stepping back from a painting to see the whole picture. It asks whether any domain has drifted out of date without your noticing. These trends only show up over several weeks.



It asks whether any domain has drifted out of date without your noticing.

Key idea:

Weekly checks and a monthly look at patterns show drift that no single week shows.

The monthly audit has eight items. Set aside **about 45 minutes**.



On the first Saturday of the month, a person works through a checklist.

Exercise: Monthly Checklist. Work through these eight items on the first Saturday of each month.	
[ ]	Review my Knowledge Inventory. Mark any High-decay item that is past its review date.
[ ]	Run one full Overwrite Drill on the most outdated belief from my weekly checks.
[ ]	Run one Assumption Inversion on my most important work domain.
[ ]	Add at least one entry to my Belief Version Log. If I find no real revision this month, I am not updating. Find out why.
[ ]	Review my list of superseded beliefs. Is it growing? Does its pace suit how fast my field changes?
[ ]	Name one thing I was very sure of 12 months ago but doubt more now. Note what changed. Was my first level of confidence right?

[ ]	Set review reminders for the next 30 days. Base them on the Half-Life Timer entries that are due.
[ ]	Check whether my sources show me truly challenging material. Am I in a comfortable echo chamber, a place where I mostly hear views like my own?

The monthly audit keeps the system accurate from month to month. The quarterly review goes **a level deeper**. It asks whether the whole system works, and where most drift has built up.

Quick check:

1. When and for how long do you run the monthly audit? Answer: On the first Saturday of each month, for about 45 minutes.
2. What two questions do you ask about your superseded beliefs? Answer: Is the list growing, and does its pace suit how fast my field changes?

11.4.3 The Quarterly Deep Refresh (2–3 hours)

The quarterly refresh **steps back** from single beliefs. It is like a full service on a car, beyond a quick check of the tyres. It checks your models, frameworks and broad assumptions against three months of evidence. Shorter weekly and monthly cycles are too brief to show these slow shifts.

This review asks whether your whole knowledge system is still **fit for purpose**, good enough for the job it has to do. It is the longest of the regular checks, short of the yearly overhaul.

Key idea:

Three months of evidence and a check of whole models catch slow shifts that weekly and monthly checks miss.

The quarterly refresh has ten items. Allow **2 to 3 hours**.

Exercise: Quarterly Checklist. Work through these ten items once every 3 months.	
[ ]	Review my Knowledge Domain Map. Have any domains changed decay rate? Are there new domains I should track? The full rebuild from scratch is part of the yearly overhaul.
[ ]	Run one full Model Autopsy. Choose a key work prediction or decision from the last quarter.
[ ]	Run a Paradigm Shift Timeline on the field most central to my current work.
[ ]	Compare my Belief Version Log with how it looked 3 months ago. Am I updating at the right rate for my field?
[ ]	Pick my top 3 Suspect zone beliefs and research each one. Update or confirm each with dated evidence.
[ ]	Run the Structured Uncertainty Drill across my whole Knowledge Inventory. Reset all my confidence ratings.
[ ]	Find one domain where I have been coasting on old knowledge. Plan a catch-up session within the next 2 weeks and put it in my calendar.
[ ]	Check whether my memory training methods need updating. Are they still in line with current best practice? Note any new methods worth adding, and try one in the coming quarter.
[ ]	Ask a colleague, mentor or partner I trust one question. In what area has my thinking become dated or rigid? Listen without defending myself.
[ ]	Write a one-paragraph “State of My Knowledge” summary. Note what I know well and what I hold provisionally. Then note what I still need to learn.

The quarterly refresh keeps the system honest at the level of frameworks. The yearly overhaul takes the **widest view**. It asks whether, over the whole year, you have become a more accurate thinker.

It also asks whether you have become more adaptable and better calibrated.

Quarterly refresh, yearly overhaul



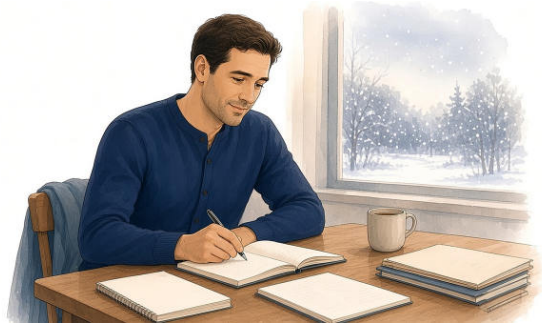
Quick check:

1. How often and for how long do you run the quarterly refresh? Answer: Once every 3 months, for 2 to 3 hours.
2. What summary do you write at the end? Answer: A one-paragraph 'State of My Knowledge' summary.

11.4.4 The Annual Knowledge Overhaul (Half-day)

THE YEARLY OVERHAUL IS the system's **deepest audit**, and it takes half a day. You rebuild your Knowledge Domain Map from scratch. It is like clearing out the whole house once a year. You also look for paradigm shifts over the year. Then you set your review schedule for the year ahead.

The yearly overhaul has **nine items**.



A person spends half a day on a yearly review in December or January.

Exercise: Yearly Checklist. Work through these nine items in December or January.	
[ ]	Build a new Knowledge Domain Map from scratch, without updating the old one. Compare it with last year's map to see what has truly changed.
[ ]	Work out my update rate for the year. Count my Overwrite Drills, Belief Version Log entries and Model Autopsies. Does this rate suit how fast my field changes?
[ ]	Name the most important belief I revised this year. How did the change affect my actions, decisions or results?
[ ]	Review my archive of superseded beliefs. Which ones lasted longest before I updated them? What does this show about my blind spots?
[ ]	Name two domains I neglected this year. In each, I knew my knowledge was dated but avoided updating. Make a dated catch-up plan for each.
[ ]	Update my decay rates. Have any domains sped up? Have my sources kept pace with my field?
[ ]	Set goals for the coming year. Include weekly and monthly upkeep hours and a target number of Belief Version Log entries. Name the domains that need the most work.
[ ]	Write my "Epistemic Will" for the year (epistemic means relating to knowledge and belief). List the 3 most important beliefs I hold about my field. Give each an honest confidence rating, and note what would change it.
[ ]	Share this review with a mentor, a learning partner or a group in my field.

There is some support for sharing your review. A meta-analysis of **138 studies** looked at tracking progress towards goals (Harkin et al., 2016). Tracking helped people reach their goals, with an effect size of 0.40.

The effect was larger when progress was reported to others or **made public**. It was also larger when progress was recorded on paper or

another physical record. No study has tested this for keeping knowledge current.

Key idea:

A half-day each year and a map rebuilt from scratch give a clear view of what has truly changed.

I see the yearly overhaul as the **biggest investment** in this system. In my view, the half-day pays back across every domain where your knowledge matters.

Quick check:

1. What effect size did tracking progress towards goals have (Harkin et al., 2016)? Answer: 0.40, across 138 studies.
2. When was the effect larger? Answer: When progress was reported to others or made public, and when it was recorded on paper or another physical record.
3. When do you run the yearly overhaul? Answer: In December or January.

11.5 The Adaptive Learner's Infrastructure

KNOWING THAT YOU NEED to update is not enough. Your surroundings must **support the habit**.

In my view, people who stay current rely on systems more than good intentions. A good system makes staying current **the default**. It is like a path cleared through snow, which makes the walk easy every day. It does not depend on an occasional big effort.

Key idea:

With a good system and supportive surroundings, you stay current by default, in my view.

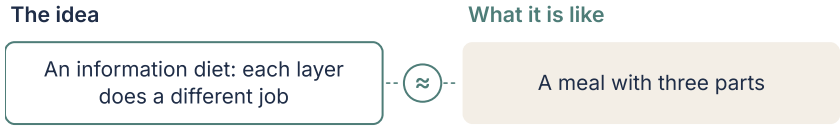
Quick check:

1. What do people who stay current rely on, in my view? Answer: Systems more than good intentions.
2. What does a good system make staying current? Answer: The default.

11.5.1 The Three-Layer Information Diet

I DESCRIBE AN INFORMATION DIET with **three layers**. Each layer does a different job. It is like a meal with three parts, where each part feeds you in a different way. In my view, most people use only one or two. They also lean towards the comfortable one.

Three layers of an information diet

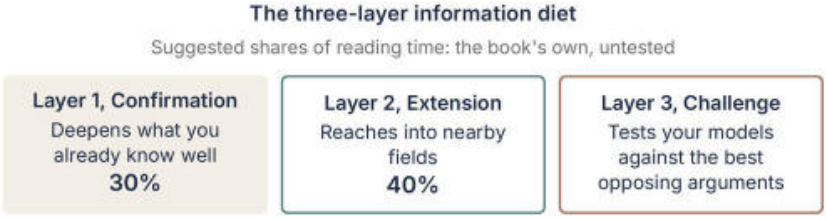


In my view, most people use only one or two.

> Definition:
>
> **INFORMATION DIET:** the mix of things you read, watch and listen to.

Layer	Purpose	Examples	Suggested Share of Reading Time
Layer 1, Confirmation	Deepens what you already know well and builds expertise.	Industry newsletters, journals, updated textbooks and experts you agree with.	30%
Layer 2, Extension	Reaches into nearby fields and new work at the edge of your own. Builds links between ideas.	Sources from other fields, preprints (studies shared before other experts have checked them), debates among practitioners and early-adopter groups.	40%
Layer 3, Challenge	Tests your current models against the best opposing arguments. In my view, it is the hardest layer and the most neglected.	Rigorous critics of leading models, people who break with the mainstream and experts from other countries.	30%

These shares are my own suggestion and have not been tested. The diet supplies the **raw material** for updating. The Update Partner System adds a person who helps make sure the review happens.



Key idea:

Confirming, extending and testing make a reading mix that tests your models, in my view. The 30%, 40% and 30% shares are untested.

Quick check:

1. What share of reading time does each layer get? Answer: About 30% for Layer 1, 40% for Layer 2 and 30% for Layer 3, as my own untested suggestion.
2. Which layer is the hardest and the most neglected, in my view? Answer: Layer 3.

11.5.2 The Update Partner System

I HOLD THAT THE MOST lasting way to stay current is with another person. It is like a running partner who gets you out of the door on cold mornings. An **Update Partner** is a colleague or peer who agrees to a regular exchange. You trade news from your fields and test each other's models. You also share the beliefs you have changed.

An Update Partner

The idea	What it is like
A peer for a regular exchange	A running partner on cold mornings

You trade news from your fields and test each other's models.

In my view, a partner offers support and a **different outlook**. Some evidence supports making progress visible to others. Tracking progress towards a goal worked better when the results were shared or made public (Harkin et al., 2016).

Step 1, choose a partner. Pick someone in a field that overlaps with yours but is not the same. Their updates should matter to you. Yet they should meet different information and question your assumptions from outside your bubble.

Step 2, set a weekly exchange. Hold a 20-minute call or written exchange each week, with a fixed agenda. Each person shares one thing they learned that challenged or changed a belief. Each also shares one thing they were sure of before but now doubt.



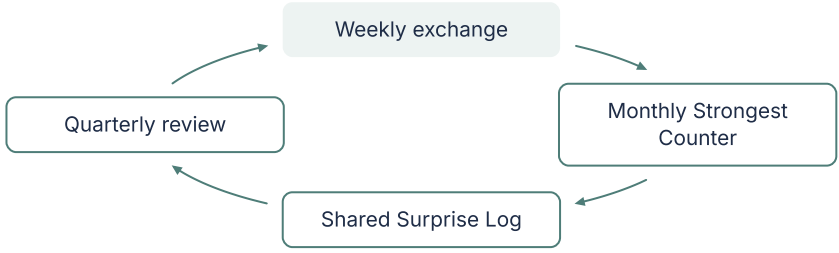
Two update partners talk on a weekly 20-minute call.

Step 3, add the Strongest Counter. Once a month, each partner builds the strongest case against the other's most confident view. The goal is to expose blind spots, not to win.

Step 4, keep a shared Surprise Log. Record things that turned out differently from what either of you expected. In my view, surprises show where a current model is failing. That makes the log a rich source of model revisions.

Step 5, review each quarter. Compare your two Knowledge Inventories. Find domains where one of you has updated and the other has not. Then work out why.

The Update Partner cycle



Find domains where one of you has updated and the other has not.

Key idea:

Two people, a weekly talk and a shared Surprise Log make updates more likely to happen, in my view.

Quick check:

1. How long is the weekly exchange with an Update Partner? Answer: 20 minutes, by call or in writing, with a fixed agenda.
2. What do partners do once a month? Answer: Each builds the strongest case against the other's most confident view.
3. What worked better when the results were shared or made public (Harkin et al., 2016)? Answer: Tracking progress towards a goal.

Key Concept:

Key Takeaways

A strong memory full of out-of-date facts is a weakness. In my view, keeping knowledge current matters as much as knowing a lot.

Three effects slow updating. Beliefs can outlast their evidence (Ross et al., 1975), and corrections do not fully undo false claims (Walter & Tukachinsky, 2020). Deep expertise can also reduce flexibility, though this can be overcome (Dane, 2010).

Different fields change at different rates. Set your review schedule to match each one.

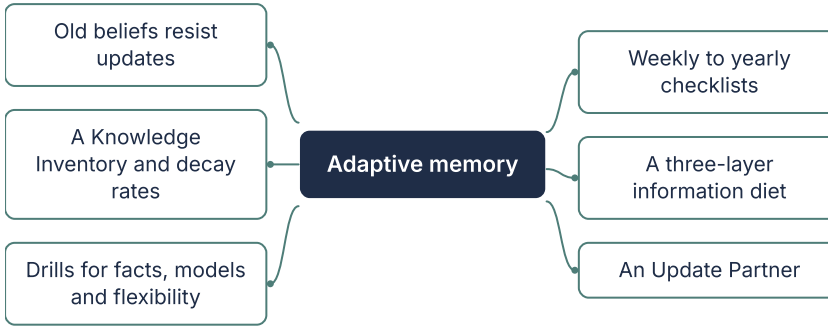
The Knowledge Currency System pairs a Knowledge Inventory with a Decay Rate Assessment. The checklists and the Half-Life Timer give it a schedule.

In my view, three drills build flexible thinking. These are the Reframe Sprint, the Assumption Inversion and the Structured Uncertainty Drill. No study has tested them.

The weekly, monthly, quarterly and yearly checklists turn these ideas into regular habits.

Good forecasters stay committed to updating their beliefs. Tetlock and Gardner (2015) found this "perpetual beta" was the strongest predictor of becoming one.

This module at a glance



Good forecasters stay committed to updating their beliefs.

Use the checklist below to **track your work** through Module 11.

Exercise: Module 11 Completion Checklist. Keeping Your Knowledge Current, Accurate and Flexible	
Core Ideas to Remember	
[ ]	Out-of-date knowledge is a weakness. Keeping knowledge current is as important as depth.
[ ]	Belief perseverance, the continued influence effect and cognitive entrenchment all slow updating.
[ ]	Different fields change at different rates. Set your review schedule to match.
[ ]	In my view, flexible thinking can be trained. The evidence for this is limited.
[ ]	The Knowledge Currency System pairs a Knowledge Inventory with a Decay Rate Assessment.
[ ]	Monthly audits keep facts current. Quarterly reviews check whole mental models.
[ ]	Knowing what you do not know is a strength.
Exercises to Do First	

[ ]	Exercise 11.1, The Knowledge Domain Map (map what you know and how old it is)
[ ]	Exercise 11.2, The Overwrite Drill (practise replacing out-of-date beliefs)
[ ]	Exercise 11.4, The Half-Life Timer (give your key domains review dates)
All Exercises	
[ ]	Exercise 11.1, The Knowledge Domain Map
[ ]	Exercise 11.2, The Overwrite Drill
[ ]	Exercise 11.3, The Contradiction Scan
[ ]	Exercise 11.4, The Half-Life Timer
[ ]	Exercise 11.5, The Model Autopsy
[ ]	Exercise 11.6, The Assumption Inversion
[ ]	Exercise 11.7, The Paradigm Shift Timeline
[ ]	Exercise 11.8, The 5-Minute Reframe Sprint
[ ]	Exercise 11.9, The Rolling News Update Protocol
[ ]	Exercise 11.10, The Belief Version Log
[ ]	Exercise 11.11, The Structured Uncertainty Drill
Regular Practice Habits	
[ ]	Weekly (Monday): run the Rolling News Update Protocol for 2 to 3 active topics
[ ]	Run the Contradiction Scan on the schedule set in Exercise 11.3
[ ]	Quarterly: review your Knowledge Domain Map and update your Belief Version Log
[ ]	After any major failed prediction: run the Model Autopsy within 48 hours
Actions to Take This Week	
[ ]	Complete Exercise 11.1 to map your knowledge domains
[ ]	Set Half-Life Timers for your 5 most relied-on knowledge areas

[ ]	Run the Structured Uncertainty Drill on 10 current beliefs, with confidence levels
[ ]	Put your Contradiction Scans in your calendar
[ ]	Run the 5-Minute Reframe Sprint on a current problem or decision

Adaptive memory keeps everything you have built in this programme **useful as the world changes**. The module on practitioner levels comes next.

Module 12: Memory Practitioner Levels

Key Concept:

Module Overview

This module sets out five levels of memory practice, from Basic to Master. You judge your own level, alone or with a partner. A level is a record of your practice. It is not a qualification.

THIS MODULE DESCRIBES **each level of practice**. It is like a runner's training log, which shows how far you have come. It also shows how to check and keep your level.

What your level records



It is like a runner's training log, which shows how far you have come.

Definition:

LEVEL: a stage of memory practice that you judge for yourself.

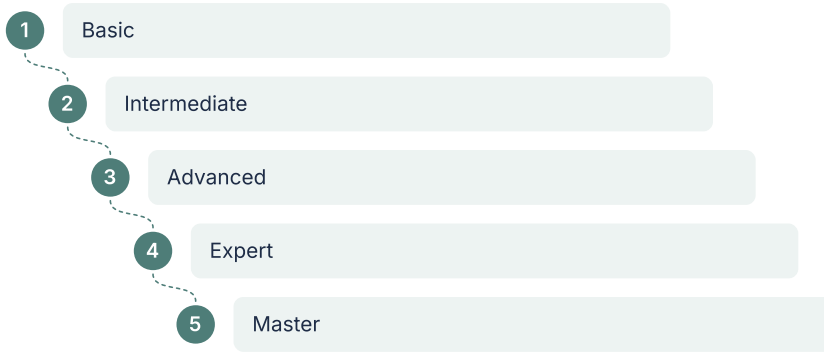
Key idea:

Your practice and your own checks set your level. A level is a record of practice, not a qualification.

In This Module

- Learn the five levels and how they differ.
- See the criteria for each level.
- Learn how to test yourself and record your practice.

Five levels



See the criteria for each level.

12.1 Levels of Memory Practice

Memory skill is not all or nothing. It **builds in stages**. It is like learning to swim, from your first width of the pool to a long swim. I use five levels to describe that progress, each with its own typical methods.



Five steps of a staircase, each one a level of memory practice.

Level	What You Can Do	Main Feature
Basic	Use simple memory methods on short lists	You use simple strategies reliably
Intermediate	Recall longer lists and keep them for days	You use chunking (grouping small bits into bigger pieces that mean something) and simple memory aids consistently
Advanced	Keep larger sets of material for weeks	You use a memory palace (places you walk through in your head, like rooms in a house, each one holding something to remember) and spaced review as routine
Expert	Keep large sets of material for months	You use several memory systems and teach others
Master	Recall large, well-organised bodies of knowledge quickly	You keep up all of the above over time

No study has set norms, typical scores taken from testing many people, for these levels, so treat them as my guide. A level does not predict success in any job. Expert memory tends to be **tied to one field** (Chase & Simon, 1973). Training also rarely carries over to unrelated skills (Sala & Gobet, 2017).

Key idea:

Simple methods mark the Basic level. Several systems kept up over time mark Expert and Master. No study has set norms for these levels.

Quick check:

1. How many levels are there? Answer: Five, from Basic to Master.
2. Does a level predict success in a job? Answer: No. Expert memory tends to be tied to one field (Chase & Simon, 1973).

12.2 Level Criteria

The table below describes each level **in words**. It is like a ruler with marks but no numbers. Use it to judge your own progress, alone or with a partner. It has no exam behind it, and no study has set norms for it.



A learner and a partner read through a table of levels together.

Level	Quick Recall (just after study)	Long-Term Recall	Recall Speed
Basic	A short list, recalled without error	A short list, kept for a short time	Steady, with some pauses
Intermediate	A longer list, using chunking	A longer list, kept for days	Faster, with fewer pauses
Advanced	A long list, using a memory palace	A large set, kept for weeks	Quick and sure
Expert	A very long list, using several systems	A large set, kept for months	Very quick
Master	Long lists, reliably, on separate days	A large body of material, kept for many months	Near the limit of your practice

Short-term memory holds only about 4 chunks at once (Cowan, 2001). Items you do not rehearse are mostly lost within about 18 seconds (Peterson & Peterson, 1959). Holding material for many minutes therefore draws on long-term memory.

Key idea:

Quick recall, long-term recall and recall speed are the three things to check at each level. No study has set norms for them.

Quick check:

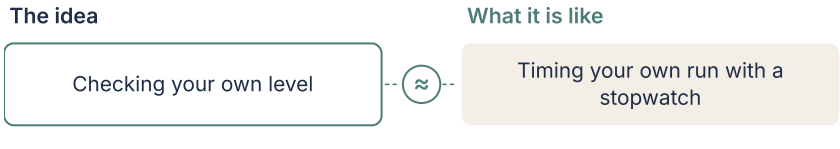
1. How many chunks does short-term memory hold at once (Cowan, 2001)? Answer: About 4.
2. How fast are items you do not rehearse mostly lost (Peterson & Peterson, 1959)? Answer: Within about 18 seconds.

12.3 The Self-Assessment Process

12.3.1 Assessment Methods

YOU CHECK YOUR OWN level with **self-tests**. It is like timing your own run with a stopwatch. You can test alone or with a partner. Either way, the tests are a self-check, not an exam.

Self-tests: a self-check, not an exam



You can test alone or with a partner.

> Definition:
>
> **SELF-ASSESSMENT:** checking your own level yourself.

> Key Concept:
>
> Testing Alone
>
> Choose a quiet place with no notes or devices nearby.
>
> Use a timer, and get the test ready before you start.
>
> Record each result in your practice journal on the day.

> **Key Concept:**
>
> Testing With a Partner
>
> Your partner gets the test ready, so you have not seen it before.
>
> Your partner times you and checks your answers.
>
> You both record the result in your journal.

A partner makes the test **fairer**, because you cannot pick easy material for yourself. Testing alone still works if you get the test ready well in advance. Use the same method each time, so your results can be compared.

Key idea:

The same method, new material and a written record give you results you can compare.



A partner picks the test material while the learner waits.

The quick-recall tests fit in one sitting. The long-term tests need **later sessions**, spaced out to match the level you are checking.



A learner takes a quick recall test in one sitting.

Quick check:

1. Why does a partner make the test fairer? Answer: You cannot pick easy material for yourself.
2. When do the long-term tests happen? Answer: In later sessions, spaced to match the level.

12.3.2 Assessment Structure and Content

A FULL self-check has **three parts**. It is like a driving test, which has a few separate parts. Each part tests a skill you built with the methods in this book.

Part	Content	Time
Short-term memory	Recall of numbers, words and visual patterns in order, against a timer	About 40 minutes
Long-term memory	Recall of material from your first study session, checked in later sessions	Spread over follow-up sessions
Finding information	Fast recall of specific items from large, mixed sets	About 40 minutes

Space the long-term checks to **match the level** you are testing. A one-week check, for example, cannot test material you are meant to keep for months.



A calendar marks a long-term recall check, one week later.

Record every result in your journal. Over time, the record shows where you are improving and where to practise next. It is also the **evidence** for the level you claim.

Key idea:

Short-term memory, long-term memory and finding information make up a full self-check. Your journal holds the evidence for your level.



A learner writes a test result in her journal.

Key Concept:

Optional: Cleverini Memory Games

Cleverini is my own platform.

Its memory games come as apps for iPhone and Android. They are free to play.

A web version is at cleverini.com/games.

At any level, you can add practice on these games. This strand, one part of a level like your self-checks or your journal, is optional.

I set no game scores for any level.

Your level rests on your self-checks and journal, never on game results.

If you play, record your results in your journal, with the date.

Quick check:

1. What are the three parts of a full self-check? Answer: Short-term memory, long-term memory and finding information.
2. Why can a one-week check not test material you are meant to keep for months? Answer: One week is too short a gap. Space the long-term checks to match the level.
3. Do game results count towards your level? Answer: No. The Cleverini strand is optional, and I set no game scores for any level.

12.3.3 Keeping Your Level

A LEVEL IS A RECORD of practice. It lasts only as long as the practice does. It is like a lawn, which stays neat only while you keep mowing it. There is no expiry date and **nothing to renew**. Instead, you keep your level by going on practising and recording what you do.

Keeping a level

The idea		What it is like
A level kept by going on practising	≈	A lawn that stays neat only while you keep mowing

There is no expiry date and nothing to renew.

Recheck your level **from time to time** with the self-check in the previous section. If a result slips, practise that skill and test again. Your journal shows when you last met each part of your level.

Key idea:

With regular practice and a dated record, you keep your level. The level lasts only as long as the practice does.



A learner practises again after a self-check result slips.

The table lists activities that help keep a level. **Record each one** in your journal with the date.

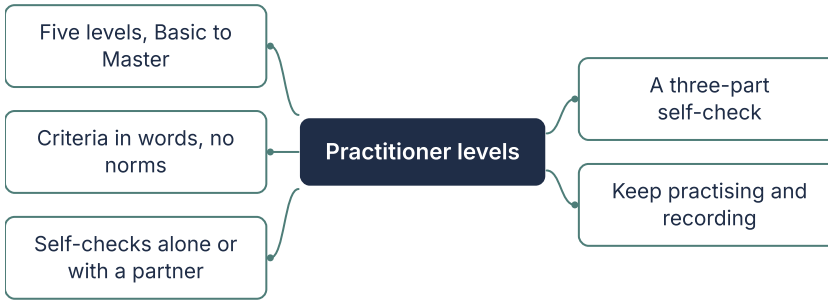
Activity	What to Record
Regular practice with my methods	The method, the material and your score
Teaching a session on memory methods	The topic, the length and who attended
Reading a research article on memory	A short summary of what you learned
Taking part in a memory competition	The event and your results
Repeating the self-check for your level	The date and your result for each part

Quick check:

1. Does a level expire? Answer: No. There is no expiry date and nothing to renew, but a level lasts only as long as the practice does.
2. What should you record when you teach a session? Answer: The topic, the length and who attended.
3. What does your journal show? Answer: When you last met each part of your level.

> **Key Concept:**
>
> Module 12 Key Takeaways
>
> The five levels describe stages of practice. No study has set norms for them, so treat them as my guide.
>
> You test yourself, alone or with a partner. The tests are self-checks, not an exam.
>
> A level lasts as long as you keep practising and recording your results.
>
> Reaching a level is a sign of progress, not the end of the work.

This module at a glance



A level lasts as long as you keep practising and recording your results.

Conclusion

You have now worked through **eleven modules** of memory science, methods and practice. You have followed the study of memory from ancient Greece to modern neuroscience. You have also built a set of methods that you can use every day.

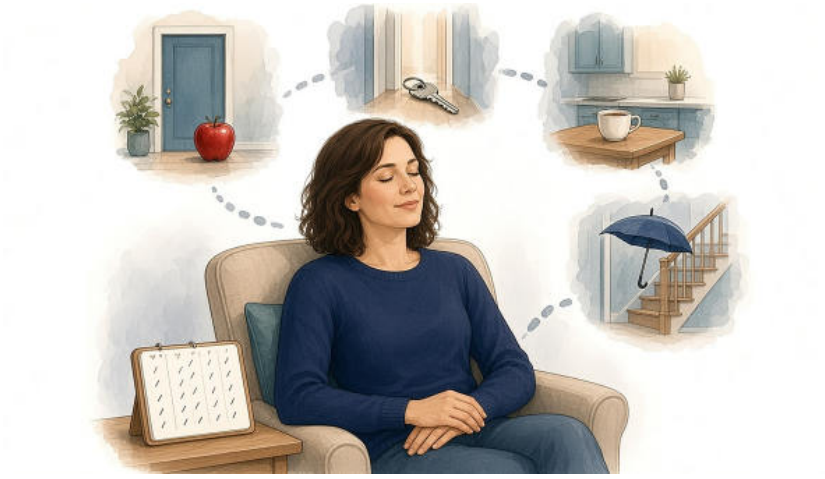
I hope you have found that your mind can do more than you expected. The levels in this module **record real work**. They are not a certificate for the wall.

A record of real work, not a certificate



The levels in this module record real work.

Some of the changes from practice can be seen in the brain. One study gave people new to the method **six weeks** of memory palace training (Dresler et al., 2017). Afterwards, their brain networks linked up in new ways. The study followed them for up to 4 months.



A beginner does memory palace training over six weeks.

The hippocampus is a key memory area. Its growth has been shown for aerobic exercise, but not for memory training. In older adults, a year of exercise grew it by **about 2%** (Erickson et al., 2011). No study has tested this programme itself.

Hippocampus growth: shown and not tested

Shown	Not tested
Shown: about 2% in a year in older adults (Erickson et al., 2011)	No study has tested this programme itself

The hippocampus is a key memory area.

Plutarch wrote that the mind "does not require filling like a bottle" (Plutarch, 1927). Rather, he said, it is like wood that needs **kindling**, small sticks used to start a fire. The line is often quoted with "brain" in place of "mind". However, "mind" is his word.

What to do next. Five steps follow from what you have learned.

- **Step 1, practise often.** Use the methods regularly, so they become habits.
- **Step 2, use your methods in real life.** Use a memory palace for your next talk. Use spaced review for your next learning project. Use vivid images when you need to remember a name.
- **Step 3, test yourself.** Use the self-check at your level, and record the result.
- **Step 4, teach someone else.** Teaching helps the teacher learn (Fiorella & Mayer, 2013). One study suggests much of the benefit comes from recalling the material (Koh et al., 2018).
- **Step 5, keep growing.** Memory skill is a practice that has no finish line.



One study suggests much of the benefit comes from recalling the material (Koh et al., 2018).

You now have **the tools**. The rest is practice.

Glossary of Key Terms

- **Acetylcholine.** A chemical messenger in the brain that helps with attention. It also helps store new memories, including in the hippocampus (Hasselmo, 2006). It falls in Alzheimer's disease.
- **Active recall.** Bringing information back from memory without looking at the source. A major review rated self-testing among the two most useful study methods (Dunlosky et al., 2013).
- **Amygdala.** An almond-shaped area deep in the brain. It processes emotion and strengthens memories of emotional events.
- **Anterograde amnesia.** The loss of the ability to form new long-term memories after brain injury or disease. Memories from before the injury are often kept.
- **BDNF (brain-derived neurotrophic factor).** A protein that helps brain cells grow, work and survive. In rats, running raised it in the hippocampus (Neeper et al., 1996). In people, it has been measured in blood (Erickson et al., 2011).
- **Chunking.** Grouping single items into larger, meaningful units. This gets around the small capacity of working memory.
- **Consolidation.** The process that makes new memories stable and lasting. Sleep plays a large part (Rasch & Born, 2013). Quiet waking rest after learning can also help (Dewar et al., 2012).
- **Declarative memory.** Memory for facts and events that you can recall on purpose and put into words. It includes episodic and semantic memory.
- **Dopamine.** A chemical messenger tied to reward and motivation. It helps store memories of rewarding events.

- **Dual coding theory.** Paivio's (1971) theory that material stored as both words and images is remembered better. Material stored in one form is remembered less well.
- **Elaborative encoding.** Linking new information to what you already know, through association, explanation and meaning. It produces deeper, longer-lasting memories.
- **Encoding.** The first stage of memory. Experience is turned into a form the brain can store.
- **Episodic memory.** Memory for events you lived through, tied to a time and a place. The hippocampus is central to it.
- **Glutamate.** The main chemical messenger that excites brain cells. It is needed for long-term potentiation, a key process in learning.
- **Hippocampus.** A curved area deep in the brain. It is key for forming new memories of facts and events. It also supports finding your way. It is sensitive to stress and ageing, and it responds to aerobic exercise.
- **Long-term potentiation (LTP).** A lasting increase in the strength of links between brain cells after repeated activity. It is thought to be a cellular basis of learning.
- **Memory palace (method of loci).** A method that places items at vivid spots along a familiar route in your mind. A review of 13 trials found a medium-sized benefit (Twomey & Kroneisen, 2021).
- **Neurogenesis.** The growth of new brain cells. Whether it continues in the adult human hippocampus is disputed. One study found none in adults (Sorrells et al., 2018), while another found it into old age (Boldrini et al., 2018).
- **Neuroplasticity.** The brain's ability to rewire itself. It forms and changes links in response to learning and experience.

- **Non-declarative memory.** Memory that shapes behaviour without conscious recall. It includes skills, priming and conditioning.
- **Prefrontal cortex.** The front part of the brain's frontal lobe. It supports working memory, planning, decisions and the search for stored memories.
- **Procedural memory.** Memory for skills, habits and learned sequences. Separate brain systems, including the basal ganglia and cerebellum, support it (Squire, 2004). It is often spared in amnesia.
- **Retrieval.** The third stage of memory. Stored information is found and rebuilt, guided by cues and context.
- **Semantic memory.** Memory for general knowledge, such as facts, ideas and language. It is not tied to a personal event.
- **Sensory memory.** The briefest kind of memory. It holds raw sense impressions for a fraction of a second, and most are lost.
- **Serotonin.** A chemical messenger involved in mood. A major review found no consistent link between serotonin and depression (Moncrieff et al., 2023).
- **Short-term memory.** A brief store that holds information for a short time without rehearsal. Miller (1956) gave the classic figure of 7, plus or minus 2. Today's best estimate is closer to 4 chunks (Cowan, 2001).
- **Spaced repetition.** Reviewing material at growing intervals. It uses the spacing effect to improve long-term memory.
- **Synaesthesia.** A condition in which one sense triggers another, such as numbers having colours. People with synaesthesia tend to show better memory than matched controls (Rothen et al., 2012). In one

group study, the gain stayed within the normal range (Rothen & Meier, 2010).

- **Working memory.** A small, active system that holds and works on information during a task. It is closely related to short-term memory, with more focus on processing.

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A. A Simple Weekly Practice Planner

Memory, like physical fitness, responds to **steady training**. Twenty minutes a day adds up, and scores often rise within weeks. A few minutes on a Sunday are enough to plan the week ahead, so each day starts with the drills already chosen.

> 🔑 **Key Concept:**
>
> How to use this planner. **Every sheet here is a blank copy of a plan from the book.** The filled rows are examples to change. The From column names the module or section that explains each idea, and Appendix C writes out every exercise the sheets name. Use a pencil, because the first version is a draft.

The key to a daily plan is **variety**. Rotate through different types of exercise, because changing the exercises keeps practice hard. Mixing your practice up tends to help you learn as well, and psychologists call this a “desirable difficulty” (Bjork & Bjork, 2011).

Table A.1: The 20-minute daily menu

Daily exercise	Minutes	What it trains	From
Number Memorisation	3	Chunking (grouping small bits into bigger pieces that mean something), number encoding, spatial encoding	Module 4
Word List Recall	4	Episodic memory, vocabulary encoding, association	Module 4
Name & Face Practice	3	Memory for people, making links, reading faces	Module 4
Backwards Review	2	Getting memories back, self-testing, finding gaps	Module 4
Spaced Flashcard Drill	5	Keeping things long-term, pulling facts back out	Module 4
Mind Palace Maintenance	3	Memory for places, tidy long-term storage	Module 4



A term planner, a Memory Palace sketch and a flashcard deck, side by side.

The six drills take **about 20 minutes together**. Your daily session should be easy enough for hard days, so keep it short when you need to. Appendix C gives the instructions for each drill in full.

Table A.2: My weekly planner

Day	Drills from Table A.1	Extra exercise from Appendix C	Minutes	Done
Monday		Weekly Knowledge Currency Check, about 15 minutes		
Tuesday				
Wednesday				
Thursday				
Friday				
Saturday				
Sunday		Weekly Failure Mode Scan, 5 minutes		

The Monday and Sunday rows come from the book. **The weekly check in Module 11 runs every Monday morning**, and the failure mode scan in Module 4 looks over your practice log every Sunday. Fill in the other days with drills and one extra exercise each, and tick the Done column as soon as you finish.

The 30-day programme

Module 4 sets out **a 30-day programme** that starts from where you are now. It gets harder slowly, so you are not swamped, and each week ends with a milestone. Record your baseline on the 30-word list in the first week, before any other exercise.

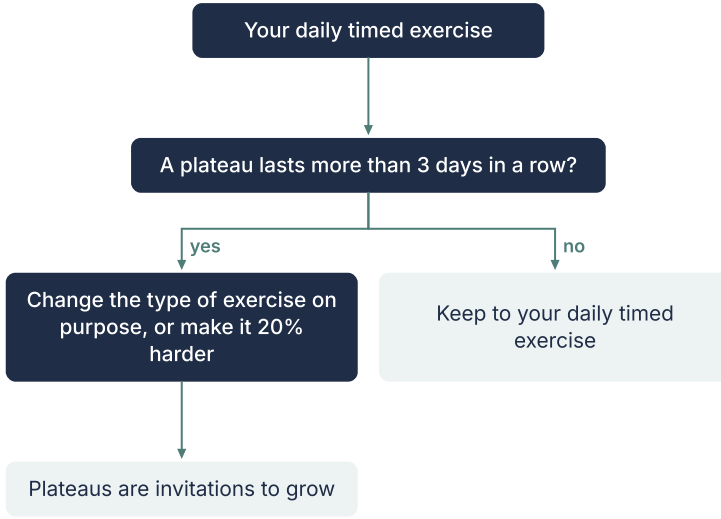
Table A.3: The 30-day memory training programme

Week	Daily focus	Milestone by week's end	Done
Week 1 (Days 1 to 7)	Visualisation and a basic Memory Palace (10 stations)	Memorise a 20-item list perfectly using your Memory Palace, the places you walk through in your head, each one holding something to remember. Record your baseline on the 30-word list	
Week 2 (Days 8 to 14)	Peg System and Number Memorisation	Memorise a 30-digit number using chunking (grouping small bits into bigger pieces that mean something) and your peg system (a list of 'pegs' learned by heart first, on which you hang new information). Add a second Memory Palace (20 stations)	
Week 3 (Days 15 to 21)	Spaced Repetition and Active Recall	Score 90%+ on a 50-word list recalled 48 hours after you learn it. Start reviewing Week 1 material with flashcards	
Week 4 (Days 22 to 30)	Speed and Volume	Memorise a shuffled deck of playing cards, or another list of 52 items. Complete your Module 4 self-assessment	

New daily habits **take time to become automatic**. For 39 people whose results were clear, the typical time was 66 days, with a range of 18 to 254 days (Lally et al., 2010). Missing a single day did not really harm the habit, so carry on the next day.

Progress is usually **fast at first and then slows** (Heathcote et al., 2000). The slower phase is normal, and it does not mean the method has stopped working. The book names the first plateau, around days 10 to 14, as the danger point, so plan for it before it arrives.

When a plateau lasts



Review dates and the progress tracker

A palace needs **early reviews** to last. Review it after about 1 day, 3 days and 7 days, because spaced reviews work better than reviews bunched together (Cepeda et al., 2006). After that, an occasional walk-through keeps it fresh.

Table A.4: My palace review dates

Palace and what it holds	Built on	Day 1 review	Day 3 review	Day 7 review

Flashcards need **a set pace of new cards**. The Anki Manual says 20 new cards a day means about 200 daily reviews. Cut new cards until reviews feel easy to handle, and about 10 a day keeps reviews near 100.

Tracking your progress **helps you reach goals**, and it helps more when you write it down or share it (Harkin et al., 2016). The tracker below

copies the six columns from the Weekly Progress Tracker in Module 4. Record at least one timed exercise a day.

Table A.5: My progress tracker

Date	Exercise	Items to memorise	Items recalled	Score (%)	Notes

At the end of each week, **work out your average score** across all exercises and plot it as a simple line graph. If a plateau lasts more than 3 days in a row, change the type of exercise on purpose, or make it 20% harder.



A learner looks over a written record of weekly scores.

When practice stops

Many people who start a memory programme stop within the first few weeks. **After more than 7 days off, the book's advice is to rebuild slowly**, and its recommitment protocol rebuilds the habit before the skill.

Exercise:

4.8d, The 21-Day Recommitment Protocol (for Returning Trainees).

1. After more than 7 days off, do not restart at your old level.
2. On days 1 to 3, do one 5-minute palace review a day, and nothing else. Rebuild the habit before the skill.
3. On days 4 to 7, add one spaced repetition session (10 minutes). Still add no new material.
4. On days 8 to 14, practise daily at 70% of your old level.
5. On days 15 to 21, go back to full practice. Add one new technique if you feel ready.
6. Work out which failure mode caused your break. Write it down. Build one specific guard against it.
7. Take new starting scores. Skills you have built usually come back faster than they took to learn (Murre & Dros, 2015). Ebbinghaus called this "savings".

Key idea:

Plan about 20 minutes of varied drills a day, review new palaces at 1, 3 and 7 days, and come back slowly after a break.

B. Sleep, Movement and Meal Planning Worksheets

Sleep after learning gives **clear help for memory** (Diekelmann & Born, 2010). Regular exercise gives little gain (Roig et al., 2013), and fish-oil pills in healthy older people give no gain (Sydenham et al., 2012). The worksheets here turn the habits of Module 10 into short logs, so you can see what helps your own memory.

> **Key Concept:**
> How to use these worksheets. **Each sheet copies a log, a plan or a scorecard from Module 10**, and each table title names the exercise behind it where there is one. Fill in one sheet for the time it names, then look for a pattern. Treat what you find as personal data, because other things also change each day.

Sleep

US sleep experts advise adults to get 7 or more hours a night (Watson et al., 2015). Another US group suggests 7 to 9 hours for

adults and 7 to 8 for older adults (Hirshkowitz et al., 2015). Short sleep night after night leads to deficits that build up, often unnoticed.

The first sheet is the Sleep and Memory Log from Exercise 10.12. **For two weeks, track your sleep and your memory side by side.** Each morning, note the hours slept and how often you woke, rate how deeply you slept from 1 to 10, then do a 15-word recall test with a fresh list.

Table B.1: My sleep and memory log (Exercise 10.12)

Day	Hours slept	Times I woke	Depth of sleep (1 to 10)	15-word recall score
1				
2				
3				
4				
5				
6				
7				
8 to 14				



After 14 days, **plot sleep quality against your test scores**. Check whether better nights go with higher scores the next morning. Two weeks is a small sample, so treat the result as a clue about yourself.

The sleep habits in Module 10 come with their evidence. **Go to bed and wake at the same times every day, weekends included.** Avoid large amounts of caffeine for at least 6 hours before bed, and try a wind-down routine, such as a warm bath or shower, light reading, gentle stretching or journaling.

Table B.2: My sleep habits

Day	Bedtime	Wake time	Last caffeine	Wind-down (bath, reading, stretching or journaling)
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				
Saturday				
Sunday				

The warm-bath evidence is **limited but positive**. A 10-minute warm bath or shower 1 to 2 hours before bed helped people fall asleep sooner (Haghayegh et al., 2019). Caffeine 6 hours before bed still disrupted sleep in one study (Drake et al., 2013).



A person relaxes in a warm bath, 1 to 2 hours before bed.

Movement

One exercise session gives **moderate help for memory soon after**. Regular exercise had small effects in a large review (Roig et al., 2013), though a year of it grew the hippocampus by about 2% (Erickson et al.,

2011). No source checked supports a fixed window after exercise, so studying soon after it is a simple habit to test for yourself.



Older adults go brisk walking as part of a year-long exercise trial.

Table B.3: My week of movement

Day	Activity (running, brisk walking, cycling, swimming or dancing)	Minutes	Studied soon after (yes or no)	Memory score that session
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				
Saturday				
Sunday				

The Module 10 table suggests **30 to 45 minutes of moderate aerobic exercise, 5 days a week**. Its table marks the brain claims for strength training, yoga and tai chi as not checked.

Meals and water

Single-nutrient pills give **mostly no memory gain** in healthy adults. The MIND diet has a link with lower risk (Morris et al., 2015), while its trial found no benefit (Barnes et al., 2023). The sheet below tallies the original MIND targets for one week, 10 food groups to favour and 5 to limit (Morris et al., 2015).

Table B.4: My MIND diet week

Food group	Target	My servings this week
Green leafy vegetables	6 or more servings a week	
Other vegetables	At least 1 serving a day	
Berries	2 or more servings a week	
Nuts	5 or more servings a week	
Olive oil	Main cooking oil	
Whole grains	3 or more servings a day	
Fish	1 or more servings a week	
Beans and legumes	More than 3 servings a week	
Poultry	2 or more servings a week	
Wine	1 glass a day. Part of the original scoring. Other evidence urges caution, and the World Health Organization says there is no safe level of drinking for health (World Health Organization, 2023)	
Red meat	Fewer than 4 servings a week (limit)	
Butter and margarine	Less than 1 tablespoon a day (limit)	
Cheese	Less than 1 serving a week (limit)	

Pastries and sweets	Fewer than 5 servings a week (limit)
Fried or fast food	Less than 1 serving a week (limit)

The Food and Focus Diary in Exercise 10.4 runs **for 14 days**. Each day, record what you ate and one memory exercise score, and rate your focus and energy from 1 to 10 at three points in the day. Treat any pattern as a clue, because many things besides food change from day to day.

Table B.5: My food and focus diary (Exercise 10.4)

Day	What I ate	Memory score	Focus and energy, morning	Midday	Evening
1					
2					
3					
4 to 14					

For most healthy people, thirst is a good guide to water. US guidance sets total water at about 3.7 litres a day for men and about 2.7 litres for women, including water from food (National Academies, 2004). The Hydration Test in Exercise 10.5 compares your scores on hydrated and normal days.

Putting it together

Food, exercise, sleep and stress care **may work best together**, though no study has tested the combined effect. The weekly scorecard from Exercise 10.18 scores each factor from 0 to 3, for a total out of 12. The book suggests aiming for 9 or more.

Table B.6: My lifestyle scorecard (Exercise 10.18)

Week	Nutrition (0 to 3)	Exercise (0 to 3)	Sleep (0 to 3)	Stress (0 to 3)	Total (out of 12)	Memory scores that week
1						
2						
3						
4						

A few minutes of **slow breathing or muscle relaxation** lowered stress measures in trials (Balban et al., 2023; Pawlow & Jones, 2002). The book's daily stress plan fits all four of its quick techniques into ten minutes.

> Exercise:
>
> 10.15, The 10-Minute Daily Stress Plan.
>
> 1. Do this short routine every morning for 30 days. It combines the four quick techniques in Module 10.
> 2. Minutes 1 and 2: do 10 rounds of cyclic sighing. Focus only on your breath.
> 3. Minutes 3 to 5: do 6 rounds of 4-7-8 breathing. Use a phone timer if counting is hard.
> 4. Minutes 6 to 8: tense and release your feet, legs and stomach. Then do your hands, arms, shoulders and face. Hold each for 5 seconds, then release fully. Go through the groups twice.
> 5. Minutes 9 and 10: sit without any technique. Notice how your mind feels compared with when you began.
> 6. Before and after each session, rate your stress and mental clarity from 1 to 10. After 30 days, compare your morning stress rating

on day 1 and day 30. If one technique does not suit you, give more time to one that does.

Key idea:

Log one habit at a time, look for your own pattern and give sleep after learning first place, since Module 10 finds clear help there.

C. Exercise Bank, Cleverini Game Guide and Offline Alternatives

Some evenings you have twenty minutes and no wish to search a whole book for something to practise. **This bank writes out every exercise in the book in full**, so you can pick one and start straight away. There are 240 rows, sorted by module, each tagged so you can find one that fits.

> **Key Concept:**
> How to use this bank. **Pick a sub-skill, then a level and a time that fit your day.** Each row gives the exercise in the words of its module, and the Topic column names the section it comes from. Table C.1 explains the four tags.

The tags are short labels for planning. **Sub-skill says what the exercise works on**, format says how you do it, time says how long it takes and level says which level of practice it fits.

Table C.1: The four tags

Tag	What it tells you	Values used
Sub-skill	The part of memory practice the exercise works on	AI tools, Attention and intake, Brain health and lifestyle, Chunking and organising, Explaining and teaching, Knowledge systems, Languages, Memory palace, Memory problems, Mnemonics and codes, Names and people, Reading and study, Self-check and progress, Spaced review and retrieval, Speed and competition, Stories and imagery, Thinking and creativity, Updating and flexibility, Work and talks, Working memory
Format	How you do it	App or cards, Checklist, Daily life, Log, On the move, Paper, Plan, With an AI tool, With others
Time	The session or programme length the exercise names	"Set in the steps" means the steps time each part, and "Your choice" means the exercise sets no time
Level	Which level of practice the exercise fits	Step: Try it, Step: Starter, Step: Middle and Step: Advanced are Module 2's own steps. Elsewhere, Intermediate, Advanced and Expert name the level in Module 12 whose main feature the exercise uses. Any means the levels table in 12.1 does not name the row's method

The level tag follows the levels table in 12.1. **Intermediate practice uses chunking and simple memory aids consistently**, Advanced uses a memory palace and spaced review as routine, and Expert uses several memory systems and teaches others. A row that uses a palace or spaced review is tagged Advanced, even when it is short.

Simple methods mark the Basic level, and several systems kept up over time mark Expert and Master. **12.1 does not say which methods count as simple**, so no row is tagged Basic. Master means keeping up every level's habits over time, which no single exercise can show, so no row is tagged Master. Any marks a row whose method the table does not name, mostly lifestyle, updating and thinking tasks.

> **Key Concept:**
> How the rows are copied. Each row is copied from its module with light trims. **Pointers to other sections are taken out**, dashes in number ranges become “to”, and lists inside a step are joined with semicolons. The Module 2 steps are split into their own rows, so each step can be tagged on its own.

Two kinds of material stay in their modules. **The quick checks are questions on the text**, and the module completion checklists list the ideas each module covered. Neither is a practice exercise, so this bank leaves them out. The 30-day programme from Module 4 appears in Appendix A.

Exercises by module

The first module opens with three short tests of your own memory. **The baseline in Exercise 1.1 is the one to keep**, because the exercise asks you to come back to it later. The other two let you feel the kinds and stages of memory for yourself.



A learner studies a list of words while a five-minute timer runs.

Table C.2: Module 1, Introduction to Memory

Topic	Exercise	Sub-skill	Format	Time	Level
Definition and Importance of Memory	1.1, Your Memory Baseline. 1. Write down everything you can remember about what you ate yesterday. Include every meal, snack and drink, in order. 2. Next, write down the names of every teacher you had in primary school. 3. Finally, recall the last three phone numbers you dialled (without looking). 4. Think back. Which was easiest? Which was hardest? Why? Keep this baseline, because you will come back to it later.	Self-check and progress	Paper	Your choice	Any
Types of Memory	1.2, Memory Taxonomy Walk. 1. Close your eyes. Spend 60 seconds recalling the details of a memorable holiday or trip. 2. Open your eyes and name the type of memory each detail is. Is it episodic, semantic or procedural? 3.	Self-check and progress	Paper	Set in the steps	Any

	Notice how your memories of that event mix several types at the same time. 4. Write three sentences describing a skill you have that is now ‘automatic’. This is procedural memory in action.				
Memory Processing	1.3, Encoding Quality Test. 1. Read the list in this step once, spending 2 seconds on each word. Do NOT reread. The list is apple, parliament, seventeen, elephant, Tuesday, mercury, cathedral, whisper, gratitude, volcano. 2. Now cover the list and write down every word you can remember. 3. Uncover the list and check. For each word you missed, ask why. Were you distracted? Did the word have no emotional hook? Did it feel alone (no links to anything)? 4. Now learn the missed words again using a	Self-check and progress	Paper	Set in the steps	Any

	bright, strange image for each. Test yourself again in 10 minutes. 5. Repeat the test 24 hours later. You should notice a big improvement from the imagery technique.				

Module 2 shows how memory works with attention, intellect and creativity. **Every topic has a Try it and three steps**, Starter, Middle and Advanced. The steps build on each other, so start with the Try it and move down the rows of one topic.

Table C.3: Module 2, How Memory Works with Attention, Intellect and Creativity

Topic	Exercise	Sub-skill	Format	Time	Level
You Cannot Keep What You Never Took In	Try it. The next time someone explains how to do something, put your phone away first. Then say the steps back once.	Attention and intake	With others	Your choice	Step: Try it
You Cannot Keep What You Never Took In	Catch the moment, Starter. Before a planned explanation, such as a handover or a lesson, put everything else away. Afterwards, write the main points from memory.	Attention and intake	Daily life	Your choice	Step: Starter
You Cannot Keep What	Catch the moment, Middle. Run a	Attention and intake	With others	Your choice	Step: Middle

You Never Took In	cue hunt for one day. Each time someone starts to explain something, note whether you stopped the second task.				
You Cannot Keep What You Never Took In	Catch the moment, Advanced. Keep an intake log for a week. Each evening, list three things you meant to keep, and check which ones you can still recall.	Attention and intake	Daily life	1 week	Step: Advanced
Working Memory	Try it. Ask someone to read you four short steps. Carry them out in order, saying each step aloud as it comes into focus.	Working memory	With others	Your choice	Step: Try it
Working Memory	One step in focus, Starter. Hold four errands in your head. Do them one by one, and say which errand is in focus before you start it.	Working memory	Daily life	Your choice	Step: Starter
Working Memory	One step in focus, Middle. Before a fiddly task, write down everything else on your mind. Then do the task, naming each step	Working memory	Daily life	Your choice	Step: Middle

	aloud as you reach it.				
Working Memory	One step in focus, Advanced. During a long task, such as a form, mark your place each time you are interrupted. Afterwards, note how quickly you got back on track.	Working memory	Daily life	Your choice	Step: Advanced
What You Know Steers What You Notice	Try it. Before you open a cupboard you use every day, name three things in it. Then open it and find one you did not name.	Attention and intake	Daily life	Your choice	Step: Try it
What You Know Steers What You Notice	Look past your list, Starter. Ask someone who knows a task well what she looks at first. Try the task with her answer as your guide.	Attention and intake	With others	Your choice	Step: Starter
What You Know Steers What You Notice	Look past your list, Middle. Before a familiar job, name one thing you usually skip. Look at it first, and note what you find.	Attention and intake	Daily life	Your choice	Step: Middle
What You Know Steers What You Notice	Look past your list, Advanced. Take something you wrote last week. Print it or read it	Attention and intake	Daily life	Your choice	Step: Advanced

	aloud, and list every slip your normal reading missed.				
Working Memory and Reasoning	Try it. Before your next sum in your head, say what you are trying to find out. Then write each total down as you reach it.	Working memory	Daily life	Your choice	Step: Try it
Working Memory and Reasoning	Find the failing part, Starter. Choose a sum you often get wrong, such as splitting a bill. Do it on paper, writing every number down before you use it.	Working memory	Daily life	Your choice	Step: Starter
Working Memory and Reasoning	Find the failing part, Middle. Run a fault finder. After a reasoning task goes wrong, note whether you lost a fact, lost the goal or could not find something you knew.	Working memory	Daily life	Your choice	Step: Middle
Working Memory and Reasoning	Find the failing part, Advanced. For one real decision, lay out every fact on one page before you reason about it. Compare the result with how you usually decide.	Working memory	Daily life	Your choice	Step: Advanced
Chunks and Expertise	Try it. After your next solved problem, write	Chunking and organising	Daily life	Your choice	Step: Try it

	one line naming what kind of problem it was and which step did the work.				
Chunks and Expertise	Grow your chunks, Starter. Pick one problem you solved this week. Name its pattern in a few words and add it to a pattern list.	Chunking and organising	Daily life	Your choice	Step: Starter
Chunks and Expertise	Grow your chunks, Middle. Before you try a new problem, study one solved example of the same kind. Note why each step was taken.	Chunking and organising	Daily life	Your choice	Step: Middle
Chunks and Expertise	Grow your chunks, Advanced. Solve five problems of mixed kinds in one sitting. Name each one's kind before you start, and check how often you were right.	Chunking and organising	Daily life	Your choice	Step: Advanced
Remembering a Similar Problem	Try it. Next time you are stuck, ask "what else is this like?" and name one case from a different part of your life.	Thinking and creativity	Daily life	Your choice	Step: Try it
Remembering a Similar Problem	Find the old case, Starter. Take a	Thinking and creativity	Daily life	Your choice	Step: Starter

	problem you solved this month. Describe it in terms of its working parts, then think of one other case with the same parts.				
Remembering a Similar Problem	Find the old case, Middle. Start a case log. For two weeks, write each solved problem as “working parts, then the fix”, in one short line.	Thinking and creativity	Daily life	Your choice	Step: Middle
Remembering a Similar Problem	Find the old case, Advanced. Before a real stuck problem, search your case log for a match. List where the old case and the new problem differ, and change the answer to fit.	Thinking and creativity	Daily life	Your choice	Step: Advanced
Associations	Try it. Write three uses for a teaspoon in one minute. Then take it apart in your mind and find one new use for one part.	Thinking and creativity	Daily life	Your choice	Step: Try it
Associations	Past the first ideas, Starter. For one small problem, write down every idea that comes at once. Mark each one remembered or built.	Thinking and creativity	Daily life	Your choice	Step: Starter

Associations	Past the first ideas, Middle. Run a two-round list. After the first round, break the problem into parts, and write a second round from the parts.	Thinking and creativity	Daily life	Your choice	Step: Middle
Associations	Past the first ideas, Advanced. Keep a bridge log for two weeks. Each day, link one new thing you learned to a field far from it, in one short line.	Thinking and creativity	Daily life	Your choice	Step: Advanced
Remembering to Imagine	Try it. Imagine a chair for a world without gravity. List three usual chair features you kept, then drop one.	Thinking and creativity	Daily life	Your choice	Step: Try it
Remembering to Imagine	Change the frame, Starter. Pick an everyday object and list its five usual features.	Thinking and creativity	Daily life	Your choice	Step: Starter
Remembering to Imagine	Change the frame, Middle. Drop one feature at a time and sketch what the object becomes each time.	Thinking and creativity	Daily life	Your choice	Step: Middle
Remembering to Imagine	Change the frame, Advanced. Borrow the frame of a different kind	Thinking and creativity	Daily life	Your choice	Step: Advanced

	of thing, such as a game or a garden, and redesign your object inside it.				
When Memory Gets in the Way	Try it. Before your next piece of work, write two faults in a familiar example of it. Then start, avoiding both.	Updating and flexibility	Daily life	Your choice	Step: Try it
When Memory Gets in the Way	Break the pull, Starter. Pick one example you rely on and write three things that are weak in it.	Updating and flexibility	Daily life	Your choice	Step: Starter
When Memory Gets in the Way	Break the pull, Middle. Sketch your own version first, then look at examples, then revise.	Updating and flexibility	Daily life	Your choice	Step: Middle
When Memory Gets in the Way	Break the pull, Advanced. Solve a regular problem with your usual answer ruled out, and compare the two results.	Updating and flexibility	Daily life	Your choice	Step: Advanced
When You Need Which	Try it. For tonight's dinner, name one step where memory led and one where you held it back.	Thinking and creativity	Daily life	Your choice	Step: Try it
When You Need Which	Four steps, one task, Starter. Pick one real task and write the four steps beside it.	Thinking and creativity	Daily life	Your choice	Step: Starter

When You Need Which	Four steps, one task, Middle. Run the task with a card that marks each step in front or held back.	Thinking and creativity	Daily life	Your choice	Step: Middle
When You Need Which	Four steps, one task, Advanced. Across three tasks, log how long you spend on each step, then lengthen the shortest.	Thinking and creativity	Daily life	Your choice	Step: Advanced

The technique module holds the core methods of the book. **Chunking, the memory palace, the six mnemonic families, spaced repetition and the story chain** each get at least two exercises. The numbers in the Exercise column are the book's own, so a row that names another exercise points to a row in this bank.

Table C.4: Module 3, Techniques for Memory Improvement

Topic	Exercise	Sub-skill	Format	Time	Level
The Power of Chunking	3.1, Master Chunker. 1. Memorise this raw string: BTTFSICIANASABCUSAAIMDNA 2. Now try again with these chunks: BTTF · SI · CIA · NASA · BC · USA · AI · MDNA 3. Now try seeing them as familiar acronyms. They are BTTF (Back to the Future), SI (as in SI units), CIA and NASA. Then come BC	Chunking and organising	Paper	Set in the steps	Intermediate

	(Before Christ), USA, AI and MDNA (Madonna album). 4. Notice how the same 24 letters become easy once chunked into units that mean something. This is chunking, and it works for all kinds of information. 5. Now take any 20-digit number and practise chunking it into groups. Can you recall it perfectly after 2 minutes?				
The Power of Chunking	3.1b, The Newspaper Chunker. 1. Find any newspaper article or dense paragraph of text you have not read before. 2. Read it once at normal speed. 3. Put it away. Now write down everything you remember. But sort what you recall into themes or groups, and skip listing random facts. 4. Compare the structure you recalled to the original. How well did	Chunking and organising	With others	Your choice	Intermediate

	chunking by theme catch the content? 5. Repeat with a different article. This time, give each sentence a group label on purpose as you read. Notice the big improvement in recall.				
The Power of Chunking	3.1c, The Hierarchical Mastermap. 1. Take any complex topic you are studying now or need to understand. It could be a project, a subject or a technical system. 2. On a blank sheet of paper, write the topic name in the centre. 3. Draw 3 to 5 major “branches”. These are the main sub-themes or groups. 4. From each branch, draw 3 to 4 “twigs”. These are the specific facts, names or details that belong under that branch. 5. Now put the map away and redraw it from memory on a new sheet. Check for gaps. 6. The map you drew	Chunking and organising	Paper	Your choice	Intermediate

	from memory is your actual mental model. Everything on the original that is missing from your recall still needs encoding. It still needs to be properly taken in.				
The Method of Loci	3.2, Your First Memory Palace. 1. Choose your home as your Memory Palace. Pick out 10 stations on a fixed route, no more and no fewer. 2. Use your palace to memorise the 10 planets and dwarf planets in order. They are Mercury, Venus, Earth, Mars, Ceres, Jupiter, Saturn, Uranus, Neptune, Pluto. 3. For each, make a silly picture you will remember. Mercury = a silver thermometer exploding at your front door. Venus = a beautiful woman painting your coat rack. And so on. 4. Walk the route in your mind three times, ‘seeing’ each	Memory palace	On the move	1 week	Advanced

	picture clearly. 5. Look away from the page. Write the 10 bodies from memory. Aim for 100%. Repeat daily for a week. 6. After one week, add a second palace for 10 historical dates. Notice how your speed improves.				
The Method of Loci	3.2b, The Route Method, Your Commute as a Palace. 1. Choose a trip you make often. It could be your morning commute, a familiar walk or a drive you know well. 2. Pick out 15 separate, fixed landmarks along the route. These are your stations. Write them down in order. 3. Use this route palace to memorise 15 key dates in history. These are the 15 most important dates you've always meant to know, such as these. 776 BCE: first Olympic Games; 44 BCE: Julius Caesar assassinated;	Memory palace	On the move	Your choice	Advanced

	1066: Battle of Hastings; c. 1440: Gutenberg printing press; 1492: Columbus; 1687: Newton's Principia; 1776: American Declaration; 1859: Darwin's Origin of Species; 1903: Wright Brothers; 1928: Penicillin; 1945: end of WWII - 1953: DNA structure; 1969: Moon landing; 1989: Berlin Wall; 1991: World Wide Web 4. For each date, make a bright scene that uses the number itself as a picture. For 1066, picture a giant "1066" carved into a stone door. Arrows are battering it. 5. Walk the route in your mind three times. Test yourself without looking.				
The Method of Loci	3.2c, The Expanding Palace Sprint. 1. Set a timer for 5 minutes. 2. Use a palace of your home. Memorise as many items from the list as you can, in	Memory palace	Paper	Set in the steps	Advanced

order. The list starts with umbrella, theorem, saxophone, parliament, whisky and cathedral. Next come nitrogen, avalanche, manuscript, telescope, tortoise and lighthouse. It ends with equations, chandelier, labyrinth, democracy, expedition and hibernate. 3. When the timer sounds, close the list. At once, write down every item in order. 4. Score yourself. Anything below 14/18 means your pictures need to be stranger, with parts that act on each other more. They should be doing something big and wild in the rooms they are placed in. 5. Repeat the exercise tomorrow with a different list. Track whether your score improves each day. 6. Advanced challenge: try the same list backwards, walking your

	palace in reverse.				
The Six Essential Mnemonic Families	3.3, Acrostic Creator. 1. Make an acrostic for the planets in order. They are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune. 2. A classic example is My Very Educated Mother Just Served Us Noodles. Can you make one that is more personal, and so easier for you to remember? 3. Now make an acronym for any 5 things you need to remember this week. 4. Test a friend. Can they work out your acronym without help?	Mnemonics and codes	With others	Your choice	Intermediate
The Six Essential Mnemonic Families	3.3b, The Personal Acronym System. 1. Choose 7 facts you need to remember for an upcoming task, talk or examination. 2. Take the first letter of the key word in each fact. 3. Arrange these letters to form a real word (acronym). Or form a non-	Mnemonics and codes	Paper	Your choice	Intermediate

	word you can say that is still easy to remember. 4. If no word is possible, make a sentence you can remember. Each word should start with one of your letters (acrostic). 5. Test yourself without looking at your list. Bring the acronym to mind and rebuild all 7 facts. 6. Bonus round: make acronyms for three different lists this week. One week later, compare how easily each comes back to you.				
The Six Essential Mnemonic Families	3.3c, Competitive Decoding. 1. Ask a friend, workmate or family member for help. They give you 8 random facts, names or pieces of information. 2. Do not write them down. At once, make an acronym or acrostic for all 8 items. 3. Tell your friend the mnemonic sentence or word. 4. One hour later, rebuild all 8 items from the mnemonic	Mnemonics and codes	With others	Your choice	Intermediate

	alone. 5. Switch roles, so you give them 8 items. Compare how well each of you recalled. 6. This exercise adds a little pressure. It is like recalling in front of others.				
The Six Essential Mnemonic Families	3.4, The Memory Songwriter. 1. Choose 5 facts you need to remember for work or study. 2. Set them to a tune you know (Happy Birthday, Twinkle Twinkle, or any pop song). 3. Sing it to yourself three times. Come back 24 hours later. Notice how much you kept. 4. For an advanced step, write a full song that covers a whole topic. It could be a process, a timeline or a list of key terms.	Mnemonics and codes	Paper	Set in the steps	Intermediate
The Six Essential Mnemonic Families	3.4b, Rhyme Architecture for Rules and Sequences. 1. Choose any rule, law, formula or step-by-step process that you always find hard to remember. Think of a	Mnemonics and codes	Paper	Set in the steps	Intermediate

	grammar rule, a maths formula, a legal principle or a cooking method. 2. Rewrite it as a rhyming pair of lines (a couplet) or four lines (a quatrain). The rhyme does not need to be perfect. Close rhymes ('near-rhymes') are fine. 3. Read your rhyme aloud three times. Set it to any simple tune. 4. Test yourself 24 hours later, then 1 week later. 5. Classic model: "I before E, except after C" is a 6-word rhyming rule. It has many exceptions, but its sound and beat make it stick. Your rhyme can do the same for any rule.				
The Six Essential Mnemonic Families	3.4c, The Memory Playlist. 1. Pick a topic you are studying. In it, you must memorise 10 to 20 facts or ideas in a set order. 2. Choose 3 to 5 songs with tunes you know well. 3. Give each song a block	Mnemonics and codes	Paper	Your choice	Intermediate

	of facts. Fit the facts into the tune as lyrics. You do not need a perfect match of syllables. A loose fit works. 4. Record yourself singing the songs (even a voice memo on your phone). Play it back twice. 5. One week later, play just the tune in your head. The facts should come up with the tune. 6. The order of the tune becomes the frame for finding everything stored in it.				
The Six Essential Mnemonic Families	3.5, Peg System Drill. 1. Memorise your 10 peg words. 1=bun, 2=shoe, 3=tree, 4=door, 5=hive; 6=sticks, 7=heaven, 8=gate, 9=vine, 10=hen 2. Use them to memorise today's top 10 news headlines. Put one on each peg, using a bright picture. 3. Test yourself tomorrow morning. How	Mnemonics and codes	Paper	Your choice	Intermediate

	many headlines can you recall? 4. For an advanced step, extend your peg system to 100. Search ‘Major System’ online. It turns numbers into consonant sounds, which gives you pegs for 00 to 99.				
The Six Essential Mnemonic Families	3.5b, The Major System, Encoding Numbers as Words. 1. Learn how the Major System matches consonants to digits. 0=s/z, 1=t/d, 2=n, 3=m, 4=r; 5=l, 6=sh/ch/j, 7=k/g, 8=f/v, 9=p/b Vowels are free. They add no number. 2. Practise storing single digits first. 1 = ‘tie’ (t=1), 2 = ‘Noah’ (n=2), 3 = ‘Ma’ (m=3); 4 = ‘rye’ (r=4), 5 = ‘law’ (l=5) 3. Now store a 4-digit number, such as 3141, the first 4 digits of pi. ‘Mature’ gives m-t-r, or 314, and ‘tie’ gives t, or 1. So 3141 becomes ‘mature tie’. 4. Practise on numbers that are not secret. Do not store	Mnemonics and codes	Paper	Your choice	Intermediate

	PINs or passport numbers this way. 5. The goal is to turn a number into a picture that ‘means’ something.				
The Six Essential Mnemonic Families	3.5c, Peg System, Weekly Agenda Lock. 1. Every Sunday evening, use your 10-peg system on the coming week. Memorise your 7 most important tasks or events. Put one on each peg, in order of priority. 2. Make a bright, strange picture for each task acting on its peg word. The sillier and busier the picture, the better. 3. On Monday morning, walk through your 7 pegs in your mind. Do this before you look at any calendar or phone. 4. At the end of the week, check how many you completed. Did you miss any? Missed items almost always match weak, vague pictures. Change how	Mnemonics and codes	Plan	Set in the steps	Intermediate

	you make your pictures to fix this. 5. After 4 weeks of this practice, extend your peg system to 20 items. Use the Major System peg words for 11 to 20.				
The Six Essential Mnemonic Families	3.6, The Feynman Memory Protocol. 1. Choose any idea from Module 1 that felt hard. 2. Write an explanation of it as if you are teaching a bright 12-year-old. No jargon allowed. 3. Find every gap. A gap is where your explanation breaks down or needs a term you cannot explain. 4. Go back to the text and fill those gaps. 5. Rewrite the explanation. Repeat until you can explain it smoothly, start to finish, from memory. 6. This is elaborative encoding in its purest form.	Explaining and teaching	Paper	Your choice	Any
The Six Essential Mnemonic Families	3.6b, The Rubber Duck Protocol. 1. Place any object in front	Explaining and teaching	Paper	Set in the steps	Any

of you, like a cup, pen or phone. This is your ‘rubber duck.’ 2. Explain aloud, to the object, everything you know about a topic you are learning now. Speak without stopping for at least 5 minutes. 3. Notice every moment you pause or use vague words (“something like”, “kind of”). Also notice when you reach for a term you cannot define. These are your encoding gaps. They are the very points where your memory is storing a label with no knowledge behind it. 4. Go back to your source material and fill each gap. 5. Return to your rubber duck and repeat the explanation. Keep going until you can speak smoothly for 5 minutes without pausing. 6. Record yourself in the final pass. Play it back 24 hours later and

	see how naturally the knowledge returns. Your own voice is a strong cue for bringing memories back.				
The Six Essential Mnemonic Families	3.6c, The 3-Level Explanation Ladder. 1. Choose any idea from Modules 1 or 3 that you feel sure about. 2. Level 1 is Expert. Write a careful explanation with the right technical terms (as if for a colleague in the field). Aim for 3 paragraphs. 3. Level 2 is Student. Rewrite it for a keen 16-year-old. Replace all jargon with comparisons in plain language. Keep every key idea. 4. Level 3 is Child. Rewrite again for a curious 8-year-old. Use a story or compare it to everyday objects. Nothing abstract allowed. 5. If any level breaks down, you have found a weak spot in your	Explaining and teaching	With others	Your choice	Any

	encoding. Return to the source and shore it up. 6. This exercise builds three separate paths back to the same information. They are expert language, plain language and story. Under pressure, that gives you more ways back to it.				
The Name-Face Association System	3.7, Name-Face Rapid Drill. 1. Go to any online source with photos of public figures you don't know. Try a list of historical figures. A team photo of a sports club you don't follow also works. So does a cast list from a foreign film. 2. Study 10 names and faces. For each, use the 5-Step Name-Face System. Find a feature that stands out, turn the name into a picture and link them. 3. Close the source. From memory, write all 10 names next to descriptions of their faces. 4. Check your	Names and people	With others	Set in the steps	Any

	score. Then wait 24 hours and test again without any preparation. 5. As a training target, aim for 9 to 10 at once. A day later, aim for 8 to 9. These targets come from training practice, and no study measured them. 6. For an advanced step, meet 5 new people this week. Use the system in real time. No practice works better than using it live.				
Spaced Repetition	3.8, Your Spaced Repetition System. Digital spaced repetition systems work out the gaps for you. 1. Download Anki (free), or make a set of physical index card flashcards. Put one fact on each card. 2. Choose 20 items you need to learn long-term (vocabulary, formulas, key facts, names, dates, processes). 3. Make a card for each. Put the question on the front	Spaced review and retrieval	App or cards	5 to 10 minutes	Advanced

and the answer on the back. Keep questions specific and testable. 4. Review the full set today. Grade each card. Use Easy (remembered at once), Good (remembered with effort), Hard (barely remembered) or Again (forgot). 5. Review again tomorrow. Anki will handle the timing of the gaps. With paper cards, split them into 5 boxes. Label them Today, Tomorrow, This Week, This Month and Archive. 6. Commit to 10 minutes of Anki review every single day for 30 days. At the end of the month, track how much you remember. 7. Set a training target for the 20 items after 30 days. Aim to remember 80 to 90% of them. It takes about 5 to 10 minutes of daily review, where cramming would take hours.

Spaced Repetition	3.8b, Paper Spaced Repetition, The Leitner Box. 1. Make 5 physical compartments (boxes, folders or sections of a binder). Label them Box 1 (Daily), Box 2 (Every 2 days) and Box 3 (Weekly). Then label Box 4 (Fortnightly) and Box 5 (Monthly). 2. Write 15 flashcards on material you are studying now. Place all new cards in Box 1. 3. Each day, review Box 1. Cards you recall correctly move to Box 2. Cards you fail stay in Box 1. 4. Review Box 2 every 2 days. Cards you recall correctly move to Box 3. Cards you fail go back to Box 1. 5. Use the same logic through all the boxes. Take a card that reaches Box 5 and is recalled correctly. It has been reviewed at growing gaps. 6. Sebastian Leitner invented this system in the 1970s, and it is	Spaced review and retrieval	Paper	Set in the steps	Advanced

	still widely used. It needs no technology. Once set up, it takes less than 10 minutes a day.				
The Story Chain	3.9, The Story Chain Challenge. 1. Use a Story Chain to memorise the 15-item list below. The list starts with Volcano, Ambassador, Saxophone, Diesel engine and Butterfly. Next come Theorem, Avalanche, Senator, Microscope and Champagne. It ends with Labyrinth, Oxygen, Telegram, Carousel, Thunderstorm. 2. Build your story aloud, speaking it as you build it. Use physical actions that change one item into the next. 3. Tell the story to yourself twice, with full detail for every sense. 4. Wait 20 minutes. Without looking, write all 15 items in order. 5. Count how many you got right. For a first try, 12 to	Stories and imagery	Plan	Set in the steps	Intermediate

	15 correct is a good target. Below 10 means your pictures are not ridiculous enough, so add more physical change. 6. For an advanced step, try the list in reverse order. Run your story 'backwards'. This tests whether your chain truly runs in one direction.				
The Story Chain	3.9b, Story Chain for Procedural Knowledge. 1. Choose a process with many steps that you need to remember. Try a procedure at work, a recipe, a scientific method or a legal process. 2. List the steps in order. 3. Build a Story Chain where each step is a character or object. Each character acts on the next one. That action should show how one step causes the next. 4. Take an example. Say step 1 is 'collect a blood sample' and step 2 is	Stories and imagery	Paper	Your choice	Intermediate

	‘centrifuge it’. A centrifuge spins a sample very fast to split it. Your story might show a vampire collecting blood. At once, the vampire is spun like a record player until the blood separates. The silly picture stores both the content and the order. 5. Write out your story. Then, from the story alone, rebuild the full procedure.				
Active Reading and the SQ4R System	3.10, SQ4R Live Application. 1. Choose any non-fiction chapter or article you need to take in this week. 2. Apply each step of SQ4R strictly, and time yourself. Do Survey (2 min) and Question (1 min). Read at your normal pace. Recite after each section (2 to 3 min per section). Then Record (brief summary) and Review (5 min). 3. Compare the time taken with your usual time. That is	Reading and study	Paper	Set in the steps	Any

	how long you spend reading the same material passively. 4. Wait 48 hours, and do not review your notes. Then write down everything you can recall from the chapter. In one study, read-recite-review beat rereading and note-taking (McDaniel et al., 2009). 5. This test lets you see the difference for yourself.				
The Memory Palace	3.11, The 50-Item Palace Master Test. 1. Choose a place you know extremely well. A large building is best. It could be your school, a workplace or a hotel you have stayed in. It needs at least 50 separate rooms, doorways or objects. 2. Map out 50 stations in a fixed route and write them down. 3. Use your palace to memorise the 50-item list. (Use the list of 50 random words at the end of this	Memory palace	On the move	Set in the steps	Advanced

exercise box below.) 4. Spend 15 minutes placing pictures. Then walk the palace in your mind twice. 5. Look away from the list. Write out all 50 items in order. Score 40 to 50 for master level and 30 to 40 for advanced. Below 30 means your pictures need to be stranger and to act on each other more. 6. Memorise this list, in order. architect, compass, serpent, ballot, mercury, curtain, glacier, oboe, covenant, hurricane; pendulum, saffron, manifesto, telescope, lantern, octopus, sovereign, archipelago, theorem, velvet; turbine, labyrinth, embassy, oxygen, caravan, locket, parliament, avalanche, sextant, mosaic; chancellor, prism,

	filibuster, cormorant, calculus, citadel, nocturne, harness, equinox, solstice; verdict, dynasty, carbon, mirage, scalpel, tributary, algorithm, eclipse, cavalry, tundra				
The Memory Palace	3.11b, The Dual-Encoding Palace. 1. Return to the Memory Palace you built for the 10 planets and dwarf planets. 2. At each station, add a second layer of information to the picture you already have. Make it one key fact about each body. Take Station 1, Mercury. Add the fact that it has the most extreme temperature swings in the solar system. Give your exploding thermometer a dial that swings wildly from fire to ice. 3. Walk the palace three times. Notice both the main picture (the planet) and the	Memory palace	Paper	Your choice	Advanced

	extra detail (the fact). 4. Test yourself. Write out the planet name AND the linked fact for each station. 5. This exercise shows what a single Memory Palace station can do. It can hold more than one piece of information at once.				
The SAVI Framework	3.12, The SAVI Encoding Session. 1. Choose 10 facts from Module 1 that you found hard to keep. 2. For each fact, use all four SAVI channels at once (steps 3 to 6). 3. Somatic. Write the fact on a card and walk around the room while reading it aloud. Or move your hands as you explain the idea to yourself. 4. Auditory. Say the fact aloud in your own words. Then exaggerate your voice. Shout it, whisper it or give it a funny accent. The change in how you say it is itself an encoding cue. 5. Visual. Make	Stories and imagery	On the move	Set in the steps	Any

	a bright mental picture for the fact. Draw a quick sketch, even a stick-figure cartoon. The act of drawing forces visual encoding. 6. Intellectual. Write one sentence linking the fact to something you already know. Try “This is similar to…”, “This contradicts my assumption that…” or “This explains why…” 7. Test yourself on all 10 facts 48 hours later. Compare the result with your score from the Module 1 Memory Baseline exercise.				
The SAVI Framework	3.12b, The Walking Lecture. 1. Pick a topic you are studying now or a presentation you need to prepare. 2. Go for a 20-minute walk. 3. During the walk, lecture the topic aloud to yourself, as if to an audience. Cover every key point. Explain all the links. Use your	Stories and imagery	On the move	Your choice	Advanced

	hands, change your tone of voice and pause to stress a point. 4. Return home and at once write down everything you covered, in order. 5. Notice how much you recall after moving, speaking aloud and pulling ideas together. Compare it with what a quiet read usually gives you. 6. For an advanced step, add new material to your ‘walking lecture’ script on later days. Give updated versions. You are building a living Memory Palace that moves with you.				
Planned Interleaving	3.13, The Interleaved Review Sprint. 1. Take three topics you are studying now (or three sets of flashcards from Module 1). 2. Do not review each set fully before moving to the next. Switch between all three on every card. Take one card from each topic in turn. Go from the	Spaced review and retrieval	With others	Set in the steps	Advanced

	first to the second to the third, and repeat the cycle... 3. Note how much harder this feels than reviewing each topic in one block. 4. Complete the full interleaved session (all cards from all three topics, in turn). 5. Return to the same cards in 48 hours, in the same interleaved format. 6. At one week, test yourself on all three topics at once. Compare your performance with a friend who studied the same material in blocks. Results vary with the material, so see what you find.				
Planned Interleaving	3.13b, The Interleaved Skill Builder. 1. Choose three types of memory technique. They are the Peg System, the Story Chain and the Method of Loci. 2. Make three separate lists of 8 items each. 3. In a single 20-minute	Spaced review and retrieval	Paper	Your choice	Advanced

	session, use each technique on its list. Switch techniques every 2 items. Do not finish one list before starting the next. 4. This forced switching makes your brain actively recall the rules of each technique. That deepens your mastery of all three at once. 5. Test yourself on all three lists the next morning. Record your scores and the points where you switched technique.

The practical module moves from a Day 1 baseline to competition-style drills, group sessions and AI-assisted practice. **The six daily drills from its table of everyday exercises are written out as rows**, beside the boxed exercises. The rows numbered G and AI need a group or an AI tool.

Table C.5: Module 4, Practical Memory Exercises

Topic	Exercise	Sub-skill	Format	Time	Level
Daily Memory Exercises	4.1, Day 1 Baseline Assessment. 1. Set a timer for 2 minutes. Study the 30 words below. piano, cloud, justice, salmon, umbrella, centenary,	Self-check and progress	Paper	Set in the steps	Any

	bronze, whistle, cathedral, parliament; asteroid, lemon, violin, democracy, eclipse, marble, hurricane, portrait, labyrinth, compass; telegraph, cinnamon, volcano, sapphire, theorem, glacier, lantern, mosaic, pendulum, meridian 2. Look away from the list. Write every word you can recall. Score yourself out of 30. 3. Save this score. At the end of Week 4, you will repeat this list with your full toolkit. 4. Record your score, the date and any notes in your Memory Journal.				
Daily Memory Exercises	4.1b, The Weekly Progress Tracker. 1. In your Memory Journal, make a tracking table. Give it six columns. Date / Exercise / Items to Memorise / Items	Self-check and progress	Log	Set in the steps	Any

Recalled / Score (%) / Notes 2. Every day for 30 days, record your result on at least one timed memory exercise. 3. At the end of each week, work out your average weekly score across all exercises. Plot these averages as a simple line graph. 4. The graph will show two things. One is your general direction, which is almost always upward with steady practice. The other is your ‘plateau zones’. These are times when scores stall and you need a new challenge. A plateau is like a landing on a staircase, flat for a while before the next steps. 5. Say a plateau lasts more than 3 days in a row. Then change the type of exercise on purpose, or make it 20% harder. Plateaus are invitations to grow. They are

	no sign of failure.				
Daily Memory Exercises	4.1c, The Sensory Encoding Sprint. 1. Write 20 random words on separate slips of paper. Shuffle them. 2. Draw one word at a time. For each, make a mental image that uses at least three senses. Choose from sight, sound, smell, touch or taste. 3. For example, take ‘LEMON’. See its yellow skin and hear the squeak as you press it. Smell the sharp citrus and feel the cold spray on your fingers. Taste the sour burst. 4. Work through all 20 words with full detail for the senses. Then set the slips aside and wait 15 minutes. 5. Recall all 20 words. Record your score. 6. Compare this score with your Day 1 baseline. Most people notice they recall more once they add sound, smell and touch. The difference is	Stories and imagery	Paper	Set in the steps	Any

	planned encoding, or getting a memory in, through many senses.				
Daily Memory Exercises	4.1d, The Dual N-Back Working Memory Builder. 1. This exercise trains working memory. It is the narrow point that limits how much you can hold in mind while learning. 2. For setup, use any free dual n-back app. Search 'dual n-back' online, as several free versions exist. Or use this simpler home version, which differs from the research task. A partner reads out letters while showing playing cards one at a time. 3. Your task is to track both streams at once. Signal when the current item matches the one from N positions ago. Start with N=2. 4. Practise for 10 minutes a day. Increase N when you reach 80%+ accuracy. 5. Jaeggi et al. (2008)	Working memory	With others	Set in the steps	Any

	published evidence in the Proceedings of the National Academy of Sciences. Its authors said dual n-back training lifted scores on reasoning tests. Bigger studies later found the gains mostly stay on n-back and tasks like it (Melby-Lervåg et al., 2016). Treat this exercise as working-memory practice. It is not a way to raise your IQ, your score on a test of how smart you are. 6. Track your highest N-value each week. Expect the gains to show mainly on this task and ones like it.				
Advanced Memory Techniques	4.2b, The 30-Digit Number Challenge. 1. Use the Major System to store the 30-digit number below as 15 two-digit images. 58 23 97 14 86 32 71 49 05 67 18 40 93 25 76 2. For each two-digit pair, use your Major System mapping. Make a vivid	Mnemonics and codes	Plan	Set in the steps	Advanced

	word or phrase. For example, 58 becomes ‘lava’ (l=5, v=8) and 23 becomes ‘name’ (n=2, m=3). 3. Place each word-image in a Memory Palace with 15 stations. 4. Wait 10 minutes. Without looking at the number, walk your palace. Write the 30-digit string from memory. 5. Aim for 100% accuracy. Any errors show which Major System conversions need more practice. 6. Extend to 50 digits this week. Reach 100 digits by the end of the month.				
Advanced Memory Techniques	4.2c, The PAO Speed Builder. 1. Make your own Person-Action-Object (PAO) table. Cover the 10 cards of a single suit (Ace through 10 of Hearts). 2. For each card, choose a Person you know well (real or fictional). Add an Action they are known for and an	Mnemonics and codes	Paper	Set in the steps	Any

Object strongly linked with them. Write these down. 3. Use these two examples as models. Ace of Hearts gives Person: Sherlock Holmes, Action: examining a clue, Object: magnifying glass; Seven of Hearts gives Person: Serena Williams, Action: smashing a serve, Object: tennis racket 4. Shuffle your 10 Hearts cards and lay them face-down. Flip them one at a time, building PAO scenes as fast as you can. 5. Practise until you can process 10 cards in under 2 minutes. Then extend to a full suit of 13. 6. For an advanced step, join three cards into a single scene. Person1 does Action2 with Object3. That packs three cards into one image. Many competitors use this technique for speed cards.

Advanced Memory Techniques	4.2d, The Binary Number Sprint. 1. Binary digits are strings of 0s and 1s. They are a standard event in the World Memory Championships. They are one of the purest tests of encoding speed. 2. Group binary digits into pairs, which are 00, 01, 10 and 11. Give each a vivid image. 00 = an egg (two zeros); 01 = a pole with a ball on top; 10 = a large 1 towering over a small 0; 11 = two soldiers standing at attention 3. Start with the 30-digit binary string below. 0 1 1 0 0 1 1 0 1 0; 1 1 0 0 1 0 1 1 0 1; 0 0 1 1 0 1 0 1 1 0 4. Group the digits into pairs. Place each image in a Memory Palace of 15 stations. 5. Wait 5 minutes. Recall the full binary string. 6. Aim for 80%+ on your first try. Extend to 60, then 100 binary digits, as your palace skill grows.	Mnemonics and codes	With others	Set in the steps	Advanced

Competition-Style Training	4.3, Speed Words, Week 1 Protocol. 1. Set a timer for 5 minutes. 2. Study the 40 words below. Use any method in Table C.4, such as a Story Chain (a story that links the items to remember, one after another) or Memory Palace. architect, sermon, canyon, covenant, diesel, aqueduct, saffron, manifesto, metronome, solstice; embassy, turbine, tapestry, verdict, tributary, algorithm, equinox, dynasty, mirage, scalpel; cavalry, cormorant, citadel, nocturne, prism, harness, calculus, comet, tundra, chancellor; filibuster, archipelago, sextant, oboe, sovereign, velvet, mercury, curtain, ballot, harpoon 3. When the timer	Speed and competition	Plan	Set in the steps	Advanced

	sounds, put the list away. Wait a full 20 minutes (no peeking). 4. Write all the words you can recall, in the order they appeared. You get 1 point per word in the correct position. You get 0.5 points per word recalled but out of order. 5. Record your score. Repeat this exercise three times a week for 4 weeks, and track your progress. 6. In Week 1, aim for 15 to 20 points. By Week 4, aim for 40 or more.				
Competition-Style Training	4.3b, Speed Words, Progressive Difficulty Programme. 1. Week 1 uses 20 words, a 3-minute study and a 15-minute recall gap. Aim for 15+ correct. 2. Week 2 uses 30 words, a 4-minute study and a 20-minute recall gap. Aim for 20+ correct. 3. Week 3 uses 40 words, a 5-minute study and a 30-minute recall gap. Aim for	Speed and competition	Plan	Your choice	Advanced

	30+ correct. 4. Week 4 uses 50 words, a 5-minute study and a 45-minute recall gap. Aim for 40+ correct. 5. After each session, find the words you missed and work out why. Was the image weak? Was the palace station crowded? Did you skip encoding one item to rush to the next? 6. Write these notes on what went wrong in your Memory Journal. Studying your mistakes and fixing what caused them is central to deliberate practice.				
Competition-Style Training	4.4, Speed Numbers, Progressive Challenge. 1. On Day 1, memorise the 20-digit number below, using chunking and the Major System. Study it for 3 minutes, and recall it after 10 minutes. 7 3 8 4 1 9 2 6 5 0; 4 7 3 1 8 5 2 9 6 4 2. On Day 3, extend to 30 digits. Add 10 new digits to your palace after the first	Speed and competition	Plan	Set in the steps	Advanced

	20. 3. On Day 7, try 50 digits. Use a palace with at least 25 stations, each holding one Major System image. 4. In each session, use the Major System to turn each digit pair into a word-image. Then place the string of images in your Memory Palace. 5. Record your longest accurate string of digits each session. Chart it weekly. 6. As a guide, 20 digits after Day 1 is good. 50 digits after Week 4 is excellent. The world's best manage over 600 digits in five minutes.				
Competition-Style Training	4.4b, The Number-Palace Integration Drill. 1. Build a 'Number Palace' just for numbers. Use a very familiar route of 50 stations, no more and no fewer. Try your morning commute, a school you attended or a long corridor you know well. 2. Each station will hold one	Memory palace	On the move	Set in the steps	Advanced

	Major System image (two digits). So your 50-station palace can hold a 100-digit number. 3. Practise loading the palace with random numbers daily. Make up a random 20-digit number. You could also use any news story's page number or reference codes. Turn it into Major System images, and place them. 4. For the recall test, wait 1 hour. Then walk the palace and rebuild the number. 5. Set a goal for the next 3 weeks. Aim to load and recall a 40-digit number with 95%+ accuracy.				
Competition-Style Training	4.5, The Historical Timeline Challenge. 1. Memorise the 20 date-event pairs below. BCE means before the Common Era, the years counted back from year 1, and CE means the years from year 1 on. Use	Speed and competition	Plan	Set in the steps	Advanced

the Date-Event Encoding System and a Timeline Palace. 776 BCE (traditional date) = First Olympic Games; 44 BCE = Assassination of Julius Caesar; 476 CE = Fall of the Western Roman Empire; 622 CE = The Hijra, which marks year 1 of the Islamic calendar; 1066 = Battle of Hastings; 1215 = Magna Carta sealed; c. 1440 = Gutenberg's printing press; 1492 = Columbus reaches the Americas; 1543 = Copernicus publishes his theory that the Earth goes round the Sun; 1687 = Newton's Principia Mathematica - 1776 = American Declaration of Independence; 1789 = French Revolution begins; 1859 = Darwin's On the Origin of Species - 1865 = 13th Amendment abolishes slavery in the

	USA - 1903 = Wright brothers' first powered flight; 1928 = Fleming discovers penicillin; 1945 = End of World War II - 1953 = Watson and Crick describe the structure of DNA - 1969 = First Moon landing; 1989 = Fall of the Berlin Wall 2. Study for 15 minutes. Walk your Timeline Palace twice in your mind. 3. Wait 1 hour. Without looking at the list, write all 20 date-event pairs from memory. 4. Score 1 point for the correct year and 1 point for the correct event. Aim for 30/40 at first. After a week of practice, aim for 38/40.				
Competition-Style Training	4.5b, Personal Timeline Palace. 1. Make a Memory Palace for the key events of your own life. You can walk this timeline of your life any time. 2. Pick 20 important moments. Think of your first day of school, first	Memory palace	Paper	Your choice	Advanced

	job and key relationships. Add achievements, setbacks, moves and decisions. 3. For each, make a vivid scene that captures both when and what. Store the when with a Major System year-image. Show the what with a strong picture of the event. 4. Place these scenes in time order through a palace that feels personal to you. Your childhood home is ideal. 5. This exercise builds your date-encoding technique. Memory of your own life is called autobiographical memory. It is closely bound up with your sense of self (Conway, 2005). Walking your own timeline may help you see your life story more clearly.				
Competition-Style Training	4.6, Abstract Symbol Encoding. 1. Draw or print 15 simple symbols. Use shapes, letter parts, random curves and	Mnemonics and codes	Paper	Set in the steps	Advanced

odd mixes. One mix is a circle with a line through it and a small square. 2. For each symbol, make up a story at once about what it could stand for. Think about what it looks like, and set aside what it is. It is like seeing animals in clouds. A circle crossed by a line could be a lollipop from above, and that could be a child at a fair. A triangle on a rectangle could be a house with a peaked roof, and that could be one person’s home. 3. Link each meaning into a Story Chain, or place each one in a Memory Palace. 4. Shuffle the symbols and wait 20 minutes. Put them back in their first order from memory. 5. The skill you are building is giving meaning at once. Aim to give any shape a memorable meaning in under 2 seconds. That target is practice, and

	the skill will likely help your other techniques too.				
Competition-Style Training	4.6b, The Symbol Alphabet. 1. Make your own Symbol Alphabet. It is a fixed set of 26 memorable images, one per letter. Choose images that are vivid, stand out in shape and mean something to you. 2. A is an ARROW, B a BEAR, C a CRESCENT MOON and D a DOOR. E is an EYE, and so on through Z. 3. Memorise your Symbol Alphabet, since it is a one-time job. Spend 2 to 3 days drilling it until every letter brings up its image at once. 4. Now use your alphabet to store information with no meaning of its own. Turn key ideas into first-letter images, and string them into scenes. You can turn any meaningless string into a vivid story. 5.	Mnemonics and codes	Paper	Set in the steps	Advanced

	Test your alphabet on 5 random 4-letter strings (like XBQM or PZLR). Store each as a Palace scene, then recall them 30 minutes later.				
Competition-Style Training	4.7, The Spoken Word Rapid Encoder. 1. Ask a partner to read 20 random words aloud, one per second. A text-to-speech app set to a 1-second gap works too. 2. As each word is spoken, make a vivid image at once. Place it at a station in a Memory Palace. You have just 1 second before the next word comes. 3. After the last word, wait 5 minutes in silence. 4. Write all 20 words in order from memory. 5. In week 1, aim for 12+ words correct. In week 4, aim for 18+. 6. The one-second limit makes you trust your first idea. Stopping to think slows you down. This exercise trains quick choices	Speed and competition	With others	Set in the steps	Advanced

	as much as memory.				
Competition-Style Training	4.7b, The Meeting Recall Protocol. 1. In your next meeting, lecture or talk, take no notes for the first 15 minutes. 2. Instead, store the spoken words as they come. Give each key point a vivid image. Place it in a Memory Palace built from the room you are sitting in. 3. After 15 minutes, pause and write down everything you stored. Write the key ideas in order. The exact words do not count here. 4. Compare your list with any notes others took. See how complete and well ordered your recall is. 5. Slowly make the no-notes time longer. Go for 15 minutes in week 1 and 30 in week 2. In week 3, go for the full meeting. 6. By week 4, aim to rebuild a 1-hour meeting's key content from memory. A personal	Work and talks	Paper	Set in the steps	Advanced

	target is 70 to 80% of it.				
Group Memory Training	G-1, The Relay Palace. 1. You need 2 to 4 people and 20 to 30 minutes. 2. Choose a Memory Palace place that everyone can picture. Try a shared office, a school or a building you all know. 3. Person A stores the first 5 items from a 20-word list. They place them at stations 1 to 5 of the palace. Then they describe each image to Person B. 4. Person B stores and places items 6 to 10. They describe them to Person C, or back to the first person. Keep going until all 20 items are placed. 5. Pick one person at random. They must recall the whole list in order without help. 6. Talk it over afterwards. Where did the handovers give the weakest recall? Whose image descriptions stuck best, and why? What	Memory palace	With others	Set in the steps	Advanced

	helped an image pass from one mind to another?				
Group Memory Training	G-2, The Teaching Chain. 1. You need 2 to 6 people and 30 to 45 minutes. 2. Each person studies a different part of some material on their own for 15 minutes. That might be one chapter each, or one module each of a course. 3. Each person then teaches their part to the group from memory, with no notes. The group may ask questions. 4. After every part has been taught, test everyone on all of the material. 5. Score each person's test on its own. You will probably score best on the part you taught. That shows the teaching effect at work. 6. Swap parts in the next session. In time, everyone teaches every part.	Explaining and teaching	With others	Set in the steps	Expert
Group Memory Training	G-3, Speed Round Recall Duel. 1. You need 2 people	Speed and competition	With others	Set in the steps	Any

	and 10 to 15 minutes. 2. Both of you study the same 20-item list for 90 seconds. Make sure you cannot see each other’s lists during recall. 3. On “go”, you both write your recall lists at the same time, on your own. 4. Compare your lists. An item on both lists scores 2 points. An item on just one list scores 1 point. An item that you both missed scores 0. 5. Add up the joint score. Items on both lists were the easiest to remember. Items on just one list show different ways of storing. 6. Afterwards, talk it through. Compare how you each stored the items.				
Group Memory Training	G-4, The Socratic Memory Drill. 1. You need 2 people and 20 minutes. 2. Person A studies some material for 10 minutes with any technique. It could be a chapter, a set of vocabulary	Explaining and teaching	With others	Set in the steps	Any

	or a process. 3. Person B then asks Person A questions for 10 minutes, and never makes statements. Try “What does that connect to?” or “Why does that matter?” Then try “What would happen if you removed that step?” Also ask “How does that relate to what you told me earlier?” 4. Person A must answer from memory. Person B’s job is to find the edges of what Person A knows. 5. Swap roles. The questioner learns as much as the one who answers. Good questions need deep understanding too. 6. Write down every question that caused a pause or a mistake. Those become the focus of your next solo study session.				
Group Memory Training	G-5, Memory Palace Construction Party. 1. You need 2 to 4 people and 45 to 60 minutes.	Memory palace	With others	Set in the steps	Advanced

	2. Together, choose a real place you all know as the Palace. A school corridor, a shared flat or an office floor works well. 3. Together, set out 20 stations in order through the place. Everyone must agree on the order and the landmarks. 4. One person reads out the items to store. Everyone makes their own image for each item at each station. 5. Each person describes their image for each station to the group. The group votes for the best image. It becomes the “official” image for that station. 6. One week later, meet again and test each other on the palace. Compare the group’s score with each person’s solo score.				
Group Memory Training	G-6, The Error Auction. 1. You need 2 to 6 people and 20 to 30 minutes. 2. After any group recall exercise, each	Updating and flexibility	With others	Set in the steps	Expert

	person lists the items they forgot or got wrong. 3. Pool these “error items” and auction them. Each person bids pretend points on the items they can explain. The top bidder then teaches that item to the group. They explain why it is memorable and show the technique they will now use. 4. Ten minutes later, everyone re-tests on the auctioned items. 5. Aim for near-perfect recall of the taught items in the re-test. Aim for good recall a week later. 6. Track the auction items across sessions. Mistakes that keep coming back show weak spots in how you store things. Give them extra work.				
Group Memory Training	G-7, The Cumulative Story. 1. You need 3 to 8 people and 15 to 20 minutes. 2. One person draws a card from a shuffled deck of memory	Stories and imagery	With others	Set in the steps	Any

	prompt cards. A random word generator works too. They say one sentence that includes that item. 3. The next person must repeat the first sentence word for word. Then they add their own sentence with the next item. 4. Keep going round the circle. Each person must recall and repeat all the sentences before adding their own. 5. When someone makes a mistake, the whole group rebuilds the correct order. Then you go on. 6. The person who adds the 20th item without a mistake wins. But the real measure is the group's total number of mistakes. Track this across sessions.				
Group Memory Training	G-8, Blind Palace Navigation. 1. You need 2 people and 30 minutes. 2. Person A describes to Person B a Memory	Memory palace	With others	Set in the steps	Advanced

	Palace they built on their own. They go room by room, station by station and image by image. They give as much detail as they can. 3. Person B asks questions to make things clear. They build their own version of the palace in their mind, from the description alone. 4. Then test Person B on the items in Person A's palace. Person B finds the way using only the description they heard. 5. Count how many items Person B recalled from A's description alone. This shows how clearly and richly A put the palace into words. 6. Swap roles. Compare your scores to see whose palace was easier to pass on.				
Group Memory Training	G-9, The 48-Hour Challenge. 1. You need 2 people, and the exercise runs over 4 days. 2. On Day 1, you both study the same	Speed and competition	With others	48 hours	Any

	30-item list on your own. Use any techniques from Modules 3 and 4. 3. Neither of you tests yourself or reviews the list. On Day 3, at the 48-hour mark, you each write your recall list. 4. Compare your lists. For items you both recalled, talk about the ways of storing you shared. For items only one of you recalled, that person explains their technique for that item. 5. Use the borrowed techniques on the items you missed. Test again 24 hours later, on Day 4. 6. You now have three points to compare. They are Day 1 storing, Day 3 recall and the Day 4 re-test. Together, they show which of your methods work best for you.				
Group Memory Training	G-10, The Collective 30-Day Scoreboard. 1. You need 2 to 10 people and 5 minutes a day for 30 days. 2. Each	Self-check and progress	With others	30 days	Any

person works through the 30-Day Memory Training Programme in Table A.3. Go at your own pace. 3. Each day, everyone reports their daily scores in a shared place. That could be a group chat, a spreadsheet or a noticeboard. Scores must include items recalled, time taken and technique used. 4. Each week, the group picks the one technique that scored best across everyone. That becomes the “technique of the week”, and everyone adds it to their practice. 5. On Day 30, compare how much each person improved. The person who improved most by percentage gets a group cheer. But the group’s average score is the main measure. 6. Look back together. Whoever’s technique report lifted others’ scores

	most is the group's best memory coach.				
Group Memory Training	G-11, The Interference Championship. 1. You need 4 to 8 people and 30 to 40 minutes. 2. The group agrees on a 20-item list to memorise. 3. Before studying, each person picks their "interference weapon". It might be counting, a second word list or a string of mental sums. Any other hard task works too. 4. You get 2 minutes to memorise the list. At the same time, each person does their chosen interference task to make storing harder. 5. Write out the full list from memory. Score it out of 20. 6. The person with the highest score explains their technique to the group. That becomes the group's target technique for the next week. 7. Change	Speed and competition	With others	Set in the steps	Any

	“interference weapons” each session, so you practise against all the main kinds of distraction.				
AI-Assisted Memory Training	AI-1, The Infinite Word List Generator. 1. Open a chat with your AI. Say, “Make a list of [N] random words. Take them from many different topics, with no two from the same topic. I will study for [X] minutes, then recall the list. Do not show me the list again until I finish recalling.” 2. Study the list with your favourite technique for the agreed time. 3. Recall the list to the AI, out loud or in writing. Ask it to score you. Ask which kinds of words you missed most often. 4. Ask the AI, “Next time, add more of the word kinds I found hard. Use fewer from kinds I recalled perfectly.” 5. Run 3 to 5 rounds each session. The AI keeps fitting	AI tools	With an AI tool	Your choice	Any

	each list to how you did. 6. At the end, ask the AI for a summary. Say, “Which word types did I find hard today? What storing method do you suggest for each?”				
AI-Assisted Memory Training	AI-2, The Socratic Memory Examiner. 1. Study some material for 20 minutes with your usual techniques. It could be a chapter, a set of facts or a module you are studying. 2. Open your AI and say, “I have just studied [topic]. Please test me with only questions, never statements. Find the edges of what I know. Start easy and get harder. Do not accept vague answers.” 3. Answer every question from memory only. Do not look at your notes. 4. When you cannot answer, say “I don’t know.” Ask the AI to note it and come back to it later. 5. After 20 minutes, ask,	AI tools	With an AI tool	Set in the steps	Advanced

	“Please list my knowledge gaps, from most to least important. Then make 10 flashcards for the top gaps.” 6. Study the AI’s flashcards. Repeat the questioning in 48 hours.				
AI-Assisted Memory Training	AI-3, The Adaptive Difficulty Ladder. 1. Tell your AI, “I want to train my digit span. Start with 7 digits. If I recall them correctly, add 1 digit. If I fail, take 1 away. Keep going for 20 rounds.” 2. In voice mode, have the AI read the digits aloud, one per second. In a typed chat, the digits stay on screen. Cover the screen after a set time. Close your eyes, repeat the digits in your head, then type your answer. 3. After 20 rounds, ask the AI to show your results. Say, “Show my string length at each round. Work out my average steady span.” 4. Run the	AI tools	With an AI tool	Your choice	Any

	same steps with random letters and with mixed letters and digits. Also try word strings, and digit strings you must recall backwards. 5. Track your best span across four weeks. Your span on this task will grow with practice. Do not expect it to help with unrelated tasks (Melby-Lervåg & Hulme, 2013). The gain mostly stays with what you trained.					
AI-Assisted Memory Training	AI-4, The Memory Palace Architect. 1. Tell your AI, “I want to store [topic or list] in a Memory Palace. I will describe my palace as I build it, one image at a time. After each image, rate how vivid, clear and memorable it is, from 1 to 10. Then suggest one improvement.” 2. Start storing out loud. Say, “Station 1 is my front door. The first item, [word],	Memory palace	With an AI tool	Set in the steps	Advanced	

	becomes [image]. It is [description].” 3. The AI rates each image and suggests ways to boost it. It might add details for the senses, make actions bigger or link to stronger feelings. 4. When the palace is done, ask, “Which three stations will I forget, and why? How can I make them stronger?” 5. Test yourself 24 hours later. Tell the AI your results. See which weak stations it guessed correctly. 6. Across sessions, track how often the AI guesses right. Keep your own notes on its guesses, because the chatbot may not remember past sessions.				
AI-Assisted Memory Training	AI-5, The Roleplay Encoding Session. 1. Choose a subject you are studying now, such as medicine, law, a language or history. Tell your AI, “I want to memorise	AI tools	With an AI tool	Your choice	Advanced

	[material] through roleplay. You will be [a character from that subject]. Try a senior surgeon, a judge or a native Spanish speaker. I am your student. Teach me the material, test me in character and make me explain every answer. Stay in character." 2. Work with the material fully inside the roleplay. The AI brings in the facts as part of the scene. Then it quizzes you on them. 3. When you get something wrong, ask for a memorable story or memory trick, in character. 4. After the session, step out of the role. Say, "Exit roleplay. List everything you tested me on, and how I did on each." 5. Study the items you got wrong in the roleplay, with your usual Memory Palace technique.				
AI-Assisted	AI-6, The Spaced Repetition	Spaced review and retrieval	With an AI tool	Set in the steps	Advanced

Memory Training	Session Designer. 1. After any big storing session, paste your full list of studied items into your AI. Say, “I have just stored these items. Make me a personal review plan for the next 30 days. Assume I know none of them yet. Make daily review lists. Space the reviews out, for example after 1, 3, 7, 14 and 30 days.” 2. Ask the AI to set this out as a day-by-day calendar you can follow. 3. Each day, do your review and tell the AI your results. Say, “Day [N] review: I recalled [X] of [Y] items. I missed [list the items].” 4. The AI updates the plan. Items you recalled move to the next gap. Items you missed come back the next day. 5. On Day 30, ask the AI for a report. Ask for the percentage kept across all items and the items that need more

	work. Also ask for a suggested plan for Month 2.				
AI-Assisted Memory Training	AI-7, The Generation Effect Drill. 1. Tell your AI, “I want to practise the generation effect. Give me the first half of a fact, a word pair or a definition. I will come up with the second half from memory or by working it out. Do not finish the item until I have tried.” 2. The AI gives you prompts, such as “The capital of ___”. Another is “The mitochondria is the ___ of the cell”. Another might be “Ebbinghaus found that memory follows a ___ curve.” 3. You finish each item. The AI confirms or corrects it. 4. For items you got wrong, ask for help. Say, “Give me a 2-sentence story that connects [prompt] to [correct answer].” 5. After 20 items, ask the AI to re-test only the	AI tools	With an AI tool	Your choice	Any

	items you got wrong. Use the stories as hints first, then go without hints. 6. Track how often you get items right across sessions. A personal target is to go from 50% to 70% or more over two weeks.					
AI-Assisted Memory Training	AI-8, The AI Cross-Examiner. 1. Prepare a 5-minute talk on any topic you want to master. Give it from memory, with no notes. 2. Give it out loud while the AI “listens”. Type or speak your talk to it. 3. Ask the AI, “Question me closely. Find every fact I stated. For each one, ask a follow-up question. Test whether I really understand it or am just repeating it. Be strict.” 4. Answer each question from memory. 5. When you cannot answer, say, “I don’t know. Give me the answer in a form I can store as a palace image.” The AI makes	AI tools	With an AI tool	Set in the steps	Advanced	

	a memorable picture for that gap. 6. Give the 5-minute talk again 48 hours later. Ask the AI to compare the two talks. It should note what you added, what you lost and what you corrected.				
AI-Assisted Memory Training	AI-9, The Dual Coding Generator. 1. Choose 20 ideas you are studying that you cannot see or touch. Try psychology terms, economic rules or ideas from philosophy. 2. For each idea, ask the AI for a picture. Say, “Give me one clear picture for [idea] to use in my palace. Make it vivid and a bit silly. It must show what the idea means, and its name alone is not enough.” 3. For each picture the AI gives, also make your own image. Store it in your palace. Compare the AI’s picture with yours, and keep whichever is more memorable. 4.	Stories and imagery	With an AI tool	Set in the steps	Advanced

	When all 20 items are stored, ask the AI, “Now test me. Name an idea, and I will describe my image. Tell me whether my image fits the idea or is misleading.” 5. Fix any misleading images before they settle into your palace. 6. Run a recall test after 48 hours. For the items you recalled correctly, ask the AI for new, harder questions. They check that you understand the ideas deeply.				
AI-Assisted Memory Training	AI-10, The 30-Session AI Training Log. 1. At the start of every AI session, open a chat and paste this prompt. “I am on session [N] of my 30-session AI memory training log. My starting recall score was [X]/30. My last session score was [Y]/30. Today I want to focus on [technique or subject]. Please plan a 20-minute training	Self-check and progress	With an AI tool	Your choice	Any

	session at [difficulty level].” 2. The AI plans a full session. It has a warm-up, a main drill and a challenge round. A calm review comes at the end. 3. After each session, tell the AI your scores. Ask it to update your progress story. Say, “Sum up my progress in 3 sentences, using what I told you today.” 4. At sessions 10, 20 and 30, ask the AI to look back over everything. Ask for your score trends and technique gains. Ask what to focus on next. 5. At session 30, compare your score with your Day 1 score from row 4.1. Ask the AI to write one paragraph about how you have grown. 6. Save the session 30 report in your Memory Journal. It is a lasting record of your AI training progress.				
AI-Assisted	AI-11, The Narrative Memory	Stories and imagery	With an AI tool	Your choice	Intermediate

Memory Training	Builder. 1. Choose 15 items you need to memorise. Share them with your AI. 2. Ask, “Put all 15 items into one story of about 200 words. Make it silly and full of feeling. Give each item a real part in the plot, more than a passing mention. Keep the items in the order I need to recall them.” 3. Read the story three times. Picture it as a film in your mind. 4. Close your eyes and replay the story in your head. When this goes smoothly, recall the 15 items in order without the story. 5. Ask the AI for a second, completely different story for the same 15 items. Study both and compare them. Which story makes recall easier, and why? 6. Spotting what makes some stories work better builds your own feel for storing with stories. I think it is a strong

	memory technique that people use too little.				
Why Memory Training Fails, and How to Succeed Where Many People Don’t	4.8, The Palace Vividness Audit. 1. Choose a palace you built more than 7 days ago. Walk through it without any help. 2. Rate each station’s image from 1 (a vague blur) to 5 (clear, vivid and moving). 3. For any station rated 3 or below, store the image again, using bizarre, motion, emotion. 4. Test again at 24 hours and at 7 days. Anything still below 4 needs a completely different image. 5. Record your average vividness score. Aim for 4.2 or above across all stations. 6. Repeat this check for every palace you use, once a month.	Self-check and progress	Paper	Set in the steps	Advanced
Why Memory Training Fails, and How to Succeed	4.8b, The Deck Health Audit. 1. Open your spaced repetition app. Count your	Spaced review and retrieval	App or cards	Set in the steps	Advanced

Where Many People Don't	total cards, today's due cards and cards added this week. 2. If daily reviews go above 100, stop adding new cards. Wait until they fall back below 100. 3. Review 20 cards at random. For each one, note yes or no. Did you try to recall it before looking? 4. If you tried first on under 18 of 20, change your review habit now. Cover the answer, try to recall it, then show it. 5. Look at your newest 10 cards. Each one should hold a single fact. Split any card that holds two or more. 6. Work out how many of the last 7 days you reviewed. Aim for 7 out of 7. The lowest you should accept is 5 out of 7.				
Why Memory Training Fails, and How to Succeed Where Many People Don't	4.8c, The Weekly Failure Mode Scan. 1. Every Sunday, take 5 minutes to look over your practice log from the past week. 2. Score each of the 10 failure modes from 0	Self-check and progress	Plan	Set in the steps	Advanced

	to 2. Give 0 if it is not there and 1 if it is mild. Give 2 if it is serious. 3. Add up your score. Any single score of 2 needs action before your next session. 4. A total of 8 or more means the problems run through your whole routine. Make your practice simpler. Your daily session should be easy enough for hard days. 5. Write one clear fix for each mode you scored 1 or 2. Make it a specific action, never a vague plan. For example, “Tomorrow’s palace session will use bizarre, motion, emotion for every image.” 6. Score yourself again after one week, and track the trend. Aim for a weekly score below 3.				
Why Memory Training Fails, and How to Succeed Where Many	4.8d, The 21-Day Recommitment Protocol (for Returning Trainees). 1. After more than 7 days off, do not	Self-check and progress	Plan	21 days	Advanced

People Don't	restart at your old level. 2. On days 1 to 3, do one 5-minute palace review a day, and nothing else. Rebuild the habit before the skill. 3. On days 4 to 7, add one spaced repetition session (10 minutes). Still add no new material. 4. On days 8 to 14, practise daily at 70% of your old level. 5. On days 15 to 21, go back to full practice. Add one new technique if you feel ready. 6. Work out which failure mode caused your break. Write it down. Build one specific guard against it. 7. Take new starting scores. Skills you have built usually come back faster than they took to learn (Murre & Dros, 2015). Ebbinghaus called this "savings".				
Daily Memory Exercises	Number Memorisation. Each day, try to memorise a number that is a little longer than the day before. Start at	Mnemonics and codes	Paper	3 minutes	Intermediate

	10 digits. Aim for 20+ by week 4. Use your peg system or chunking. Trains chunking; number encoding; spatial encoding.				
Daily Memory Exercises	Word List Recall. Write 15 random words. Study for 2 minutes using bright images. Recall after 10 minutes. Track your score daily. Trains episodic memory; vocabulary encoding; association.	Stories and imagery	Paper	4 minutes	Any
Daily Memory Exercises	Name & Face Practice. Look up 5 new historical figures online. Learn their name and one key fact by making a strong picture that links them. Trains memory for people; making links; reading faces.	Names and people	Paper	3 minutes	Any
Daily Memory Exercises	Backwards Review. At day's end, tell yourself your day in reverse order in your head, from now back to waking up. Notice what you cannot recall. Trains	Spaced review and retrieval	Paper	2 minutes	Any

	getting memories back; self-testing; finding gaps.				
Daily Memory Exercises	Spaced Flashcard Drill. Use Anki or paper flashcards to review what you learned before. Keep to the spaced repetition gaps. Trains keeping things long-term; pulling facts back out.	Spaced review and retrieval	App or cards	5 minutes	Advanced
Daily Memory Exercises	Mind Palace Maintenance. Walk through a Memory Palace you already have and check that every picture is still bright and in place. Replace any that have faded. Trains memory for places; tidy long-term storage.	Memory palace	Paper	3 minutes	Advanced

The context module carries the methods into study, languages, talks, meetings and client work. **Most rows here are built around one real task**, such as an exam, a talk or a meeting, so pick the one that matches your week.

Table C.6: Module 5, Memory in Context

Topic	Exercise	Sub-skill	Format	Time	Level
Memory and Learning	5.1, Spaced Repetition Schedule. 1. Choose 20 key	Spaced review and retrieval	App or cards	Set in the steps	Advanced

	facts from the first module that you want to keep. 2. Write them on flashcards, or enter them into Anki, a flashcard app that uses spaced repetition. 3. Review all 20 today. Mark each one as easy, medium or hard. 4. Review easy cards in 7 days, medium ones in 3 days and hard ones tomorrow. 5. Repeat after each review. Change the gaps based on how well you remembered each card. 6. After 4 weeks, test yourself with no hints. Note what percentage you recall. Compare it with what you kept the last time you crammed.				
Memory and Learning	5.2, The Interleaved Subject Review. 1. Take three different subjects or topics you are studying now. 2. Make 10 flashcards for each subject, so you have 30 cards in total. 3. Do not review one	Spaced review and retrieval	With others	Set in the steps	Advanced

subject’s cards as a block. Shuffle all 30 cards together and review them in a fully random order. 4. Mark each card as Easy, Good or Hard. Notice how much harder it feels to switch between subjects than to stay on one. 5. Repeat this mixed review every 3 days for 2 weeks. 6. At the two-week mark, test yourself on all three subjects cold. That means no warm-up and no looking at your cards first. Compare with a classmate or colleague who studied one subject at a time. 7. In one study, people looked at paintings by different artists. Some saw the artists mixed together, and some saw one artist at a time. Later, the mixed group named the artist of unseen paintings more often. Yet most of them thought seeing one artist at a

	time had helped more (Kornell & Bjork, 2008). Trust the result over the feeling of ease.				
Memory and Learning	5.3, The Pre-Test Protocol. 1. Before you study a new topic or chapter, test yourself on it first. 2. Read the headings and write down everything you already know or can guess. Try to answer any questions at the start of the chapter. 3. You will get most answers wrong, and that is fine. This step gets your memory ready to learn. 4. Now study the material in your normal way. 5. A wrong guess before studying still makes the right answer easier to learn (Kornell et al., 2009). Scientists call this the pretesting effect. Mistakes you felt sure about are fixed especially well once you see the answer. That second	Spaced review and retrieval	Paper	Your choice	Any

	finding is called the hypercorrection effect (Butterfield & Metcalfe, 2001). 6. Make this a normal part of how you study. Pre-test every chapter before you read it. Expect your scores to improve within two weeks.				
Memory and Learning	5.4, The Retrieval Practice Marathon. 1. At the end of each study session, close all your materials. On a blank sheet, write down everything you can remember from that session. 2. Do not organise it, and do not make it neat. Write whatever comes, such as facts, ideas, names, examples and links between them. 3. Set a timer for 10 minutes. Keep writing until the timer goes off. 4. Only after the 10-minute recall should you go back to your materials. Check them for gaps. 5. Circle anything in your notes	Spaced review and retrieval	Paper	Set in the steps	Any

	that you missed in your recall. These gaps are what you study first next time. 6. Repeat this at the start of your next session, before any new study. Do a fresh 5-minute recall of the last session's material. Recalling at the start is one of the best ways to make memories stick.				
Memory and Learning	5.5, The Exam Preparation Accelerator. 1. Choose an upcoming exam, certificate or knowledge test you are working toward. If you have none, choose any subject you want to master within 60 days. 2. Find the 30 most important ideas in the material. These are the basic ideas, key terms, main differences and core processes. 3. Make one Anki card for each idea. Put a test question on the front, like what the hippocampus	Spaced review and retrieval	App or cards	Set in the steps	Advanced

	does in memory. Write a, exact answer in your own words on the back. 4. Do not copy text straight from your sources. Your own words make you link the answer to what you know. So you are learning while you build your review system. 5. Run your first full review session. Sort each card honestly. Then follow the spaced gaps carefully for 3 weeks. 6. In the last week before your exam, review every card daily, whatever its gap. This makes sure everything is fresh on the day.				
Memory and Learning	5.6, The Interleaved Subject Mixer. 1. Take your Anki deck or flashcard set and split it into three subject groups. For example, use the book's ideas, its techniques and its exercises. 2. Do not review each group as a block. Shuffle all	Spaced review and retrieval	With others	Your choice	Advanced

	three groups together, so cards from different subjects come up in random order. 3. This mixed review feels harder and less useful while you do it. Keep going anyway. 4. After one week of mixed review, test yourself on all three subjects at once. Use fresh questions. 5. Compare your results with a starting score from studying one subject at a time. In the paintings study, mixing worked clearly better. Yet most people felt it had worked worse (Kornell & Bjork, 2008). 6. Record your results. Mixing feels harder yet works better. That gap is the main finding of mixing research. Seeing it in your own scores makes it hard to forget.				
Memory and Learning	5.7, The Teaching Protocol, Learn by Teaching. 1. Find someone who is happy	Explaining and teaching	With others	Set in the steps	Expert

to be “taught” a topic for 15 minutes. It could be a friend, colleague, family member or study partner. 2. Choose any section from Modules 1 to 4 that you want to make stick. Prepare nothing written, and teach it all from memory. 3. Give a 15-minute explanation of the topic. Ask your “student” to ask questions, especially ones that show your gaps. 4. After the session, go back to the material. Find every point where you paused, stayed vague or could not answer a question. These are your storing gaps. 5. Study only those gaps again. Then teach the same topic again 48 hours later, with no preparation. 6. In one study, some students expected to teach a text, and others expected a test. The

	future teachers recalled more of it. Their recall was also more complete and better organised (Nestojko et al., 2014). Expecting to teach changed how they studied.				
Memory and Learning	5.8, The Connection Web. 1. Choose an idea from your current studies or work. 2. Write it in the middle of a blank page. 3. Draw five branches. Label them causes, effects, real-world examples, links to other ideas and why it matters. 4. Keep branching for 10 minutes. You are building a web of links. 5. The fuller this web, the more paths you create back to the memory. You are building your own memory on purpose.	Thinking and creativity	Paper	Set in the steps	Any
Memory and Learning	5.9, The Analogy Builder. 1. Choose an idea that feels hard to picture, remember or	Thinking and creativity	Log	Your choice	Any

understand. It can come from this programme, your studies or your work. 2. Write it at the top of a page. Below it, complete the sentence “This is like… because…”. 3. Come up with at least five different analogies for the same idea. Pick each from cooking, sport, buildings, nature, friendships, machines, music or another area. They do not all need to be good. Aim for many first and good ones second. 4. For each analogy, write 2 to 3 sentences. Say which parts of the analogy match which parts of the idea. Then say where the analogy breaks down. 5. Finding where an analogy breaks down forces you to understand the idea in fine detail. That detailed understanding is what makes the memory last and work in new places.

	6. Now explain the idea using only one of your analogies, with no technical words. If your explanation is clear, you have stored it deeply. If it falls apart, you have found a gap. 7. Pick the analogy that feels most natural and easy to remember. That is your main hook for this idea. 8. Test yourself one week later. First recall the best analogy, then rebuild the idea from it. The analogy works like a key that opens the whole memory.				
Memory and Learning	5.10, The Five Whys Encoding Drill. 1. Choose a fact, rule or piece of information you need to remember. 2. Ask “Why is this true?” and write the answer. 3. Ask “Why?” again, this time about the answer you just wrote. Write the new answer. 4. Repeat until you have asked “Why?” five times. By	Thinking and creativity	Paper	Your choice	Any

	the fifth answer, you should reach a basic rule that explains the first fact. 5. Now recall the first fact by working backwards from that basic rule. 6. Facts learned through a chain of reasons last far longer than facts learned alone. They also come back more easily in new situations. This is how elaborative encoding works.				
Memory and Learning	5.11, The Concept Map Sprint. 1. Set a timer for 8 minutes. On a blank sheet, map one chapter or module you studied recently. 2. Every point on the map must connect to at least one other point. Give each link a label. Use words like causes, allows, goes against, is an example of or leads to. 3. When the timer goes off, count your points and links. A chapter you	Chunking and organising	Paper	Set in the steps	Any

	know well should give 15+ points and 20+ links. 4. Now cover your map and draw it again from memory on a new sheet. Compare the two. Every missing point or link is a gap in your picture of the topic. 5. Repeat once a week for any module you are studying. Track how your maps fill up over time. That growth shows your skill growing.				
Memory and Learning	5.12, The Concept Map Hierarchy. 1. Choose a broad topic, such as “The Neuroscience of Memory”, “Project Management” or “Contract Law”. 2. On a blank sheet, draw three levels. Put the topic at the top and 4 to 6 main themes in the middle. Below each theme, add the facts or examples that belong to it. 3. Use arrows to show what causes what and how ideas follow from each other.	Chunking and organising	App or cards	Set in the steps	Advanced

	Say an arrow runs from “amygdala” to “emotional memory” with the label “amplifies”. It tells you more than a plain branch. 4. Put the map away. 24 hours later, draw it again fully from memory on a blank sheet. 5. Compare the two maps. Every missing point and arrow is a gap in your storing. Add those gaps to your Anki deck. 6. This exercise mixes mind mapping, sorting by levels and recall practice in one task. That makes it very useful for hard subjects.				
Memory and Learning	5.13, The Question-First Study Session. 1. Before your next study session, spend 5 minutes writing questions about the material. Use the headings, what you half know and what you wonder about. 2. Write at least 10 questions. They become your reading plan. 3. Study	Reading and study	Paper	Set in the steps	Any

	the material with the goal of answering each question. Make notes only when you find a direct answer. 4. After studying, close the material and answer each question from memory. Write the answers out in full. 5. Check your answers. Go back to the text only for questions you could not answer. 6. Writing questions first helps in much the same way as pretesting. You read with a purpose, hunting for answers. A related finding is the generation effect. Words you make up yourself are remembered better than words you only read (Slamecka and Graf, 1978).				
Memory in Different Fields	5.14, The Academic Study Blueprint. 1. Choose a subject you are studying for an exam or qualification. 2. Follow the full plan below for one week. 3.	Reading and study	App or cards	1 week	Advanced

Day 1. Look over the whole topic. Build a concept map of every key area. Pick the 20 most important facts, definitions or principles. 4. Day 2. Make Anki flashcards for all 20 items, and do your first review. Pre-test yourself on any new chapters. 5. Day 3. Do a recall session. Close all your materials and write everything you know about the topic for 10 minutes. Find the gaps, and study only those. 6. Day 4. Review your flashcards mixed together. Add 10 new items. Teach one idea out loud to a pretend student. 7. Day 5. Review the Day 2 cards again. Answer practice exam questions against the clock. Recall without notes. 8. Day 6. Link the new material to what you already know. Update your

	concept map. Do a free recall session. 9. Day 7. Test yourself on everything so far, and score it. Next week, focus on your lowest-scoring areas.				
Memory in Different Fields	5.15, The Language Learning Immersion System. 1. Choose a language you are learning or want to learn. This system works for complete beginners and for advanced learners. 2. Build your word base. Make Anki flashcards for 10 new words a day, using the keyword method. For each word, make a bright image of something that sounds like it. Review all your cards daily. That is more than 3,000 new cards in a year. 3. Learn grammar through stories. For each new grammar rule, make up a short story or sentence that shows it. Memorise the example sentence, and	Languages	App or cards	Set in the steps	Advanced

	skip learning the rule on its own. The example becomes the rule. 4. Soak in the language. Every day, spend 15 minutes on real audio, video or text in the language. Pick material just above your level. Before each session, choose 3 words or grammar points to listen for. 5. Practise speaking or writing. Once a week, write or say a short paragraph. Use only words and grammar you learned recently. Recording yourself and playing it back helps a lot. 6. Track three things. Count the words you learn each week and the grammar you can use. Also note how much real material you understand. These numbers show you what to work on next.				
Memory in Different Fields	5.16, The Presentation Palace. 1. Choose a presentation,	Memory palace	Paper	Set in the steps	Advanced

talk or speech you need to give from memory. 2. Break it into 5 to 10 key sections. For example, start with an opening hook, the background and points 1 to 3. Then add a case study, answers to objections, a call to action and a close. 3. Build a Memory Palace with one station for each section. At each station, place a bright image that brings up that section's main message. The image stands for the idea, and you do not need the exact words. 4. Your opening and closing lines matter most, so learn their exact wording. Use the Story Chain technique, where a story links the items to remember, one after another. Place each key phrase at a smaller station inside the opening and closing spots. 5. Rehearse by

	walking through your palace in your mind three times, without speaking. Then give the whole talk out loud once. 6. Give it again 24 hours later, with no rehearsal in between. Notice whether the second run feels smoother after a night's sleep. 7. Set yourself a goal. Give a long talk from memory, with less preparation than notes would need. With the palace, you pull the talk out of memory. You do not recite it word for word.				
Memory in Different Fields	5.17, The Client Intelligence System. 1. Before any important meeting, client call or networking event, make a short mental file. Make one for each person you will meet. 2. Store 5 facts about each person in a small palace of their own. Use their office, or somewhere their name	Names and people	Paper	Set in the steps	Advanced

	makes you think of. Store their role or title and something they care about at work. Add something personal they shared and the last thing you talked about. Finish with anything still to follow up. 3. Turn each fact into a bright image. Link it to the person's face or to a feature that stands out. 4. Before the meeting, walk through their palace in your mind for 30 seconds. 5. After the meeting, add any new facts while they are fresh. The file grows into a living record that deepens with every meeting. 6. When you recall what someone told you, they can tell you were paying attention. Most people appreciate that.				
Applied Memory	5.18, The Pre-Exam Memory Architecture. 1. Six weeks before a big exam, make a Subject Map. This is one	Reading and study	App or cards	Set in the steps	Advanced

page that shows the whole course. Break it into 5 to 8 main themes. Put 4 to 6 key ideas under each one. 2. Turn each key idea into an Anki flashcard. Anki is a free flashcard app that spaces your reviews. Aim for 80 to 120 cards per subject. Put a clear question on the front. On the back, write your answer in your own words and one real example. 3. Do 20 minutes of Anki every day. In weeks 1 and 2, work on new cards. In weeks 3 and 4, mix new cards with reviews. In weeks 5 and 6, focus on reviewing all your cards. 4. Once a week, take a closed-book quiz. From memory, write the 10 most important points from each theme. Mark yourself honestly. Your mistakes show which cards need a stronger image or link. 5. In the last 3 days before the

	exam, add nothing new. Review your whole deck and read your Subject Map. Then walk a Memory Palace that holds the 20 facts you most need. 6. On exam day, walk your palace in your mind for 90 seconds. Do this before you write anything. This brings the shape of what you know back to mind.				
Applied Memory	5.19, The Active Recall Loop. 1. Straight after a lecture, class or reading session, set a timer for 10 minutes. 2. Do not look at your notes. Write down everything you can remember from the session, in any order. This is called free recall. Include ideas, names, links, examples and any questions it raised. Write in full sentences, not bullet points. 3. When you run out, check your notes. Add anything you missed in a different	Spaced review and retrieval	With others	Set in the steps	Any

	colour. The new colour shows you at a glance what you forgot. 4. Recalling before you review makes you search your memory. That search helps the facts stick. In one study, students read a passage. Then they either tested themselves on it or read it again. A week later, the testing group recalled 61% and the rereading group recalled 40% (Roediger & Karpicke, 2006). 5. Do the same free recall again 24 hours later, and again after a week. In the same study, rereading did a little better on a test five minutes later. Testing won after two days and after a week (Roediger & Karpicke, 2006).				
Applied Memory	5.20, The 30-Word Language Sprint. 1. Choose a language you are learning, studied before or would like to	Languages	App or cards	Set in the steps	Advanced

start. If you are starting fresh, Spanish, French or Italian are good choices for English speakers. Many of their words look like English words. 2. Pick 30 common words from a frequency list. If you have no list, use these 30 words. water, house, person, day, time, hand, eye, way, child, woman; man, thing, work, life, place, year, door, food, tree, road; fire, city, night, name, word, letter, book, voice, stone, heart 3. Use the Keyword Method on all 30 words. Find a sound-alike, make a vivid image and write a sentence. 4. Put all 30 into Anki or onto paper cards. Study for 20 minutes, testing yourself as you go. 5. Test yourself by writing the meaning of each word from memory. Aim for 25 or more right on

	your first try. Aim for 30 out of 30 after 3 days of Anki review. 6. This exercise sets the rhythm and the method for your language learning. Protect the daily Anki review habit you start here above all.				
Applied Memory	5.21, The Grammar Scaffold. 1. Grammar rules are often learned as plain lists, and lists are easy to forget. Try turning each rule into a story or a picture instead. 2. Choose 5 grammar rules in the new language that you often get wrong. These could be verb endings, gender, tenses or irregular forms. 3. For each rule, make up a vivid character who acts out the rule. In Spanish, ser and estar both mean to be. Ser is a stern teacher who only talks about lasting facts. Estar is a restless artist who only talks about states	Languages	App or cards	Your choice	Advanced

	that change. 4. When you use either verb, call up the character for a moment. The story helps you choose the right form as you go. This is a rule of thumb with exceptions, such as estar muerto (to be dead). 5. Test yourself by writing 5 sentences for each rule from memory. Then check them against a grammar book. Fix any mistakes in your Anki deck.				
Applied Memory	5.22, The 5-Minute Talk from Memory. 1. Choose any topic you know fairly well. It could be your job, a hobby or a topic from this book. 2. Pick 5 key points you want to make. These are your 5 palace stops. 3. Build a Memory Palace with 5 stops on a fixed route. Your home works well. At each stop, place a vivid image for that point. 4. Walk your 5-stop palace twice in	Work and talks	On the move	5 minutes	Advanced

	your mind. Then give the talk out loud to yourself, walking the palace as you speak. 5. Record yourself on your phone and play it back. Did you cover all 5 points? Did you move from point to point smoothly? Where did you pause? 6. Make the image stronger at any stop where you paused. Give the talk again 24 hours later, with no new preparation. Notice how well the palace holds the order after a day.				
Applied Memory	5.23, The Impromptu Speech Palace. 1. This exercise trains a useful work skill. You learn to speak clearly on a topic with no warning. 2. Ask a partner to give you a random topic. Take 60 seconds to build a 3-stop palace for it before you speak. 3. Stop 1 holds the key meaning or background. Stop 2 holds	Memory palace	With others	Set in the steps	Advanced

	the most important result or example. Stop 3 holds your conclusion or advice. 4. Give a 2-minute talk using your 3-stop palace. Your partner times you and notes any big gaps or repeats. 5. Practise every day with new topics. Within 2 weeks, aim to cut your planning time from 60 seconds to 20 seconds. Within 4 weeks, aim for the 3-stop shape to come to mind by itself. 6. Next level: move to a 5-stop palace for 5-minute talks with no preparation. This helps you stay calm when someone suddenly asks you to speak.				
Applied Memory	5.24, The Meeting Memory System. 1. When a meeting starts, use the room itself as a Memory Palace. The door holds agenda item 1. The agenda is the list of topics for the	Work and talks	With others	Set in the steps	Advanced

meeting. The window holds item 2, the whiteboard holds item 3, and so on. 2. As each item is discussed, turn its key decision or action into a vivid image. Place it at that item’s spot. Say the team agrees to push the deadline back two weeks. Picture a calendar with legs running away from the door. 3. When you meet someone new, use the Name-Face System at once. It links a person’s name to a picture tied to a feature of their face. 4. After the meeting, do not look at any notes yet. Spend 5 minutes walking the room palace in your mind. Write down every key point and decision you stored. 5. Check what you recalled against the official minutes, the written record of what the meeting decided. Track how much you got right over

	4 weeks. 6. Over time, you will need your notes less to know what was decided. That makes follow-up faster. Still keep written minutes of decisions and actions. Your memory backs up the official record, but it does not replace it.				
Applied Memory	5.25, The Client Memory File. 1. For each important client, colleague or partner, make a character profile in your mind. Build it from vivid images. 2. Store their name with a name-face image. Add their role, their top priorities at work and how they like to communicate. Add any personal details they have shared, such as family, interests and key dates. Add the key history of your work together. 3. Store this profile in its own Memory Palace room. Picture the client's office, or a place you	Names and people	With others	Set in the steps	Advanced

	link with them. 4. Before any meeting with that person, spend 2 minutes walking their palace room. This brings their details back to mind before you walk in. 5. After each meeting, update the room. Walk through it and add any new details to the scene. Over time, the room becomes a full and up-to-date record of the relationship. 6. If you also write any of these details down, keep them safe. Follow your employer's rules on personal data.				
Applied Memory	5.26, The Idea Capture System. 1. Start a First Landing habit. Within 30 seconds of having an interesting idea, write it down or record it. That could be in a talk, while reading or on a walk. Use whatever is fastest. A voice memo, a phone note or a pocket notebook you	Work and talks	Paper	Set in the steps	Advanced

carry all work. 2. At the end of each day, spend 10 minutes going through what you caught. Read each idea and add one sentence about where it came from. Then tag it with a project name, a theme or a question. 3. Once a week, read the ideas you caught that week. Look for links between them. Two ideas from different days may connect in a way you did not expect. That link can be the seed of your next big piece of work. 4. Build a Creative Palace. This is a Memory Palace for your most important ideas. Give each big project its own room. When a new idea links to a project, walk that room in your mind. Store the new idea as an image at a free spot in that room. 5. Once a month, walk your Creative Palace. Notice which ideas have grown,

	which have stalled and which have joined with others. This monthly walk works like a weekly progress check on a work project.				
Applied Memory	5.27, The Reference Retention Protocol. 1. Some books, films, talks or shows spark your creative work. Afterwards, spend 15 minutes storing their key ideas. Use the five steps below. 2. Pick the 3 main ideas from the work that struck you most. Write one sentence for each. 3. Make a vivid scene for each idea. The image should hold the heart of the idea, not its exact words. 4. Put these 3 images in a Reference Palace room set aside for that work. Name the room after the title. 5. Store the source itself. Include the author's name and the year, and why it mattered to	Work and talks	App or cards	Set in the steps	Advanced

	you. A name-face image can help with the name. 6. Add an Anki card that asks, “What are the 3 key ideas from [title]?” Put your 3 sentences on the back.				
Applied Memory	5.28, The Relationship Memory Practice. 1. After an important conversation, spend 5 minutes writing conversation notes. It might be a first meeting, a talk with a friend or a work chat. Keep the notes in one notebook or app. 2. Write down the person’s name and what they shared about themselves. Add any problems they mentioned and any promises you made. Add anything they said that surprised or moved you. 3. Move the most important points into a People Palace. This is a Memory Palace where each person you care about has their own room. Fill the	Names and people	With others	Set in the steps	Advanced

	room with images for what you know about them. 4. Before you see this person again, walk their room for 2 minutes. Let the details come back to mind. 5. In your next conversation, mention something they told you before. Notice how this changes the talk and how they respond to you. 6. Practise this with 5 people over the next month. Notice what changes in those relationships.				
Applied Memory	5.29, The Conversation Detail Challenge. 1. Have your next 5 conversations, at home or at work. Quietly decide to remember 3 details from each. Pick something personal they shared and something they said they care about. Also pick one thing they are dealing with or looking forward to. 2. After each conversation,	Names and people	Plan	Set in the steps	Advanced

	write these 3 details in your notes. Do this before anything else. 3. Within 48 hours, store them in that person's room in your People Palace. 4. When you next see each person, bring up one detail in a natural way. One is enough, and more is fine. It might be a day later or a month later. Bring it up because you want to hear more, not to show off your memory. 5. Track how many details you remembered before you checked your notes. After 4 weeks of practice, aim for 8 to 10 of the 15 details. Try to do it without your notes.				
Applied Memory Masterclass	5.30, The Body Palace. 1. Use your own body as a Memory Palace with 12 stops. Work from the top down. skull, eyes and ears, throat, chest (lungs), chest (heart), upper belly (liver and stomach); lower belly	Memory palace	Paper	Your choice	Advanced

(gut), hips, upper arms, lower arms, upper legs, lower legs 2. Use this Body Palace to learn these 12 body systems and their main jobs. Nervous: sends electrical signals. Cardiovascular: moves blood around the body. Respiratory: swaps gases in the lungs. Digestive: takes in food. Endocrine: controls hormones. Immune: fights germs. Musculoskeletal: gives movement and shape. Integumentary: skin and body heat. Renal: filters blood and balances fluid. Reproductive: making babies. Lymphatic: moves fluid and immune cells. Sensory: senses the world. 3. For each system, place a vivid scene at its body stop. Put the nervous system at the skull. Picture a lightning storm inside a glass dome. Put the

	cardiovascular system at the heart. Picture a red river pumping through endless tunnels. 4. Recall all 12 systems and their jobs from memory. Then add one key fact for each system, as a second image at each stop.				
Applied Memory Masterclass	5.31, The Procedure Chain. 1. Choose a task with many steps from your work or study. It could be a lab method, a surgical checklist or a legal process. It could also be a money audit or a safety routine. For real clinical or safety work, the written checklist comes first. 2. List every step in the right order. If a step has smaller steps, list those too. 3. Build a Story Chain. Turn each step into a character, whose action shows what the step is. Each character's action must set up the next	Stories and imagery	Paper	Set in the steps	Intermediate

	one. 4. Tell the whole Story Chain out loud. Then write down the full task from the story alone. 5. Practise until you can rebuild the whole task from memory in 90 seconds or less. 6. Test yourself under pressure. Ask someone to stop you halfway through, and then carry on. If your recall falls apart when you are stopped, keep practising until it holds.				
Applied Memory Masterclass	5.32, Keyword Method in Practice. 1. Choose 15 words from a language you are learning or want to learn. If you have no language on the go, use these Spanish words. perro (dog), libro (book), ciudad (city), agua (water), tiempo (time or weather); trabajo (work), casa (house), gente (people), vida (life), noche (night); amor (love), mano (hand), ojo (eye), boca (mouth), cabeza (head)	Mnemonics and codes	With others	Set in the steps	Intermediate

2. For each word, find an English word that sounds or looks like it. Perro sounds like “pear-o”, so picture a pear with a dog’s face. Libro looks like library, so picture a book in a library. 3. Make a vivid scene that joins the sound-alike image to the meaning. Picture the pear with a dog’s face, barking in a park. 4. Review all 15 using the scene images. Test yourself both ways, from English to Spanish and from Spanish to English. 5. Come back in 24 hours and test yourself again, with no review first. Aim for at least 13 out of 15. 6. In the classic study, students learned 120 Russian words. The keyword group got 72% right on the final test. A comparison group got 46% (Atkinson & Raugh, 1975). An early review found that the

	method helps people learn new words in a dependable way (Pressley et al., 1982).				
Applied Memory Masterclass	5.33, Grammar Palace. 1. Choose the three grammar rules you find most confusing in a language you are learning. 2. For each rule, write a story sentence that shows the rule at work. Make it so striking that it brings back the rule every time you recall it. 3. Build a Grammar Palace with one stop for each rule. At each stop, place the story sentence as a vivid scene. 4. For each rule, also store one wrong example with a wild result. For example, a character uses the wrong tense and lands in the wrong century. 5. Test yourself by translating 10 new sentences that need these rules. Check which rules you used correctly and	Memory palace	Paper	Your choice	Advanced

	which still trip you up.				
Applied Memory Masterclass	5.34, The 30-Day Vocabulary Sprint. 1. Learn 10 new words a day in your new language for 30 days. That makes 300 words. It is a good start for a traveller and a firm base for further study. 2. Each day, make Keyword Method images for all 10 words, which takes about 5 minutes. Add them to Anki, the flashcard app, in about 5 minutes. Then spend about 10 minutes on any older cards due that day. 3. Twice a week, use as many new words as you can. Write a paragraph or talk out loud to yourself. Using words yourself is harder than recognising them. It shows which ones you really know. 4. On Day 30, test yourself on all 300 words with no review first. Count any score above 240, which is 80%, as a	Languages	App or cards	30 days	Advanced

	strong pass. 5. After Day 30, drop to 5 new words a day. Keep up your Anki reviews. Your vocabulary keeps growing, and your review time stays easy to handle.				
Applied Memory Masterclass	5.35, The 5-Minute Memory Talk. 1. Prepare a 5-minute talk on a subject you know well. Try your job, a hobby, a country you know or a book. 2. Use the Five-Layer Speech Architecture. Make a 5-stop Memory Palace and learn a doorway phrase for each section. Find one story for each point, and note any numbers or quotes. Learn your opening and closing lines word for word. 3. Give the talk alone, twice in the same day. Use a mirror or record it on your phone. Notice where you pause, because those are the gaps in what you stored. 4. 24	Work and talks	Paper	5 minutes	Advanced

	hours later, give the talk again with no practice in between. This tests whether it has settled in your memory. 5. The next week, stretch the talk to 10 minutes. Then try 20 minutes. By the end of the month, aim for a smooth 20-minute talk from memory.				
Applied Memory Masterclass	5.36, The Impromptu Structure Framework. 1. At work, you are often asked to speak with no warning. It might be a question in a meeting or an interview, or a toast. This framework gives you a ready outline for those moments. It is another option, next to the 3-stop palace in Exercise 5.23. 2. Learn PREP as a 4-stop Memory Palace. PREP is a widely used outline for short answers. Stop 1, Point: state your main view in one sentence. Stop 2, Reason: give the main reason it is	Work and talks	Paper	Set in the steps	Advanced

	true. Stop 3, Evidence: offer a real example, a number or a story. Stop 4, Point: state your main view again. 3. Practise PREP for 2 minutes every day. Pick a random topic. Try an object in the room, a headline word or an idea from this book. Give a 60 to 90 second answer using all four stops. 4. Keep practising daily for two weeks. Aim for the outline to come to mind by itself under pressure. 5. The framework shrinks the question you face. You stop asking “What do I say?” You only need to ask, “What is my point?” That leaves more of your attention for speaking clearly, eye contact and reading the room.				
Applied Memory Masterclass	5.37, The Idea Capture and Palace System. 1. Set up an Idea Capture Palace with 20 stops. Most palaces hold things in order. This one	Memory palace	App or cards	Set in the steps	Advanced

stores surprising, inspiring or useful ideas from daily life. 2. Put each idea you want to keep at the next free stop in the palace. Use the most vivid image you can make on the spot. This should take less than 10 seconds. 3. At the end of each day, spend 5 minutes walking your Idea Palace. Write the day's ideas down in a notebook, an app or a project file. 4. Each week, read through your written ideas and look for links between them. Two ideas from different days may make something new side by side. Links like these are the raw material of original work. 5. Keep up this practice as a creative habit. Trust your system to catch ideas, and you may find that more of them come.				
5.38, The Associative Expansion	Thinking and creativity	Paper	Set in the steps	Any

Applied Memory Masterclass	Exercise. 1. Take any single word, image or idea. It can come from your work, a book, a talk or a random word. 2. Set a timer for 5 minutes. Write down every link that the word brings to mind, without judging any of them. Follow each link to the next one, and let the links branch freely. 3. When the timer goes off, look over your map of links. Circle every link that surprises you. Also circle any that joins two unlikely things. 4. Choose the most surprising link and spend 2 minutes exploring it. Ask what it would mean, how you could use it and what follows from it. 5. Practise this daily. One theory says creative thinking mixes ideas that are far apart (Mednick, 1962). This exercise trains you to look for those far links.

Applied Memory Masterclass	5.39, The Reference Library Palace. 1. Creative people gather huge stores of reference material. These can be examples, case studies, quotes, images, technical fixes and past cases. Much of it can be hard to find again when you need it. 2. Choose 10 reference examples from your field that you want to have on hand. They could be pieces of design work or good ad campaigns. They could also be first lines from novels or clever engineering fixes. 3. Build a Reference Library Palace, based on a library or gallery you know well. Give each section of it one kind of reference. 4. For each item, make a vivid scene in its section of the library. The scene should show its key quality, what	Memory palace	Paper	Set in the steps	Advanced

	makes it stand out and why. 5. Practise recalling references when you need them. Take any creative brief or problem. A creative brief is a short note that sets out a creative job. Try to recall 3 useful examples from your palace within 30 seconds.				
Applied Memory Masterclass	5.40, The Team Intelligence Palace. 1. Build a Memory Palace with one stop for each person on your team. You could also use your department or your key work contacts. For a team of 10, use 10 stops in a room you know. For a bigger group, use a whole building. 2. At each person's stop, build a layered scene. Store their name with the Name-Face System in row 3.7. Find a feature that stands out, turn the name into a picture and link them. Add their main role and their	Memory palace	With others	Your choice	Advanced

	key job. Add their latest work or project. Add one thing they care about outside work, and one open item between you. 3. Walk this palace at the start of each week. Update it after any important talk. 4. Before a review, a team meeting or a one-to-one talk, walk the stops you need. This brings your recall up to speed. 5. Use what you recall to ask good follow-up questions. In studies of chats and speed dates, people who asked more questions were liked more (Huang et al., 2017). The full version of this method for single clients is Exercise 5.25.				
Applied Memory Masterclass	5.41, The Decision History Archive. 1. Each time you make a major decision, make a short Decision Record straight away. This works at work or in life. Store it in a Memory	Work and talks	Paper	Your choice	Advanced

Palace kept for key decisions. 2. For each decision, store four things. Store what was decided and why. Store which other options you turned down, and why. Store what you expected to happen at the time, and what you assumed. 3. Use vivid scenes. Show the decision as an image that holds its heart. Show the reasons as the physical cause of that image. 4. Six months later, walk your Decision Archive. Compare what really happened with what you expected. Writing your forecast down first is important. Once people know the outcome, they tend to think it was easy to predict (Fischhoff, 1975). This is called hindsight bias. 5. Keep up this record over time. It shows you your own patterns. It also helps you explain your

	reasons clearly to others.				
Applied Memory Masterclass	5.42, The Strategic Framework Palace. 1. Pick 5 planning models or thinking tools that matter most in your field. Examples include Porter’s Five Forces, SWOT and the Eisenhower Matrix. SWOT stands for strengths, weaknesses, opportunities and threats. First principles thinking is another example. Others are the OODA Loop, the BCG Matrix, systems thinking and scenario planning. 2. Build a Frameworks Palace with one stop for each model. At each stop, store the model’s name and its core logic in one sentence. Add what it is mainly used for. Then add one vivid real example of it working well. 3. Practise using each model on a current	Memory palace	Paper	Your choice	Advanced

	problem or decision. Recall the model from memory, with no sheet. 4. Think of two sailors. One checks the map at every turn. The other knows the waters by heart. Under pressure, you are most likely to use the models you carry in memory.				

Module 6 links memory to the other pillars, extracting meaning, creating and reasoning. **Each of these rows starts by saying whether you work alone or with others and how long it takes**, and the last two run as a weekly session and a two-week project.

Table C.7: Module 6, Memory as an Amplifier

Topic	Exercise	Sub-skill	Format	Time	Level
Memory as the Engine of Extractivity	6.1, The Schema-First Reading Protocol. You do this alone. Each session takes 30 to 45 minutes. Use it for any new book, paper or long document. It is close to the Question-First Study Session (Exercise 5.13). 1. Before you open the text, spend 3 minutes recalling what you know about the	Reading and study	Paper	30 to 45 minutes	Any

topic. Write down everything you know, every related idea and every question you have. This is your schema pre-load. It gets your stored knowledge ready to sort new facts as you read. 2. Skim the text first. Look at the contents, headings and diagrams. Read the first and last sentences of key sections. Your goal is not to understand it yet. Your goal is to see its structure and where the new parts fit. 3. Read actively. Treat the text as a conversation with what you already know. Mark three kinds of content in different ways. Put a tick by what you already knew. Put a plus by what adds to it. Put an X by what goes against it. Give the most attention to the pluses and the Xs. 4. After each main

	section, stop and write a one-paragraph summary from memory, without looking back. If you cannot write it, the section did not reach your memory. Read it again and try once more. 5. When you finish the text, rebuild its whole argument from memory, using only your marks. The parts you cannot rebuild did not turn into lasting memory. Those are the parts to study again. 6. One week later, recall the text's argument from memory, without your notes. Check how much you kept. Over 10 sessions, track whether your scores rise as your pre-load gets richer.				
Memory as the Engine of Extractivity	6.2, The Chunking Elevation Drill. You do this alone. It takes 20 minutes. You need a text you have read recently. 1. Take a text you read in the past week. From memory, write a one-	Chunking and organising	Paper	20 minutes	Intermediate

sentence summary of the whole text. 2. Now write a 5-sentence summary of the whole text, from memory. 3. Now rebuild the text's three to five main arguments, each in one sentence. 4. Now pick the single most important argument. It is the one that all the others follow from or depend on. State it in one sentence. 5. Finally, write one word or a phrase that sums up what the text adds. This is the highest-level chunk. 6. Compare your rebuild at each level with the actual text. Where does your memory hold the structure well? Where does it fall apart, flatten or twist? Those weak points show where your reading stayed on the surface. 7. Repeat this drill every week for 6 weeks, on different texts. Track which levels get

	better fastest. That shows your current limit and the level to work on next.				
Memory as the Engine of Extractivity	6.3, The Active Listening Memory Build. You can do this alone or in a group. It takes 20 minutes. Use it for lectures, podcasts and conversations. 1. At the start of a talk, podcast or meeting, set one goal. Plan to find the three most important things said in the next 20 minutes. Write three empty slots in your notebook before you start. 2. Listen actively. Keep asking yourself whether what you hear is one of the three. You are not trying to store everything. You are trying to catch the points that matter most. 3. Halfway through, pause if you can. Write down what you have caught so far. Do not replay anything, and rebuild it from memory instead. The	Thinking and creativity	With others	20 minutes	Any

	effort of rebuilding helps you store it. 4. At the end, write the three most important points from the whole session. Do not look at your notes. Compare your halfway list with your final list. Did your choices change as you learned more? That change shows how well you update what matters as the talk goes on. 5. 24 hours later, write what you remember of the three main points. Use nothing to help you. Score yourself. Over 20 sessions, compare these scores with sessions where you listened with no goal.				
Memory as the Raw Material of Creativity	6.4, The Cross-Domain Collision. You do this alone. It takes 15 minutes. It works best at the start of a creative work session. 1. Open your Memory Journal, your notebook of what you stored in past sessions, with	Thinking and creativity	Paper	15 minutes	Any

an entry for each session, at two random pages from different fields. For example, pick one session where you stored a historical event. Pick another where you stored a science idea. 2. Set a 5-minute timer. Write down every way the two entries are alike in structure. They are about different topics, so ignore the topic. Do they share a similar pattern of cause and effect? Do they share a pull between two forces, or a way of being resolved? Do they share a similar network of parts? 3. For each shared structure, make a new idea in the field you work in now. Use the same structure. The structure from one field is your template, and your current field supplies the content. 4. Rate each new idea for surprise and

	for use. Surprise asks how unexpected the link is. Use asks how helpful or interesting the idea is. The best ideas score high on both. 5. Over 10 sessions, track which kinds of collision give you your highest-scoring ideas. This shows your own collision profile. It tells you which pairs of fields work best for you. 6. Advanced version: on purpose, store new knowledge in fields far from your own. That widens the ground you can draw on for collisions.				
Memory as the Raw Material of Creativity	6.5, The Memory Palace Story Engine. You do this alone. It takes 20 minutes. It works best for creative writing, design or problem-solving. 1. Choose a creative problem you are working on now. It could be a story, a	Memory palace	Paper	20 minutes	Advanced

product design, a message or a plan. 2. Walk the Memory Palace you use most. At each stop, ask how its image links to your problem. Do not force a link. Simply note whether one comes up by itself, and what it suggests. 3. The stops that give you links are your creative resonance points. Write down every link they suggest, however thin or silly. 4. Now pick the three most surprising links. These are the ones furthest from the obvious ways into the problem. For each, write one paragraph on how the problem looks from that angle. 5. Weigh up the three angles. Which one shows a side of the problem that your usual approach misses? That is your creative way in. Memory found it, not

	deliberate reasoning. 6. Come back to this exercise after 48 hours, with sleep in between. In one study, people worked on a task with a hidden shortcut (Wagner et al., 2004). More than twice as many of those who slept found it. Sleep helped only those who had worked on the task first.				
Memory as the Raw Material of Creativity	6.6, The Analogical Transfer Drill. You do this alone. It takes 30 minutes. It works best with a real problem you need to solve. 1. Write your current problem or creative challenge at the top of a page. 2. In your Memory Journal, find 5 problems solved in a way you find elegant. They can come from any field. Try science, history, nature, maths, business, art or your own life. Write one sentence on each solution and why it is	Thinking and creativity	Log	30 minutes	Any

elegant. 3. For each solution, pull out its structural logic. Focus on how it solved the problem, not what it solved. What was the core mechanism, and what was the principle behind it? State it in the most general terms you can, with no field-specific words. 4. Now apply each general logic to your current problem. Say the core mechanism is X, and your problem has a similar structure. Ask what a solution might look like in your field. 5. You are not looking for a figure of speech. You are looking for a real transfer of structure. Your solution might share its structure with one from a very different field. 6. Rate each transfer for how specific it is. A vague one, like “evolution, but for business”, scores 1. A concrete one you can act on scores 5. Take

	competitive exclusion in ecology, where one species wins a shared, limited resource. You might find the one limited resource in your market. Then focus everything on winning it. 7. Repeat this drill over many sessions. An analogy is seeing that two things from different fields work in the same way. People often fail to use an analogy from a single example. Comparing two similar examples helps them find the shared principle (Gick & Holyoak, 1983). Then they can use it on a new problem. So, for each transfer, try to find two elegant solutions that share it.				
Memory as the Foundation of Intellect	6.7, The Premise Audit. You do this alone. It takes 20 minutes. Use it when you prepare for any important decision or analysis. 1.	Thinking and creativity	Paper	20 minutes	Any

Write down the conclusion you are leaning toward. It might be a judgement, a decision or a belief. State it as clearly as you can. Put it in a way that could be shown wrong.
2. List every premise your conclusion depends on. A premise is a statement that must be true for the conclusion to follow. Work backwards. Say to yourself, “For my conclusion to be right, I must be assuming that…” Then keep adding “and also that…”. The first few premises come quickly. Finding the rest takes steady effort.
3. For each premise, ask where in your memory it came from. Is it from your own experience, or from a single source? Is it from a model you built years ago and never checked again? Is it from someone

	you trusted without checking? 4. Rate each premise in two ways. First, give your confidence from 0 to 100%. Second, note when you last saw evidence for it. Some fields change quickly. There, watch for a firm premise you have not checked in a long time. That is a risk point. 5. Take the premise with the lowest confidence, or the one checked longest ago. Spend 10 minutes testing it. Look for evidence against it and other ways to read it. Recall cases where it failed. 6. Revise your conclusion in light of the full audit. Often the conclusion stays the same. Still, you can now state it more clearly and honestly. Sometimes it changes a great deal.				
Memory as the Foundation of Intellect	6.8, The Causal Chain Builder. You do this alone. It takes 25	Thinking and creativity	Paper	25 minutes	Any

minutes. It works best for making sense of complex systems or situations. 1. Choose something you want to understand. It could be a market trend or a result in your own life. It could be a historical event, a body process or a pattern in society. 2. Write it in the centre of a page. Now work backwards through its causes. What caused it directly? Write 2 to 3 direct causes. For each one, ask what caused that, and write those causes down. Keep going for 4 to 5 levels. 3. At each level, ask yourself a question. Is this from real memory of checked facts? Or am I filling the gap with a guess that sounds right? Mark each link M, for memory, or A, for assumed. 4. Find the longest run of A links in a row. That is

	your blind spot in this analysis. There, you are reasoning without the knowledge you need about how the causes work. 5. For that run of A links, spend 10 minutes building the missing knowledge. Look up how the causes really work, using reliable sources. Store what you find on purpose. Then go back to the chain and replace guesses with knowledge. 6. Do this over 10 sessions on different topics. Each time, count the M and A links you start with. As you learn more about causes in your field, aim for more M links.				
Memory as the Foundation of Intellect	6.9, The Strongest Counterargument Protocol. You can do this alone or with a partner. It takes 20 minutes. Use it before any important decision or message. 1. State your current position on an	Thinking and creativity	With others	20 minutes	Any

important question. It could be about work, ideas or your own life. Write it as clearly and precisely as you can. 2. Search your memory on purpose for arguments against it. What has happened to you that your position does not explain well? What cases do you know where the opposite was true? What do you know from other fields that goes against what your position assumes? 3. Come up with the three strongest counterarguments you can build. Draw on your memory as much as you can. Rate each one from 1 to 5 for strength. Ask how much evidence from your memory really supports it. 4. For the strongest counterargument, write the best answer you can. Your answer must rest on specific memories,

	such as facts, cases, causes and evidence. Simply repeating your position does not count. 5. Perhaps you cannot answer the strongest counterargument with specific evidence. Then your position is weaker than you thought. Write that down plainly. Either research the counter-evidence and store it, or change your position. 6. This works for work decisions and personal choices as well as for ideas. Any important decision gains from facing the strongest counterargument that you can build.				
Integration Exercises	6.10, The Full Cognitive Cycle. You do this alone. It takes 60 minutes. Make it a weekly session. 1. Extraction, 15 minutes. Read one hard text in a field that is important to your work. Use the Schema-First Reading Protocol, Exercise 6.1. First load what	Thinking and creativity	Paper	60 minutes	Advanced

you already know. Mark what is new and what you knew. Then rebuild each part from memory. 2. Memory, 5 minutes. From memory, sum up the text at three levels. Write one sentence, then one paragraph, then the core argument. Name the one new schema you gained that adds to what you already knew. 3. Creative links, 15 minutes. With the new schema in mind, run the Cross-Domain Collision, Exercise 6.4. Ask what it links to in your Memory Palace. Find 5 links to knowledge in other fields that are not obvious. Rate each one for surprise and for use. 4. Testing, 15 minutes. Take the top-rated link from step 3. Run the Premise Audit, Exercise 6.7, on it. Ask what the link depends on, and whether

	that is really true. Ask what would have to be shown for the link to be useful in practice. 5. Storing, 10 minutes. Add what this cycle produced to your Memory Palace as a new station. Make one vivid image for three things. Show the new schema and its most surprising link. Also show the key condition the link depends on. 6. Journal. Write one sentence on what this cycle gave you. Pick something you needed all four stages to get. Over time, these entries show what the full loop adds beyond any one pillar.				
Integration Exercises	6.11, The Knowledge Synthesis Project. You do this alone. It is a project that runs for 2 weeks. 1. Choose a complex question, ideally one tied to your work or your learning. It should need knowledge from several	Thinking and creativity	Paper	2 weeks	Advanced

fields to answer well. 2. Week 1 is for reading and building memory. Find 5 good sources from at least 3 different fields that bear on the question. Use the Schema-First Reading Protocol on each one. Build a Memory Palace just for this question. After each source, add new stations for what you learned from it. 3. Also in week 1, run the Causal Chain Builder, Exercise 6.8, twice. Do it once at the start, when your knowledge is thin. Do it again at the end of the week, once you know far more. Compare the two chains. This is a personal before-and-after check. It is no controlled test. Still, it shows you how your own chains changed as your knowledge

grew. 4. Week 2, creative linking and building your case. Walk your Memory Palace on purpose, looking for new ideas. Run the Cross-Domain Collision across its stations. Look for links in structure across the five sources. Ask what combined view is possible that no single source tried. 5. Final piece. Write a 500-word synthesis, a piece that combines ideas from all five sources. It should go beyond any one of them. Defend its main argument against the two strongest counterarguments your memory can now supply. 6. Review. Ask whether you could have written this piece at the start of week 1. If not, that gap gives a rough, personal sense of the project's gain.

The integration module builds whole systems for a term of study, a job, a language, law, medicine, a business and a reading life. **The first seven rows build one system each**, and the last four tie Anki and the memory palace into one personal system.

Table C.8: Module 7, Transfer to Real Life, Complete Integration Systems

Topic	Exercise	Sub-skill	Format	Time	Level
The Seven Context Blueprints	7.1, The Semester Memory Architecture Build. 1. Map your term. List every subject, every main topic and each exam date. 2. For each subject, choose 1 place for a memory palace. Build a 10-station palace this week. 3. Make a separate Anki deck for each subject. Add 10 cards today. Add no more than 15 new cards a day per deck. The Anki manual gives a rough guide. At 15 new cards a day, expect about 150 reviews a day per deck. 4. Set one fixed time each week for a full palace walk. Keep it apart from your Anki sessions. 5. From week 4 on, put one practice past	Reading and study	App or cards	Your choice	Advanced

	paper in your calendar every two weeks. 6. Four weeks before your first exam, start the pre-exam routine from the workflow table (Table C.8a). 7. After the exam, check where you went wrong. Turn each wrong or weak answer into 5 new palace stations and 10 new Anki cards.				
The Seven Context Blueprints	7.2, The Professional Memory System Setup. 1. List your 10 most important work relationships. Make a Client Intelligence File for each one. Include their name and role, their key priorities, and the last 3 things you discussed. Add what they care about most. Store these files safely, following your employer's data rules and any data-protection law that applies. 2. Choose a place for your strategic framework palace. This week, store	Work and talks	App or cards	Set in the steps	Advanced

	the 5 business frameworks you use most as 5 separate stations. 3. Build one Anki deck for your field. Start with 20 cards on core terms and facts you often have to look up. 4. After your next meeting, spend 5 minutes recalling it from memory before you write notes. Note what you missed. 5. Start your Decision History Archive. Write down the last 3 big decisions you made, with your reasons and the other options you weighed. 6. Block 20 minutes in your calendar every Friday to keep the system up to date.				
The Seven Context Blueprints	7.3, The Language Memory Architecture Build. 1. Choose your first Vocabulary Palace, a room you know well. Give each wall and large object one topic, such as kitchen items, travel, feelings	Languages	App or cards	Your choice	Advanced

or work. 2. Take your top 50 target words. Make Keyword Method images for the 20 you find hardest. Add all 50 to Anki as sentence cards. 3. Build your Grammar Palace in your front hallway, with one door for each tense. Place the rule and an example at the door handle. Place the exception at the door frame. 4. Set your daily Anki limit at 15 new cards at most. Keep to it, as steady work beats volume. At 5 new words a day, reaching the B2 range takes about 2 years. Cambridge B2 learners (B2 is an upper-middle level of skill in a language) in one study knew about 3,250 to 3,750 words (Milton, 2010). That counts only the 5,000 most common English words. 5. Choose graded input at the right level. It should feel slightly hard,

	but you should know nearly all the words. Reading research puts the bar at 95 to 98% of words known (Laufer & Ravenhorst-Kalovski, 2010). Make it a fixed daily slot. 6. Every Friday, walk your Vocabulary Palace. If a word does not come at once, rebuild its image.				
The Seven Context Blueprints	7.4, The Legal Knowledge Architecture Build. 1. Choose one area of law you are studying now. List every case you need to know, aiming for 20 to 30. At 5 minutes each, that is 100 to 150 minutes of storing. 2. Build a Case Law Palace, with one room for each area of law and one piece of furniture for each case. Turn the case name into an image on the object. Put the principle in the object’s action. 3. Make 1 Anki card per case. On the front, write “What does [case	Work and talks	App or cards	Set in the steps	Advanced

	name] establish?" On the back, give the principle in one clear sentence. One idea per card keeps cards easy to learn (Wozniak, 1999). 4. Take your most complex statute section and build a Statute Palace. Use one room, with one section on each wall. The key words become the object on that wall. 5. Choose the most important legal argument in your current topic. Write it as a story. The start is the rule, and the middle is the leading case. The turn is the exception, and the end is where the law stands now. 6. Test yourself. Close everything, open a blank page and write every case name and principle you know. This is your starting score. Repeat it monthly.				
The Seven Context Blueprints	7.5, The Medical Knowledge Architecture Build. 1.	Work and talks	Paper	Set in the steps	Advanced

Choose one body system, such as the brachial plexus or the blood vessels of the liver. Use your own body as the palace. Map the main structures to places on an imagined version of that anatomy. 2. Build your drug deck for your current rotation. Note every drug you meet, but add no more than 3 new cards a day. On the front, write “Drug: [name]. Mechanism?” On the back, give the mechanism in 1 to 2 sentences. Check each drug fact against the official label, such as DailyMed. 3. Choose 3 common diseases in your current specialty. Write each one as a story: the trigger, the chain of events in the body and how the patient presents. Store the story in a palace. 4. Build your Diagnostic Peg System. Peg

	the 5 steps of the usual clinical assessment to 5 vivid images. The steps are presenting complaint, history, examination, investigations and diagnosis. 5. Take the clinical procedure you are tested on most. Write every step as a numbered list, and store it as a story chain. Rehearse until you can recall the full order from memory. In real practice, always follow the official written checklist. 6. After every patient encounter, spend 2 minutes recalling one thing you saw. If you cannot, it was not stored. Ask one question and store the answer at once.				
The Seven Context Blueprints	7.6, The Entrepreneur Knowledge System Build. 1. Name the 10 mental models you use most. Build a Mental Model Palace with one room and 10	Work and talks	App or cards	Your choice	Advanced

stations. Give each station one model, as a vivid action image. 2. Take the last business book you read. Try to recall 5 key ideas without looking. If you cannot, store them now, one idea per station. 3. Make Adviser Intelligence Files for your 5 most useful advisers. For each, sum up how they see the world in one sentence. Add the best advice they have given you, and your next question for them. 4. Build an Idea Capture Palace on a walk you take often, such as your commute or a morning walk. Each landmark holds one idea. Make a habit of storing one new idea per walk. 5. Set up an Anki deck for your field. Start with 20 cards on the terms and facts that mark you as an insider in your industry. 6. After your next big decision, record your reasoning in a

	Decision History Archive, as in the office blueprint. Note what you decided and why, what you turned down and what you assumed.				
The Seven Context Blueprints	7.7, The Book Encoding Masterclass. 1. Choose the last nonfiction book you finished. From memory, list every key idea you recall, and count them. This is your starting count. 2. Now read the table of contents. Count how many chapter arguments you can sum up in one sentence. Each chapter you cannot sum up is knowledge you paid for but did not keep. 3. Build a Book Palace for this book in one room. Put the 5 most important ideas on 5 stations, each as a vivid, specific image. Walk the palace three times. 4. Make 5 Anki cards: one figure, one striking claim, one finding that surprised you, one	Reading and study	App or cards	Set in the steps	Advanced

	practical use and one quote in your own words. Add them to a “Books” deck. 5. Write three Connection Notes, such as “This book’s idea about X links to [something I know] because…” In my view, these links are where the real value lies. 6. In 4 weeks, walk your palace without opening the book. Count how many stations are still vivid, and rebuild any that are not. Make this your new reading habit.				
How to Build Your Personal Knowledge System	7.8, The Integration Audit: Sort What You Already Know. 1. Open your Anki decks and review 20 cards at random. Take any card whose answer needs more than 1 sentence out of the deck. It belongs in a palace. 2. Look through the memory palaces you are using. Find any station that holds a	Knowledge systems	App or cards	Your choice	Advanced

	simple fact, such as a date, a name or a single definition. Move it to Anki, and keep the palace simple. 3. For your 3 most important fields, count your Anki cards and your palace stations. This shows how your knowledge is split between the two tools. 4. Add cross-references. Make sure each palace station has a matching Anki card. Write the palace place in the card's notes field. 5. Find any field where you have Anki cards but no palace. That field lacks a structure to hang its facts on. This week, build a palace of at least 5 stations for it.				
How to Build Your Personal Knowledge System	7.9, Live Book Encoding Session. 1. Choose a nonfiction book you read in the last 3 months. You will store it now. 2. Open it at the table of contents. From memory first,	Reading and study	App or cards	Set in the steps	Advanced

write down the 5 ideas you think matter most in the book. 3. Skim the chapters that match your 5 ideas. Confirm or change your list. 4. Choose a place for the palace. Use a route you know well, such as your home or a regular walk. Walk it in your mind, and give each idea one station. 5. At each station, make one vivid, specific image that captures the idea. The image must hold the idea itself. An image that only shows the idea exists is not enough. Test it this way. Could someone who saw only your image rebuild the idea? 6. Make 5 Anki cards for this book. Include one surprising fact, one key definition, one figure and one way to use the idea. Add one summary card that starts “The author argues that…”. 7. Review the palace after 24 hours, and

	check how vivid it is. Review it again after 7 days, and then after 30.				
How to Build Your Personal Knowledge System	7.10, The Annual Knowledge Review Protocol. 1. Book a 3 to 4 hour slot in December or January. Treat it as a fixed yearly commitment. 2. If you do not yet have an Annual Review Palace, create one. Choose a route you walk often. Give each year one landmark of its own. Give each book one station between landmarks. 3. Work through Blocks 1 to 6 in order. Do not skip Block 3, the summary of your year. In my view, the year's value takes shape here. 4. If you change your Anki deck settings, know what each one does. The Starting Ease setting applies only to new cards as they first graduate. It does not change cards you already have. With the	Knowledge systems	App or cards	Set in the steps	Advanced

	FSRS scheduler, ease options are hidden. Desired Retention is then the main control. Aer Maximum Interval means more reviews. 5. Write one sentence on the most important thing you learned this year. Store it as the last station in this year's part of the palace. 6. Set a calendar reminder for the same review in 12 months. The system keeps building only if you keep it going.				
How to Build Your Personal Knowledge System	7.11, The Seven-Day Knowledge System Build. 1. Day 1, structure. Name your 3 main fields of knowledge. For each one, choose a palace location and create an Anki deck. Write the 5 most important questions you have about that field. 2. Day 2, what you already know. List every book you read in the last year. For each one,	Knowledge systems	App or cards	Your choice	Advanced

write the idea you remember most clearly. Count them. This is your starting count. 3. Day 3, storing a book. Choose the book from Day 2 you value most. Build its Book Palace today. Use 5 to 7 stations with vivid images, and walk it three times. 4. Day 4, linking Anki. Make sure each of your 3 fields has at least 20 active Anki cards. Add cross-references from palace stations to the matching cards. 5. Day 5, a mental model palace. List the 10 frameworks, mental models or decision rules you use most. Build a Mental Model Palace for them, and walk it. 6. Day 6, the Annual Review Palace. Create the route, and make this year its first section. Build one station for each book you stored this week. Walk the whole route. 7. Day 7, review the system.

	Hold a 1-hour mini annual review. Ask what themes link your three fields. Ask what the week's most important idea was. Store that idea. Then book a 20-minute slot on the same day each week, for upkeep, the regular care that keeps something working.

Exercise 7.1 runs its pre-exam routine from the term-of-study workflow in Module 7. **The workflow runs the palace, Anki and self-testing as one regular routine**, from daily reviews to the last 4 weeks before exams.

Table C.8a: The term-of-study workflow (Exercise 7.1)

How often	What to do	Time
Daily	Review the Anki cards that are due. Add 1 new palace station for each subject you studied today.	15 to 20 minutes
Per lecture	Use SQ4R active reading. SQ4R is a way to read in six steps, Survey, Question, Read, Recite, Record and Review. Right after the lecture, store 3 key ideas in the palace.	10 minutes after the lecture
Weekly	Walk the full palace for every subject you studied this week. Do 1 Feynman Protocol drill.	30 to 40 minutes
Every two weeks	Try a past paper question from memory. Find the gaps, then store those parts again.	45 to 60 minutes
Last 4 weeks before exams	Pull together each subject's palaces. Speed up Anki intervals. Sit 3 full timed papers.	45 minutes a day
After exams	Add weak areas to your decks and reset their intervals. Start building for the next term.	One 1-hour session

The challenges module helps with common memory problems, ageing and targeted fixes. **Sudden confusion, or sudden trouble speaking or understanding speech, can signal a stroke, so call 9-1-1 right away.** For other worries, read the module's section on when to see a doctor.

Table C.9: Module 8, Overcoming Memory Challenges

Topic	Exercise	Sub-skill	Format	Time	Level
Common Memory Problems	8.1, Memory Failure Audit. 1. For the next 7 days, keep a Memory Failure Log in your journal. Each time you forget something, note three things. What did you forget? When did you need it? What were you doing when you took it in? 2. After 7 days, review your log. Look for patterns. Check whether failures cluster in one area, such as names, tasks or study. 3. Match each pattern to the table (Table C.9a). This gives you a plan aimed at your own problems. 4. Use the first steps for your top two patterns for the next 14	Self-check and progress	Paper	Set in the steps	Any

	days. Log your results.				
Common Memory Problems	8.2, The Attention Audit. 1. For 3 days, keep a tally. Mark each time you catch yourself not fully attending. This might be in a conversation, lecture or meeting, or while reading. 2. For each one, note the situation and what distracted you. It might be a thought, your phone, background noise or tiredness. Estimate roughly what share of the conversation you missed. 3. After 3 days, work out your average share of attention in each setting. Note where your attention holds best, and where it breaks up most. 4. Find your top 3 sources of distraction. Plan one specific fix for each. For example, put your phone face down in conversations. Write an agenda before each meeting,	Attention and intake	Paper	1 week	Any

	so you know what to attend to. Do a 2-minute breathing exercise before you study. 5. Use all three fixes for 1 week. Then run the tally again and compare.				
Common Memory Problems	8.3, The Stress and Memory Performance Test. 1. Phase 1, baseline. Study a list of 20 random words for 2 minutes in normal conditions. Recall them after 10 minutes, and write down your score. 2. Phase 2, stress. Study a different list of 20 words. Just before you recall them, spend 2 minutes thinking about a real worry. Then recall the list. 3. Phase 3, recovery. Study a third list of 20 words. Before you recall it, spend 2 minutes breathing slowly from the belly. Breathe in for 4 counts, hold for 4 and breathe out for 6. Then recall	Memory problems	Paper	Set in the steps	Any

	the list. 4. Compare your three scores. See whether thinking about a worry lowered your score, and whether slow breathing changed it. 5. This is a personal test with one person and three lists. It cannot prove a cause. Still, it shows you how stress may affect your own recall.				
Common Memory Problems	8.4, The Tip-of-the-Tongue Resolution Protocol. 1. In a tip-of-the-tongue state, you know that you know something but cannot recall it. It is frustrating, but it also shows you how recall works. 2. Next time it happens, do not strain harder. Straining makes you tense, and that can make recall harder. Work through the cues below in order. 3. Cue 1, the first letter. Ask what letter the word starts with. Even an unsure guess	Memory problems	Paper	Your choice	Any

	can bring the answer. 4. Cue 2, the setting. Ask where you last met this word or name. Recall who was there and what you were doing. Going back to the setting in your mind can help. 5. Cue 3, the category. Ask what kind of thing it is and what it is like. Going through nearby words can lead you to the missing one. 6. Cue 4, let it go. Stop searching. The answer often comes back later, once you stop trying.				
Common Memory Problems	8.5, The Interference Reduction Experiment. 1. Retroactive interference means new information getting in the way of memories you have just formed. It is a common cause of forgetting that people rarely notice. 2. This week, test it yourself. After you study something important, flip a coin. It decides what you do for the next 20 minutes. 3.	Memory problems	Paper	Set in the steps	Any

	Heads means high interference. For 20 minutes, take in new words and ideas. Read articles, watch the news or have a complex conversation. 4. Tails means low interference. For 20 minutes, do something with few words. Take a gentle walk, stretch lightly or rest without talking. 5. Recall the material 1 hour later. Repeat the test several times, and compare your scores. 6. Notice whether quiet rest helps you. In one study, people heard a story and then rested quietly for 10 minutes (Dewar et al., 2012). Others played a spot-the-difference game. The resters recalled more, both soon after and a week later.				
Memory and Ageing	8.6, The Ageing Brain Risk Audit. 1. Review the 14 risk factors listed in Table C.9b. 2. Rate yourself	Brain health and lifestyle	Paper	Set in the steps	Any

	honestly on each one. Low risk means it does not apply or is well managed. Medium risk means it is present but manageable. High risk means it is present and you are not yet dealing with it. 3. Pick your top 1 or 2 high or medium risk factors. 4. For each one, write one specific action you could take this week. Make it a single action, not a resolution. You might book a blood pressure check or a hearing test. Or you might walk for 20 minutes today. 5. Take that action this week. Come back to this exercise in one month and audit yourself again.				
Memory and Ageing	8.7, The Cognitive Reserve Builder. 1. Cognitive reserve is the brain's toughness. It is its ability to cope with damage before symptoms appear. It is	Brain health and lifestyle	With others	Set in the steps	Any

built by hard mental work through life. The Lancet Commission lists less early education as a risk factor. It also links mentally demanding work to lower risk (Livingston et al., 2024). 2. This week, start a mentally demanding activity that is new or rare for you. You could learn an instrument or a new language. You could take an online course in an unfamiliar subject, or learn chess or Go. You could take up a complex craft, such as woodworking or coding. Or you could join a book group. 3. It must be truly new to you, beyond more of what you already do well. It must also keep stretching you as you improve. 4. Stick with it for at least 8 weeks. In a large trial of older adults, training gains lasted 2 years (Ball et al.,

	2002). At 10 years, reasoning and speed training still helped those skills (Rebok et al., 2014). Memory training no longer helped memory. 5. Track your progress. Each week, note what you found hard and what became easier.				
Memory and Ageing	8.8, The Brain Health Weekly Protocol. 1. Use the table (Table C.9c) to design a 7-day brain health plan. Make it suit your current life. Then follow it. 2. Aerobic exercise. Book 30-minute sessions on at least 4 of the 7 days. Walk, cycle, swim or jog. Doing it steadily matters more than the type. 3. Mental challenge. Spend 15 minutes a day on a new skill that keeps getting harder. Take care with brain games sold as a way to prevent dementia. The National Institute on Aging (n.d.) urges caution	Brain health and lifestyle	With others	Set in the steps	Any

	about them. The 2024 Lancet Commission looked at computer brain training (Livingston et al., 2024). It found only weak evidence of-term gains, and none of lasting gains. 4. Social life. Plan at least 2 meaningful social contacts this week. It could be a dinner or a group activity. Or you could call a friend you have not spoken to lately. 5. Sleep. Set a steady bedtime and wake time. Aim for 7 to 9 hours. Put screens away for 30 minutes before bed. 6. Mindfulness. Spend 10 minutes a day on focused breathing or guided meditation. Morning or evening both work. 7. At the end of the week, rate your memory from 1 to 10. Compare it with your starting score from row 4.1.				
Memory and Ageing	8.9, The Sleep Architecture Audit. 1.	Brain health and lifestyle	Paper	Set in the steps	Any

Different stages of sleep seem to support different kinds of memory. Deep sleep and dreaming sleep both play a part. The details are more complex than a simple split. 2. For 7 nights, keep a sleep log. Note your bedtime, roughly how long you took to fall asleep and any waking. Also note your wake time and how well you slept, from 1 to 10. 3. Also note any alcohol you drank, any exercise and any screen use before bed. Note how warm your bedroom was. Alcohol delays dreaming sleep at all doses (Ebrahim et al., 2013). In most of the studies reviewed, moderate and high doses also cut total dreaming sleep. A review found evening exercise was generally fine for sleep (Stutz et al., 2019). Hard exercise ending within an hour of bed

	might be the exception. 4. After 7 nights, look for patterns. Find the nights you slept best, and see what they had in common. 5. Make one change based on what your own log shows. Choose a specific change, not a general resolution. 6. Check whether your memory exercise scores track the previous night's sleep. This is only a personal check, so it cannot prove a cause.					
Memory and Ageing	8.10, The Stress Inoculation Practice. 1. Long-term stress can harm the brain areas used for thinking (Lupien et al., 2009). The effects depend on when stress happens and for how long. Much of the evidence on brain structure comes from animals. In my view, mild stress followed by recovery may help you cope better. This idea is	Brain health and lifestyle	Paper	Set in the steps	Any

	called stress inoculation. It works like a vaccine, where a small dose trains you to cope with the real thing. 2. This week, take on some mild mental stress on purpose. Do a hard practice test on a topic you only partly know. Spend 15 minutes on it, and accept the discomfort of not knowing. 3. Straight after, spend 5 minutes breathing slowly from the belly. Breathe in for 4 counts, hold for 7 and breathe out for 8. Repeat this 4 to 6 times. 4. Notice how you feel before and after. 5. Practise this daily for 2 weeks, after tests and after any other stressful moment. The aim is to calm down faster after stress. Slow breathing may help you feel calmer. No study has tested this method on memory.			
Targeted Steps for	8.11, The Single-Tasking	Paper	Your choice	Any

Specific Memory Problems	Protocol. 1. For one full working day, do one thing at a time. When you are doing something, do only that. Play no music with lyrics in the background, and keep your phone off the desk. Keep email closed in meetings, and stay off social media while you eat. 2. This will feel uncomfortable. The discomfort shows how used you have become to splitting your attention. 3. Before any conversation you need to remember, put your phone away and face the speaker. Make eye contact. Repeat back what you hear in your own words. Each of these steps keeps your attention on the speaker. 4. At day's end, think about how well you recall its events, talks and facts. Compare this with a typical day of multitasking. 5. Keep the protocol going	Attention and intake

	for a full week. See whether single-tasking starts to feel more natural than split attention.				
Targeted Steps for Specific Memory Problems	8.12, The Pre-Encoding Preparation Ritual. 1. Before a lecture, meeting or talk you need to remember, spend 60 seconds getting ready. 2. Step 1, 20 seconds. Put down or silence all your devices. Turn your body toward the source of information. 3. Step 2, 20 seconds. Ask yourself, “What do I most need to remember from this?” Setting a clear aim helps you notice what matters. 4. Step 3, 20 seconds. Take three slow, deep breaths to settle yourself. 5. These 60 seconds cost nothing. Longer mindfulness training has shown benefits. In one randomised study, students	Attention and intake	Paper	Set in the steps	Any

	took a 2-week mindfulness course (Mrazek et al., 2013). A randomised study puts people into groups by chance, so the groups can be fairly compared. Their working memory and reading test scores improved, and their minds wandered less.				
Targeted Steps for Specific Memory Problems	8.13, The Pressure Recall Drill. 1. Study a list of 20 items for 3 minutes in normal conditions. 2. Over four separate days, recall it under four conditions that get steadily more stressful. 3. Day 1. Recall alone, with no time limit. Write down your score. 4. Day 2. Recall within 90 seconds. Write down your score. 5. Day 3. Recall aloud within 90 seconds, while another person watches you. Write down your score. 6. Day 4. Recall straight after doing 20 press-ups,	Memory problems	Paper	Set in the steps	Any

	adding physical stress to the task. Write down your score. 7. Compare your scores. If they drop from Day 1 to Day 3, keep practising under pressure. Aim for your Day 3 score to match your Day 1 score. This drill is my own, and no study has tested it.				
Targeted Steps for Specific Memory Problems	8.14, The Contextual Retrieval Anchor. 1. Choose material you are studying for a test, presentation or exam. 2. Study each main topic in two or three different places and positions. You might sit at your desk, stand in the kitchen or walk in the garden. 3. Vary the senses too. Sometimes study with music and sometimes in silence. Sometimes have a specific scent nearby, such as a candle or coffee. 4. At the exam or event, you will then have	Memory problems	Paper	Your choice	Any

	several anchors to draw on. The exam room may be unlike your study room. Even so, some of the settings you used may partly match it. 5. Godden and Baddeley (1975) showed the setting effect with divers. Divers who learned words underwater recalled them better underwater than on land. The reverse was also true. Studying in more than one place is a known approach (Smith, Glenberg, & Bjork, 1978). You cannot always control where you recall, but you can vary where you study.				
Targeted Steps for Specific Memory Problems	8.15, The Working Memory Expansion Programme. 1. This is a 4-week training plan that gets harder each week. 2. Week 1, digit span, the number of digits you can hold at once. Each day, have	Working memory	App or cards	Your choice	Any

someone read you random digits at 1 per second. A digit span app also works. Recall them in order. Start with 5 digits. Add one digit each time you get 3 right in a row. Track your best span each day. 3. Week 2, backwards span. Do the same, but recall the digits in reverse order. Now you must work with the digits as well as hold them. That demands much more of working memory. 4. Week 3, dual task. Hold a 5-digit string in mind while you read a short paragraph aloud. At the end of the paragraph, recall the digits. Add 1 digit each time you succeed twice. 5. Week 4, complex span. Read a sentence and judge whether it is true or false. Then hold its last word in mind. After 4 or 5 sentences, recall all the last words in order. This is

	the reading span task, a standard working memory measure (Daneman & Carpenter, 1980). 6. Track your scores each day, and plot them each week. Expect to improve on these tasks. Do not expect the gains to spread much beyond them.				
Targeted Steps for Specific Memory Problems	8.16, The Cognitive Load Reduction System. 1. The aim is an outside system that handles routine load. Your working memory is then free for what matters. 2. Step 1, move the trivial out of your head. Put any recurring task, appointment or commitment into a system you trust. A calendar, task manager or note app will do. Once it is captured, you no longer need to hold it in mind. 3. Step 2, chunk before you start. Before a complex task, spend 2 minutes on paper. Sort the relevant	Memory problems	App or cards	Set in the steps	Intermediate

	information into 3 to 5 chunks. Having the structure on paper eases the load during the task. 4. Step 3, cut distractions around you. Close browser tabs you are not using. Silence notifications. Clear your desk. 5. Step 4, offload on purpose. Write down what you are thinking about. In my view, getting thoughts onto paper frees working memory for new information. That is one reason active note-taking can help, as opposed to copying word for word.				
Targeted Steps for Specific Memory Problems	8.17, The Relearning Sprint. 1. Choose a subject, language or skill you once studied. You should not have used it for 2 years or more. Pick one you feel you have largely lost. 2. Spend 30 minutes recalling everything you can, with no	Spaced review and retrieval	Paper	Set in the steps	Advanced

	notes or books. Write or say whatever comes to mind. Do not judge how patchy it is. 3. Now spend 30 minutes reviewing the same material from a source. A textbook, notes or course materials all work. Note what comes back quickly and what feels truly new. 4. The material that came back quickly may not have been lost at all. Seeing or hearing it again was enough to bring it back. This is savings at work. 5. Build a spaced repetition deck (cards you review after longer and longer gaps) of the 30 most important items from the subject. Review them over the next 3 weeks. Notice how quickly you regain your old level, compared with how long it first took.				
Targeted Steps for Specific	8.18, The Forgotten Language Reactivation. 1.	Languages	App or cards	Set in the steps	Advanced

Memory Problems	Use this if you feel you have lost most of a language you once studied. It shows how much may still be there. 2. Day 1. Without any aids, write every word you can remember in the language. Do not strain. Write whatever comes up, then count the words. 3. Day 2. Spend 20 minutes listening to the language at native speed. A news broadcast, a podcast or a film will do. Do not try to understand it. Just listen, and notice roughly what share of words feel familiar. 4. Day 3. Learn 20 new words with the Keyword Method, linking each new word to a familiar word that sounds like it, through a bright picture. Notice whether storing them feels faster than it would for a complete beginner. 5. Week 2. Start a daily 15-minute Anki review

	(Anki is a flashcard app that uses spaced repetition), using an existing word deck for your language. Notice whether words you could not recall in week 1 start coming back. 6. In my view, relearning a language is a clear example of savings. It can also be a strong reason to keep studying.				
Targeted Steps for Specific Memory Problems	8.19, The Memory-Protective Power Nap Protocol. 1. Naps can help learning. In one study, people napped for 60 to 90 minutes, with deep and dreaming sleep (Mednick et al., 2003). The nap helped them learn a visual skill. It gave about the same gain as a night of sleep. The task was spotting fine visual patterns, not general memory. 2. To try a short nap, set an alarm for 25 minutes. That allows about 5	Memory problems	Paper	Set in the steps	Any

	minutes to fall asleep and 20 minutes of sleep. Lie down somewhere comfortable and dark. 3. Try the nap on 3 days in a row this week. Before each nap, and 30 minutes after waking, test yourself on 15 random words. Compare your scores from before and after. 4. See whether your recall is better after the nap. This is a personal test, so it cannot prove a cause.				
Targeted Steps for Specific Memory Problems	8.20, The Fatigue-Aware Study Schedule. 1. Not all mental work suits the same time of day. Insight problems need a sudden new view of the problem. In one study, people solved them better when they were less alert (Wieth & Zacks, 2011). Time of day had no consistent effect on step-by-step problems. In my view, detailed work such as	Memory problems	Plan	Set in the steps	Any

	memorising suits your peak hours. 2. This week, rate your alertness from 1 to 10 every hour, from waking to sleeping. After 3 days, plot your alertness curve. 3. Move your most memory-heavy study or work into your peak hours. Keep routine or admin tasks for your low points. 4. If you must study when your alertness is low, keep sessions to 15 minutes. Do more self-testing than new learning. Add movement, such as standing, writing by hand or reading aloud. 5. Track whether matching tasks to your alertness helps you. Compare your recall on weeks with and without the new schedule.

Three of the rows above work from material in Module 8. **To fix a memory problem, you first need to name it clearly**, so Exercise 8.1 matches each pattern in your log to this table.

Table C.9a: Memory problems and first steps (Exercise 8.1)

Symptom	Likely cause	Memory system affected	First step
You forget things right after hearing them	Too little attention while taking them in, or distraction	Short-term memory (the memory that holds a few items for a short time) and working memory (short-term memory that also works on what it holds)	Do one thing at a time. Give new information your full attention before you act on anything else.
You study but cannot recall it in exams	Passive revision with no self-testing, and too much rereading	Storing in long-term memory (the store that keeps what you know for days, years or life), and getting it back out	Switch to self-testing now. Rereading feels like learning, but it helps less.
You remember faces but not names	Names are labels with no meaning or picture of their own	Memory for events and for facts	Use the name in the conversation straight away. Make an image that links the name to a feature of the face.
You forget where you put things	You put them down on autopilot, without noticing	Memory for events	Say what you are doing out loud: "I am putting my keys on the kitchen counter." This makes you notice the act.
Your mind goes blank under pressure	Short bursts of stress can weaken the front of the brain, which helps with recall	Recall under stress	Practise recall in advance, which can protect memory under stress. Slow breathing may help you calm down, but it has not been tested on recall.
You remember old things better than new ones	Taking longer to learn new things is usually a normal part of ageing	Forming new memories of events	Use planned memory strategies.

The 2024 Lancet Commission found **14 risk factors for dementia** that can be changed (Livingston et al., 2024). Exercise 8.6 rates you on each one.

Table C.9b: The 14 risk factors (Exercise 8.6)

Risk factor
Less education early in life
Hearing loss
High LDL cholesterol
Depression
Head injury
Physical inactivity
Diabetes
Smoking
High blood pressure
Obesity
Heavy drinking
Social isolation
Air pollution
Untreated vision loss

The table below sets out **the main options** for brain health in later life. It shows what the evidence says and how to put each one into practice, and Exercise 8.8 builds its weekly plan from it.

Table C.9c: Brain health options (Exercise 8.8)

Option	Evidence	How to do it	What to expect
Aerobic exercise	In a trial with 120 older adults, a year of aerobic exercise grew the hippocampus by 2%. That reversed about 1 to 2 years of age-related loss (Erickson et al., 2011). A review of 18 studies found fitness training helped thinking skills, most of all for planning and control (Colcombe & Kramer, 2003).	30 minutes of moderate aerobic activity, such as brisk walking, swimming or cycling, 5 days a week	A possible gain in hippocampus size and in some thinking skills
Mental training	In a large trial, reasoning training cut reported problems with daily tasks over 5 years. Memory and speed training had no clear effect on this (Willis et al., 2006). At 10 years, memory training no longer helped memory (Rebok et al., 2014).	Learn new skills, such as an instrument or a language	Gains mostly in the skills you train

Social life	A review found that an active, socially connected life in later years is linked with protection against dementia (Fratiglioni et al., 2004).	Regular social activities, group learning, discussion groups and community life	A possible lower dementia risk
Good sleep	In 20 healthy adults, one night without sleep raised a protein tied to Alzheimer's, called beta-amyloid, in parts of the brain (Shokri-Kojori et al., 2018).	7 to 9 hours of regular sleep, a fixed sleep and wake schedule, and a dark, cool bedroom	Better-stored memories
MIND diet	MIND mixes the Mediterranean and DASH diets. In one long-term study, people who followed it most closely had a 53% lower rate of Alzheimer's (Morris et al., 2015). The study only observed people, though. It did not put them into groups, so it was an observational study. A 3-year trial found no clear benefit to thinking over a control diet (Barnes et al., 2023).	Leafy greens daily, berries 3 times a week, fish twice a week, olive oil and little processed food	Unclear. The trial found no clear benefit.
Mindfulness (paying attention to what is happening right now, without judging it)	In a small study, an 8-week mindfulness course raised grey matter (the parts of the brain packed with nerve cells) in part of the hippocampus (Hölzel et al., 2011). There were 16 people in the course and 17 on a waiting list.	10 to 20 minutes of mindfulness meditation daily, yoga, tai chi or time in nature	A possible change in brain structure. Effects on memory were not tested.

The lifestyle rows cover food, movement, sleep and stress. **The rows turn food, movement, sleep and stress into plans, audits and logs**, so your own record shows what helps you. Appendix B gives blank sheets for the same habits.

Table C.10: Module 10, Memory and Lifestyle

Topic	Exercise	Sub-skill	Format	Time	Level
Nutrition and Memory	10.1, Brain-Nutrient Mapping. 1. Review the nutrient table (Table C.10a). For each of the 7 nutrients, note whether you eat it each week. 2. Draw a grid with the 7 nutrients as rows and the 7	Brain health and lifestyle	Paper	Set in the steps	Any

	days as columns. Tick each cell where you ate a good source. 3. After one week, count your ticks. Use the total as a picture of your eating habits. It is not a measure of your memory. 4. Find your two biggest gaps, the nutrients you eat least often. Look up one meal or snack that covers both. 5. Add that meal or snack the following week and repeat the grid. Note any changes you notice in how you feel.				
Nutrition and Memory	10.2, The MIND Diet Transition Plan. 1. Change your diet over six weeks, in three phases. Do not change it all at once. I prefer gradual change because sudden overhauls are hard to keep up. 2. Weeks 1 and 2, add before you take away. Add one MIND food to each meal without removing anything. Try blueberries at	Brain health and lifestyle	Plan	Your choice	Any

	breakfast and spinach at lunch. Have walnuts as a snack and salmon or sardines at one dinner. 3. Weeks 3 and 4, crowd out. As the new foods become habits, check your food log. Note which limit-list foods, such as red meat and pastries, you now eat less. 4. Weeks 5 and 6, swap. Make planned swaps for the gaps that remain. Try whole-grain bread for white and olive oil for butter. Swap crisps for nuts, and sugary desserts for dark chocolate with berries. 5. After six weeks, score yourself against the MIND targets again. Compare your memory exercise scores from the start and the end.				
Nutrition and Memory	10.3, The 7-Day Brain Diet Audit. 1. For 7 days, keep a food log. Record everything you eat and drink. 2. At the end	Brain health and lifestyle	Paper	7 days	Any

	of the week, score each day against the MIND targets (Table C.10b). 3. Find the 3 biggest gaps in your current diet. 4. In week 2, make one change for each gap. You might add blueberries to breakfast or switch to whole-grain bread. You could also add one fish meal a week. 5. Notice whether your energy, focus or memory seem different by the end of week 2.				
Nutrition and Memory	10.4, The Food and Focus Diary. 1. For 14 days, keep a combined food and memory log. Each day, record what you ate and one memory exercise score. Rate your focus and energy from 1 to 10 at three points in the day. 2. After 14 days, look for patterns. Do your best memory days follow certain meals? Do your scores drop after particular lunches? 3. Treat any pattern as a	Brain health and lifestyle	Log	Set in the steps	Any

	clue. It is not proof. Many things besides food change from day to day. 4. Use what you find to plan when and what you eat before study. 5. Repeat the diary later if your routine changes.				
Nutrition and Memory	10.5, The Hydration Test. 1. Mild dehydration can affect thinking. One review looked at losing 2% of body weight in water (Adan, 2012). It impaired attention, movement speed and immediate memory. Working memory and long-term memory held up better. 2. On day 1, do your usual morning memory exercise after your normal routine. For example, study 20 random words for 2 minutes, then recall them. 3. On day 2, drink 500 ml of water in the 30 minutes before testing. Record both scores. 4. Repeat this	Brain health and lifestyle	Paper	Set in the steps	Any

	over 5 pairs of days, hydrated and not. Compare your average scores for the two kinds of day. 5. US guidance sets total water at about 3.7 litres a day for men (National Academies, 2004). For women, it is about 2.7 litres. This includes water from food, and most comes from drinks. For most healthy people, thirst is a good guide.				
Nutrition and Memory	10.6, The Pre-Study Meal Plan. 1. Plan a meal or snack to eat before a 90-minute study session. 2. Include a slow-release carbohydrate, such as oats, whole-grain bread or sweet potato. Add a source of choline or omega-3, such as eggs, smoked salmon or walnuts. Add a flavonoid source, such as blueberries or green tea. Drink water with the meal. 3. Avoid sugary foods and heavy,	Brain health and lifestyle	Plan	Set in the steps	Any

	fatty meals before study. Avoid alcohol too. Heavy drinking can stop new memories being stored (NIAAA, n.d.). 4. Compare your plan with a usual meal, such as a sandwich and crisps. Test each over four sessions. Score a memory exercise at 30 and 90 minutes into each session. 5. Record your results in your memory journal. Keep the meal that gives you the best scores.				
Physical Activity and Memory	10.7, The Study-Exercise Plan. 1. For the next 14 days, do 20 minutes of brisk walking or other aerobic activity. Do it just before your main study session. 2. While you exercise, preview what you will study. You might listen to an audio review or go over key ideas in your head. 3. Start your study session as soon as you return. Keep	Brain health and lifestyle	Plan	Set in the steps	Any

	the type of material similar across the 14 days, so the scores compare fairly. 4. Each day, rate the quality of your session from 1 to 10. Include focus, recall and understanding. 5. Compare your average score for the first 7 days with the second 7 days. Decide whether to keep the habit.				
Physical Activity and Memory	10.8, The Short Hard Workout Before Study. 1. HIIT means bursts of hard effort with rest between them. This exercise tests whether it suits you before a short study session. 2. The plan takes about 12 minutes and needs no equipment. Warm up with 2 minutes of light movement. Then do 6 rounds of 30 seconds all-out and 90 seconds of slow walking. Cool down for 1 to 2 minutes. 3. Start studying within 5 minutes of finishing. 4. For 14 days,	Brain health and lifestyle	Paper	Set in the steps	Any

	alternate this workout with the 20-minute walk from Exercise 10.7. Track your memory scores after each type. 5. Compare the two. Note which one helps more for short sessions and which helps more for long ones. 6. Use whichever works best for you before each kind of session.				
Physical Activity and Memory	10.9, The Movement-Learning Test. 1. This exercise tests whether moving while you study helps you remember. 2. Choose 20 words, key ideas or facts you are learning now. Split them into two groups of similar difficulty. 3. Condition A: study 10 items while seated at a desk, using flashcards. 4. Condition B: study the other 10 items while walking slowly. Say each item aloud and use a gesture to show its meaning. 5. Test yourself on all 20 items	Brain health and lifestyle	Paper	Set in the steps	Advanced

	24 hours later. Compare your recall for the two conditions. 6. If Condition B works better for you, try it for a full week of study. Note its effect on recall and on how studying feels.				
Physical Activity and Memory	10.10, The 30-Day Exercise-Memory Challenge. 1. Commit to 30 days in a row of aerobic movement. 2. Each day, do at least 20 minutes of walking, cycling, swimming, dancing or similar. Aim to raise your heart rate to 60 to 70% of its maximum. 3. Exercise within 2 hours of your main memory practice each day. 4. On days 1, 10, 20 and 30, do the 30-word test in row 4.1. Record your scores. 5. Also note how easily you form images, walk your memory palaces and recall during review. 6. On day 30, compare your scores with day 1. Any change is	Brain health and lifestyle	Plan	30 days	Advanced

	useful data for planning your routine. A month is short next to the year-long trial, so keep tracking if you continue.				
Sleep and Memory	10.11, The Pre-Sleep Review. 1. This exercise builds a short review habit before bed. Sleep tends to favour memories people expect to need later (Wilhelm et al., 2011). 2. Spend 5 minutes before sleep in a dim room without screens. Recall the 5 most important things you learned that day. Do not read notes first. Then check whether you missed anything. 3. For 3 minutes, walk through any memory palace you updated or built today. Check that each image is clear and in place. 4. For 2 minutes, pick the 3 things you most want to remember from today. Say them aloud once, then let them go. 5. Do this	Brain health and lifestyle	Paper	Set in the steps	Advanced

	every night for 14 nights, keeping other habits steady. Compare your next-morning recall of the previous day's material on night 1 and night 14.				
Sleep and Memory	10.12, The Sleep and Memory Log. 1. For two weeks, track your sleep and your memory side by side. 2. Each morning on waking, rate your sleep in three ways. Note the hours slept and how often you woke. Rate how deeply you slept from 1 to 10. 3. Then do a 15-word recall test. Study the words for 90 seconds and recall them after 5 minutes. Use a fresh list each morning. 4. After 14 days, plot sleep quality against your test scores. Check whether better nights go with higher scores the next morning. 5. Treat what you find as personal data. Two weeks is a small sample, and other	Brain health and lifestyle	Log	Set in the steps	Any

	factors also change from day to day.				
Sleep and Memory	10.13, The 14-Night Sleep Plan. 1. Choose the three habits from the table (Table C.10c) that you follow least well. These are your main targets. 2. For 14 nights, practise all three together. Leave the others for now, so you can focus. 3. On nights 1 to 7, rate your sleep quality each morning from 1 to 10. Expect some disruption while your body clock adjusts. 4. On nights 8 to 14, keep going as the habits settle. Watch whether your ratings rise. 5. On night 14, compare your average for nights 8 to 14 with your starting rating. Also compare your memory scores with your baseline from row 4.1. 6. Use the results to choose which habits to add next month. I hold that adding a few habits at a	Brain health and lifestyle	Plan	14 nights	Any

	time makes them last.				
Stress, Cortisol and Memory	10.14, The Stress Awareness Audit. 1. For 7 days, rate your stress each morning, afternoon and evening. Use a scale from 1 to 10. Here 1 means deeply relaxed, 5 means busy but engaged and 10 means overwhelmed. 2. Each time, note what caused your stress level. Record any physical signs, such as a tight chest, shallow breathing or tense muscles. Note whether you were doing any memory work then. 3. After 7 days, work out your daily average. Find the time of day when it is usually highest. Note which situations most often raise it. Count how many hours a day you spend at your own high levels. 4. Use this data to make two changes to your week. Schedule your hardest memory work	Brain health and lifestyle	Paper	Set in the steps	Any

	in your calmest times. Pick one regular stressor that you can reduce, delay or deal with this week.				
Stress, Cortisol and Memory	10.15, The 10-Minute Daily Stress Plan. 1. Do this short routine every morning for 30 days. It combines the four techniques in Table C.10d. 2. Minutes 1 and 2: do 10 rounds of cyclic sighing. Focus only on your breath. 3. Minutes 3 to 5: do 6 rounds of 4-7-8 breathing. Use a phone timer if counting is hard. 4. Minutes 6 to 8: tense and release your feet, legs and stomach. Then do your hands, arms, shoulders and face. Hold each for 5 seconds, then release fully. Go through the groups twice. 5. Minutes 9 and 10: sit without any technique. Notice how your mind feels compared with when you began. 6.	Brain health and lifestyle	Plan	10 minutes	Any

	Before and after each session, rate your stress and mental clarity from 1 to 10. After 30 days, compare your morning stress rating on day 1 and day 30. If one technique does not suit you, give more time to one that does.				
Stress, Cortisol and Memory	10.16, The Stress and Recall Drill. 1. This drill tests how well you can recall under pressure. Many people must think clearly in exams, talks or hard conversations. 2. Make a 20-item word list and learn it with a memory palace. Recall it once while calm and record your score. 3. Watch a 3-minute clip that you find tense, such as a dramatic sports finish. Choose something tense. Avoid anything truly upsetting. Then try to recall the list. 4. Spend 3 minutes on cyclic sighing	Brain health and lifestyle	Paper	Set in the steps	Advanced

	(Table C.10d). Then try the recall again. 5. Repeat the three tests, calm, stressed and recovered, once a week for 4 weeks. Use a fresh word list each week. Track whether your stressed and recovered scores move closer to your calm score. 6. The gap between your calm and stressed scores shows how much stress affects your recall. In my view, narrowing that gap is a useful training goal.				
Stress, Cortisol and Memory	10.17, The Study Space Audit. 1. Your surroundings can add low-level stress through clutter, noise, interruptions, poor light and unfinished tasks. This audit helps you find and reduce these sources. 2. Sit where you do most of your memory work. Rate clutter and noise from 1 to 10, where 10 is worst. Count interruptions per hour, and	Brain health and lifestyle	Paper	Your choice	Any

	note the light and temperature. Mark every score above 5. 3. Count how many alerts your phone or computer sends per hour while you study. Note how many unread emails or messages you can see. In my view, each one can pull at your attention. 4. For each item scored above 5, make one change this week. You might clear a desk or turn on Do Not Disturb. You could add a lamp, find a quieter room or file old emails. 5. After the changes, rate your space again. Note whether your study sessions feel calmer. Repeat the audit after a month, as clutter and alerts tend to return.				
Stress, Cortisol and Memory	10.18, The Lifestyle Scorecard. 1. Each Sunday, fill in this short weekly scorecard. Score yourself honestly on each of the four factors,	Brain health and lifestyle	Log	Set in the steps	Any

using the scale below. 2. Nutrition, 0 to 3. Score 3 if you met the MIND targets on 5 or more days. Score 2 for 3 or 4 days and 1 for 1 or 2 days. Score 0 if you did not track. 3. Exercise, 0 to 3. Score 3 for 4 or more aerobic sessions of 20 minutes or longer. Score 2 for 2 or 3 sessions, 1 for one session and 0 for none. 4. Sleep, 0 to 3. Score 3 for 7 or more hours on a steady schedule, 5 or more nights. Score 2 for 6 to 7 hours on 3 or more nights. Score 1 for an irregular schedule or under 6 hours on most nights. Score 0 for badly broken sleep all week. 5. Stress, 0 to 3. Score 3 if you used a stress-reduction technique every day. Score 2 for 4 to 6 days and 1 for 1 to 3. Score 0 for none. 6. Your weekly total is out of 12. I

	suggest aiming for 9 or more. Compare it with your memory scores that week. Look for a pattern over 4 weeks.				
Stress, Cortisol and Memory	10.19, The Peak Week. 1. Plan one week in which you follow every lifestyle habit at once. This is a short experiment. It is not a permanent plan. 2. Nutrition: follow the MIND targets for all 7 days. Prepare meals ahead if needed. Avoid processed food, added sugar and alcohol. 3. Exercise: do 30 minutes of aerobic activity daily. Fit it within 2 hours of your memory practice. 4. Sleep: keep a fixed bedtime and wake time. Use the sleep habits in Table C.10c. Aim for 7.5 to 8.5 hours a night. 5. Stress: do the 10-minute morning stress plan each day. Limit news you do not need, and keep one evening free of	Brain health and lifestyle	Plan	Set in the steps	Any

	screens. 6. Memory practice: do your usual 20-minute daily training from the daily drills in Table C.5. Do it when you feel most alert. 7. Record your memory scores each day. Compare them with your scores from the past month. Note which habits seemed to matter most for you.

Three lifestyle rows work from tables in Module 10. **A pill may show no memory benefit**, and the food can still belong in a healthy diet.

Table C.10a: Nutrients and the evidence (Exercise 10.1)

Nutrient	Food Sources	Proposed Role	What the Evidence Shows
Omega-3 fats (DHA/EPA)	Salmon, mackerel, sardines, herring; walnuts and flaxseeds (ALA)	DHA is a key part of brain cell membranes	Pills showed no memory gain in healthy adults (Mazereeuw et al., 2012; Sydenham et al., 2012)
Flavonoids (polyphenols), a kind of plant chemical	Blueberries, dark chocolate (70%+), green tea	May affect brain growth factors and blood flow	Evidence is mostly from animal studies (Gómez-Pinilla, 2008)
Vitamin K and folate	Spinach, kale, broccoli, Brussels sprouts, asparagus	Folate lowers homocysteine, a blood marker	Most trials show folic acid pills do not affect thinking or dementia; no official source found for vitamin K
B vitamins (B6, B12, B9)	Eggs, lean meat, fish, legumes, whole grains, fortified cereals	Help keep nerves healthy and lower homocysteine	Trials show no gain in thinking from B12 pills in older adults
Choline	Eggs (especially yolks), liver, fish, soy, broccoli	Needed to make acetylcholine, a chemical messenger	Supplements gave no clear gain in thinking in healthy adults
Magnesium	Dark leafy greens, nuts, seeds, legumes, dark chocolate	Involved in nerve signalling	No official source found linking it to memory
Probiotics (gut bacteria)	Yoghurt, kefir, kimchi, sauerkraut, miso, kombucha	Gut bacteria help make serotonin in the gut (shown in mice)	No memory effect shown (Yano et al., 2015)

The MIND scoring has **10 food groups to favour** and 5 to limit. Each target comes from the original scoring (Morris et al., 2015).

Table C.10b: MIND targets (Exercise 10.3)

Food Group	MIND Target	Notes
		Source of vitamin K, folate and lutein

Green leafy vegetables	6 or more servings a week	
Other vegetables	At least 1 serving a day	
Berries	2 or more servings a week	
Nuts	5 or more servings a week	
Olive oil	Main cooking oil	
Whole grains	3 or more servings a day	
Fish	1 or more servings a week	
Beans and legumes	More than 3 servings a week	
Poultry	2 or more servings a week	
Wine	1 glass a day	Part of the original scoring. Other evidence urges caution, though. The World Health Organization says there is no safe level of drinking for health (World Health Organization, 2023).
Red meat	Fewer than 4 servings a week	Limit
Butter and margarine	Less than 1 tablespoon a day	Limit
Cheese	Less than 1 serving a week	Limit
Pastries and sweets	Fewer than 5 servings a week	Limit
		Limit

Fried or fast food	Less than 1 serving a week

Good sleep habits **protect the stages of sleep** that support memory. The table lists common habits, how to use them and what the evidence shows, and some details are the book's own suggestions, marked as such.

Table C.10c: Sleep habits (Exercise 10.13)

Habit	How to Use It	What the Evidence Shows
Regular sleep schedule	Go to bed and wake at the same times every day, weekends included. Aim for 7 to 9 hours.	Adults should get 7 or more hours (Watson et al., 2015); 7 to 9 hours for adults and 7 to 8 for older adults (Hirshkowitz et al., 2015)
Dark, cool bedroom	Blackout curtains or an eye mask; a cool room	Light lowers melatonin, a hormone that helps sleep (Chang et al., 2015); exact temperature figures not found in official sources
Caffeine cut-off	Avoid large amounts of caffeine for at least 6 hours before bed	Caffeine 6 hours before bed still disrupted sleep (Drake et al., 2013); average half-life (the time the body takes to clear half a dose) about 5 hours, range 1.5 to 9.5 (Institute of Medicine, 2001)
Screen cut-off	No screens 60 to 90 minutes before bed (my suggestion)	Reading on a light-emitting device delayed sleep and the body clock (Chang et al., 2015)
Wind-down routine	A warm bath or shower, light reading, gentle stretching or journaling	A 10-minute warm bath or shower 1 to 2 hours before bed helped people fall asleep sooner (Haghayegh et al., 2019)
Short nap	10 to 20 minutes in the early afternoon if tired; set an alarm	A 10-minute nap worked best for alertness (Brooks & Lack, 2006); memory was not tested
Pre-sleep review	Spend 5 minutes recalling the day's key learning before sleep	Sleep favoured memories people expected to need later (Wilhelm et al., 2011)

Exercise 10.15 uses **the four quick stress techniques** from Module 10, and 10.16 uses cyclic sighing. The 10-minute plan in 10.15 fits all four into one morning routine.

Table C.10d: Four quick stress techniques (Exercises 10.15 and 10.16)

Technique	Name	How to do it
Technique 1	Cyclic sighing	Breathe in twice through the nose, first fully and then with a short extra sip. Then breathe out slowly through the mouth.
Technique 2	The 4-7-8 breath	Breathe in for a count of 4 and hold for 7. Then breathe out for a count of 8.
Technique 3	Progressive muscle relaxation	Tense and release each major muscle group in turn, from feet to head. Hold each tension for about 5 seconds before letting go.
Technique 4	Mindful breathing (5 minutes)	Sit comfortably. Focus on the feeling of air at the nostrils or the chest rising and falling.

The adaptive memory module keeps what you know up to date. **Its drills and its four checklists run from a weekly 15-minute check to a half-day yearly overhaul.** The checklist items keep the book's own first-person wording, because you tick them for yourself.

Table C.11: Module 11, The Adaptive Memory

Topic	Exercise	Sub-skill	Format	Time	Level
Your Knowledge Inventory	11.1, The Knowledge Domain Map. 1. In your Memory Journal, start a section called "Knowledge Inventory". Draw 6 columns. Label them Domain (an area of knowledge, such as a field or a skill), Core Beliefs, Source, Year Learned, Last Checked and Decay Rate. 2. List your top 10 work domains. These are the areas where	Updating and flexibility	Paper	Your choice	Any

you judge, advise or act on what you believe. Examples include your field's best practices, your technical skills and your view of your market.
3. For each domain, list 3 to 5 of your firmest beliefs or models. These are the ideas you act on without thinking twice.
4. For each belief, note where it came from. It might be a course, a book, a mentor or your own experience. Then note when you last saw evidence that confirmed or changed it.
5. Give each domain a decay rate of High, Medium or Low. High fits areas that change fast, such as technology, medical guidelines, markets and law. Medium fits areas such as management, finance and science. Low fits slow areas, such as basic maths and historical facts.
6. Review the

	list. Mark in red any High-decay belief older than 3 years. Do the same for any Medium-decay belief older than 7 years. These cut-offs are my suggestion. These beliefs are the ones most likely to be out of date. They may be costing you accuracy without your knowing.				
Factual Update Drills	11.2, The Overwrite Drill. 1. Choose one belief from your Knowledge Inventory that you marked as likely out of date. Check its current state in two or three trusted sources. 2. In your Memory Journal, write the old belief as one clear sentence. Underline it, then draw one line through it. 3. Write the updated belief just below it, in a different colour if you can. This is the new version you will learn. 4. Build a vivid memory palace image for the updated belief.	Updating and flexibility	Paper	Set in the steps	Advanced

	In my method, the new image replaces the old one. Picture the old belief being torn down. Then picture the new belief being built in its place. 5. Test yourself 24 hours later. Write the updated belief from memory without your notes. If the old belief comes back instead, repeat the drill with a stronger image. 6. Log the update in your Knowledge Inventory, with today's date under "Last Checked".				
Factual Update Drills	11.3, The Contradiction Scan. 1. Set a timer for 20 minutes. Your only task is to look for evidence against something you believe about your work. 2. Start with the High-decay domains in your Knowledge Inventory. Look for recent meta-analyses that revise past findings. Also look for debates on settled	Updating and flexibility	Paper	Set in the steps	Any

	questions and for new rules or guidelines. 3. For each piece of evidence, write a entry. Use four parts: old belief, new evidence, strength of evidence and your updated position. Rate strength as strong, moderate or early. 4. Do not change a belief because of one early study. Rate the evidence honestly. “Early evidence suggests X” is a fair updated position. The aim is honest thinking. It is not about changing your mind often. 5. Run this scan once a week in your fastest-changing work domain. Over four weeks, you will have reviewed more than 20 of your working beliefs.				
Factual Update Drills	11.4, The Half-Life Timer. 1. For each key fact you learn, add a “best before” note in your Memory Journal. Examples include a statistic, a	Updating and flexibility	With others	Set in the steps	Expert

guideline, a best practice or a research finding. Use this format: Fact, Date Learned and Review By. Base the review date on the domain's decay rate. 2. Set a repeating calendar reminder for each review date. When it comes, spend 5 minutes checking whether the fact still holds. If it has changed, use the Overwrite Drill. If not, set a new review date. 3. After 3 months, review your timer log. Note which domains produce the most updates. These are the areas where your knowledge drifts most. 4. Start a "Superseded" section in your Memory Journal for beliefs you have replaced. Review it every quarter. A longer list shows that you are keeping your knowledge up to date. 5. Each week, share one

	replaced belief with a colleague or study partner. Explain what changed and why. In my view, teaching the change helps the new version stick.				
Model Revision Exercises	11.5, The Model Autopsy. 1. Choose one past prediction that turned out badly wrong. It might be a work judgement, a business forecast or a personal decision. 2. Write a model autopsy. Asking why it went wrong is not enough. Ask which mental model produced the prediction, and what hidden assumptions it held. Name the model in one line, such as “I assumed this because I believed that.” 3. Find the assumption that failed. Was it an outdated fact or a flawed idea of cause and effect? Was it a lesson taken from a different setting? Was it a blind spot, a part of your	Updating and flexibility	Paper	Your choice	Advanced

	own thinking that you cannot see, that you had never examined? 4. Write the revised model in one paragraph. Describe how you now understand the area that produced the wrong prediction. Be precise, because vague revisions do not prevent the same error. 5. Store the revised model at one station of a memory palace. Use an image that links the old model to the reason it failed. Let the image lead on to the new model. 6. Test yourself six months later. Try to recall the revised model and explain why the old one failed. If you can, the update has lasted. If the old model comes back, the new one needs more practice.				
Model Revision Exercises	11.6, The Assumption Inversion. 1. Choose one area where you hold	Updating and flexibility	Paper	Set in the steps	Any

strong beliefs. It might be your field, a personal philosophy or an area of expertise. Write down the 5 assumptions behind your approach to it. 2. For each assumption, write its opposite. If you believe one thing causes another, write that it does not. If you believe one approach is best, write that another one is better. 3. Spend 3 minutes on each reversed assumption. List every case, example or piece of evidence that would support it. 4. Judge honestly. Did you find more support than you expected? Had you been recalling only the evidence that agreed with you? 5. You do not have to change your beliefs after this exercise. You do have to hold them more loosely than before. You are now aware of the

	evidence against them that you had set aside. 6. Repeat for a different area each week. After a month, you will have checked four of your most important areas of knowledge.				
Model Revision Exercises	11.7, The Paradigm Shift Timeline. 1. Choose a field you work in or study. Look into its history and find 3 major paradigm shifts. These are times when the field's basic model was overturned and replaced. 2. For each shift, answer three questions. How long did the old model last after evidence against it first appeared? What kept it in place, such as institutions, habits of mind or money? Finally, note the people who updated early in each case. What let them change while most people kept the old model? 3. Now apply this to the	Updating and flexibility	Paper	Set in the steps	Any

	present. Find one leading model in your field that has loose ends. It may fail to explain some things well. People in the field may tend to dismiss its exceptions. This model is your candidate for the next shift. 4. Write a “Future Correction” entry in your Memory Journal. Name the belief you hold now and the evidence that might overturn it. Then name what you will watch for over the next 12 months. 5. Review the entry after 12 months. Whether or not the model changed, you have kept its limits in view. In my view, this habit makes it easier to update when change does come.				
Flexibility and Speed Drills	11.8, The 5-Minute Reframe Sprint. 1. Set a timer for 5 minutes. Choose a current situation at work. It might be a problem,	Updating and flexibility	Paper	5 minutes	Any

a project, a relationship or a strategy. 2. In minute 1, explain the situation as you see it now. 3. In minute 2, explain it as your strongest critic or rival would. This is someone who thinks the opposite of your approach is right. 4. In minute 3, explain it as a complete outsider with no knowledge of the field. 5. In minute 4, assume your current model is wrong and always has been. Explain how the situation looks from there. Stay with this view for the full minute, even if it feels uncomfortable. 6. In minute 5, write one sentence. Say what the four views showed together that your first view did not. 7. Run this drill 3 times a week on different situations. After 4 weeks, check whether taking an opposing view feels less threatening than before.

	Notice whether it has become more useful too.				
Flexibility and Speed Drills	11.9, The Rolling News Update Protocol. 1. Choose your top 3 work domains. These are the areas where staying current is most important. 2. For each domain, find 2 good, current sources. These might be journals, newsletters, podcasts or experts. Pick sources at the edge of the field that push back on your views. Avoid feeds chosen for you by an algorithm. 3. Each week, spend 15 minutes per domain in “active update mode”. Read for contradiction, not confirmation. Look for content that challenges, changes or replaces what you believe. 4. For each new finding that goes against your views, take three quick steps. Note it in one	Updating and flexibility	Paper	Set in the steps	Advanced

	sentence in your journal, starting “New evidence suggests”. Rate it as strong, moderate or early. Then link it to the belief in your Knowledge Inventory that it affects. These links show which beliefs are under the most pressure. 5. At the end of each month, count how many inventory items your reading touched. If the count is under 3 per domain, your sources may mostly agree with you. Look for sources that disagree with you more. 6. Each quarter, turn your strongest new findings into memory palace updates with the Overwrite Drill. This moves them from your notes into long-term memory.				
Flexibility and Speed Drills	11.10, The Belief Version Log. 1. In your Memory Journal, start a “Belief Version Log”. This is a running record	Updating and flexibility	With others	Set in the steps	Any

of major changes in your thinking. 2. For each entry, record six things. Note the domain, your original belief and your current belief. Then note what changed it, the date and your confidence from 0 to 100%. 3. Aim for at least one real entry a month. It should be a belief you truly held. You should have revised it because of new evidence or experience. 4. After 12 months, review the log. Check your average confidence. Notice whether your revisions match the evidence, or whether they look random. Strong evidence should bring confident revisions, and early evidence should bring cautious ones. 5. Once a quarter, share the log with a colleague or mentor you trust. Ask whether there are beliefs you

	should be updating but are not. An outside view can find blind spots that your own review misses. Note any belief they name and add it to your inventory. 6. In my view, the log is a record of your intellectual honesty. It shows that you change your mind when the evidence calls for it.				
Flexibility and Speed Drills	11.11, The Structured Uncertainty Drill. 1. Choose 10 beliefs from your Knowledge Inventory. For each, write how sure you are that it is still accurate. Use a scale from 0 to 100%. 2. Sort each belief into one of four zones. Established (85 to 100%) is core knowledge you would stake your name on. Working (60 to 84%) is your best current model, used with its limits in mind. 3. Provisional (40 to 59%) is truly uncertain and held lightly.	Updating and flexibility	Paper	Set in the steps	Any

	Suspect (below 40%) is marked for checking first. The zones show at a glance where to spend your checking time. 4. Lower each Established belief in a High-decay domain by 15 points. Skip this if you checked it in the last 12 months. This step accounts for knowledge going out of date. 5. Focus your next round of checks on the Suspect zone. In my view, these beliefs are the most likely to cause hidden errors. They can affect your thinking and decisions without your noticing. 6. Run the full 10-belief drill each month and track your average over time. If it stays above 80%, I suggest you may be overconfident.				
Adaptive Memory Checklists	Weekly Knowledge Currency Check. Work through these seven items every Monday morning. 1.	Updating and flexibility	Checklist	15 minutes	Any

Find one belief I acted on last week without checking it first. Was it still current? 2. Check one item in my Knowledge Inventory that is overdue for review. Use the Decay Rate Framework. 3. Scan one good source in my fastest-changing work domain. Look for anything that contradicts or updates what I know. 4. Write one entry in my Rolling News Update log. Do this even if it confirms a belief and changes nothing. 5. Ask whether anything last week went against an assumption I hold. If so, note it. If nothing comes to mind, I am probably not looking hard enough (my suggestion). 6. Keep any belief that looks out of date for the monthly audit. There, I can run a full Overwrite Drill on it. 7. Rate my knowledge

	currency this week. Am I more up to date than last week, the same or further behind?				
Adaptive Memory Checklists	Monthly Model Audit. Work through these eight items on the first Saturday of each month. 1. Review my Knowledge Inventory. Mark any High-decay item that is past its review date. 2. Run one full Overwrite Drill on the most outdated belief from my weekly checks. 3. Run one Assumption Inversion on my most important work domain. 4. Add at least one entry to my Belief Version Log. If I find no real revision this month, I am not updating. Find out why. 5. Review my list of superseded beliefs. Is it growing? Does its pace suit how fast my field changes? 6. Name one thing I was very sure of 12 months ago	Updating and flexibility	Checklist	45 minutes	Any

	but doubt more now. Note what changed. Was my first level of confidence right? 7. Set review reminders for the next 30 days. Base them on the Half-Life Timer entries that are due. 8. Check whether my sources show me truly challenging material. Am I in a comfortable echo chamber, a place where I mostly hear views like my own?				
Adaptive Memory Checklists	Quarterly Deep Refresh. Work through these ten items once every 3 months. 1. Review my Knowledge Domain Map. Have any domains changed decay rate? Are there new domains I should track? The full rebuild from scratch is part of the yearly overhaul. 2. Run one full Model Autopsy. Choose a key work prediction or decision from the last	Updating and flexibility	Checklist	2 to 3 hours	Any

quarter. 3. Run a Paradigm Shift Timeline on the field most central to my current work. 4. Compare my Belief Version Log with how it looked 3 months ago. Am I updating at the right rate for my field? 5. Pick my top 3 Suspect zone beliefs and research each one. Update or confirm each with dated evidence. 6. Run the Structured Uncertainty Drill across my whole Knowledge Inventory. Reset all my confidence ratings. 7. Find one domain where I have been coasting on old knowledge. Plan a catch-up session within the next 2 weeks and put it in my calendar. 8. Check whether my memory training methods need updating. Are they still in line with current best practice? Note any new methods worth adding, and try one in the

	coming quarter. 9. Ask a colleague, mentor or partner I trust one question. In what area has my thinking become dated or rigid? Listen without defending myself. 10. Write a one-paragraph “State of My Knowledge” summary. Note what I know well and what I hold provisionally. Then note what I still need to learn.				
Adaptive Memory Checklists	Annual Knowledge Overhaul. Work through these nine items in December or January. 1. Build a new Knowledge Domain Map from scratch, without updating the old one. Compare it with last year’s map to see what has truly changed. 2. Work out my update rate for the year. Count my Overwrite Drills, Belief Version Log entries and Model Autopsies. Does this rate	Updating and flexibility	Checklist	Half a day	Any

suit how fast my field changes? 3. Name the most important belief I revised this year. How did the change affect my actions, decisions or results? 4. Review my archive of superseded beliefs. Which ones lasted longest before I updated them? What does this show about my blind spots? 5. Name two domains I neglected this year. In each, I knew my knowledge was dated but avoided updating. Make a dated catch-up plan for each. 6. Update my decay rates. Have any domains sped up? Have my sources kept pace with my field? 7. Set goals for the coming year. Include weekly and monthly upkeep hours and a target number of Belief Version Log entries. Name the domains that need the most work. 8. Write

	my “Epistemic Will” for the year (epistemic means relating to knowledge and belief). List the 3 most important beliefs I hold about my field. Give each an honest confidence rating, and note what would change it. 9. Share this review with a mentor, a learning partner or a group in my field.

Module 9 covers tools and resources and Module 12 covers the levels. **Neither has a boxed exercise**, so neither has a table here. Appendix E carries the self-check and journal steps from Module 12.

Two count tables close the bank. **Thinking and creativity, brain health and the memory palace have the most rows**, and every sub-skill has at least three. Use the counts to spot a sub-skill you have not tried yet.

Table C.12: Rows by sub-skill

Sub-skill	Rows
Thinking and creativity	28
Brain health and lifestyle	24
Memory palace	21
Updating and flexibility	20
Mnemonics and codes	16
Spaced review and retrieval	16

Work and talks	12
Self-check and progress	11
Attention and intake	11
Working memory	10
Chunking and organising	10
Stories and imagery	10
Reading and study	8
Speed and competition	8
Memory problems	8
Explaining and teaching	6
Names and people	6
AI tools	6
Languages	6
Knowledge systems	3
Total	240

The level count shows how the book's practice leans. **Rows that use a palace or spaced review and rows tagged Any are the two largest groups**, with about 90 rows each.

Table C.13: Rows by level

Level	Rows
Step: Try it	10
Step: Starter	10
Step: Middle	10
Step: Advanced	10
Intermediate	20
Advanced	90
Expert	4
Any	86
Total	240

Cleverini game guide

Cleverini is my own platform, so you should know that before you read about its games. **Its memory games come as apps for iPhone and Android, and they are free to play.** A web version is at cleverini.com/games.

> 🗝 **Key Concept:**
> Optional strand. At any level, you can add practice on these games. **This strand is optional**, one part of a level like your self-checks or your journal. I set no game scores for any level, and your level rests on your self-checks and journal, never on game results. If you play, record your results in your journal, with the date.

The book names no single memory game and gives no game benchmarks. **This appendix therefore lists no games and no scores**, and it pairs no game with a paper partner. Treat any game you play as practice in that game.

Offline alternatives

The offline alternatives are the rows tagged Paper and With others. **The rows tagged Paper need only a pen, paper and the material you want to learn**, and the rows tagged With others need a partner or a group.



A partner reads a list of words aloud, one per second.

The self-check in Module 12 needs no screen. **It tests short-term memory, long-term memory and finding information**, alone or with a partner who gets the test ready. Appendix E sets out the three parts and the journal that holds your results.

Key idea:

Pick an exercise by sub-skill, level and time, and treat any game you play as optional practice, recorded in your journal with the date.

D. Practice Tasks with Worked Examples

A memory method is easier to use once you have **watched it work on real material**. Each example below walks through one method from the book with the book's own material, then ends with a practice task you can try straight away.

> **Key Concept:**
> How to use these examples. **Read the worked example first, then do the practice task** under it. The From column in Table D.1 names the section or exercise behind each method. The scores in Example D.7 are made up to show the sum and come from no study.

Table D.1: The worked examples

Example	Method	From
D.1 Six letters, two chunks	Chunking	3.1.1
D.2 A number as words	The Major System	Exercises 3.5b and 4.2b
D.3 The planets in your home	The memory palace	Exercise 3.2
D.4 Ten headlines on ten pegs	The peg system	Exercise 3.5
D.5 A card through the boxes	The Leitner Box	Exercise 3.8b
D.6 Choosing review gaps	Spaced repetition	3.4.2 and Module 4
D.7 A week on the scorecard	The lifestyle scorecard	Exercise 10.18

D.1 Six letters, two chunks

Take the letter string **B-B-C-I-B-M**. As raw letters, it takes 6 slots in short-term memory. If you recognise BBC and IBM, it takes only 2 slots. Nothing is lost, and there are fewer things to hold.

The working is two questions. **Which groups mean something to you, and how many groups are left?** Here the answer is two familiar names, so 6 items become 2 chunks. Today's best estimate puts the limit of short-term memory nearer 4 chunks (Cowan, 2001), so 2 chunks leave room to spare.

> ✎ **Exercise:**
>
> Practice task. Take a long string you need, such as a reference number. **Split it into groups that mean something to you** and count the chunks before and after.

D.2 A number as words

The Major System swaps each digit for a consonant sound. **0 is s or z, 1 is t or d, 2 is n, 3 is m and 4 is r.** 5 is l, 6 is sh, ch or j, 7 is k or g, 8 is f or v and 9 is p or b. Vowels add no number.

Take **3141**, the first 4 digits of pi. “Mature” gives m-t-r, or 314, and “tie” gives t, or 1, so 3141 becomes “mature tie”. Pairs work the same way. 58 becomes “lava” (l is 5, v is 8) and 23 becomes “name” (n is 2, m is 3).

3141 as words



So 3141 becomes ‘mature tie’.

> **Exercise:**
>
> Practice task. Practise on numbers that are not secret. **Do not store PINs or passport numbers this way.** Turn one four-digit number into a picture that means something.

D.3 The planets in your home

Choose your home as your palace and **pick out 10 stations on a fixed route**. The 10 planets and dwarf planets in order are Mercury, Venus, Earth, Mars, Ceres, Jupiter, Saturn, Uranus, Neptune and Pluto. Each one needs a silly picture at its station.

The first two stations show the working. **Mercury is a silver thermometer exploding at your front door.** Venus is a beautiful woman painting your coat rack. The item does something to the station, and never just sits there, because images that interact are remembered better (Wollen et al., 1972).



A silver thermometer bursts at a front door, the first station of a home palace.

> Exercise:
>
> Practice task. Finish the route for all ten, **walk it in your mind three times**, then look away and write the ten from memory. To keep the palace, review it after about 1 day, 3 days and 7 days.

D.4 Ten headlines on ten pegs

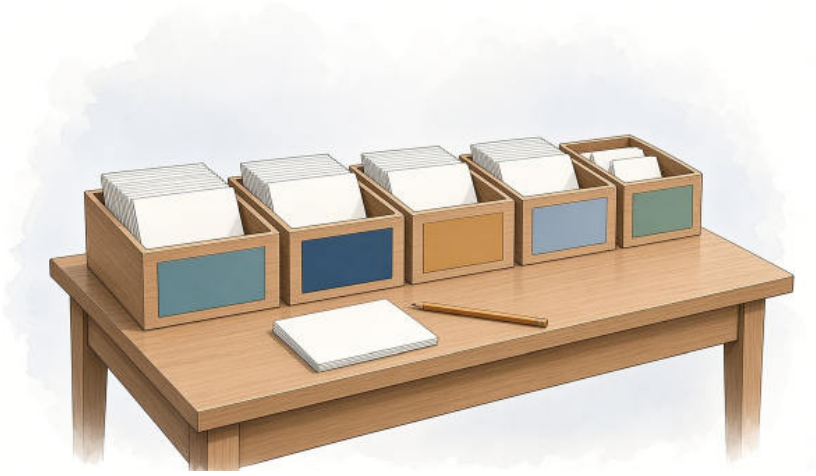
The peg words are learned by heart first. **1 is bun, 2 is shoe, 3 is tree, 4 is door and 5 is hive.** 6 is sticks, 7 is heaven, 8 is gate, 9 is vine and 10 is hen. Each news headline then hangs on one peg with a bright picture.

> Exercise:
>
> 3.5, Peg System Drill.
>
> 1. Memorise your 10 peg words. 1=bun, 2=shoe, 3=tree, 4=door, 5=hive; 6=sticks, 7=heaven, 8=gate, 9=vine, 10=hen.
> 2. Use them to memorise today's top 10 news headlines. Put one on each peg, using a bright picture.

3. Test yourself tomorrow morning. How many headlines can you recall?
4. For an advanced step, extend your peg system to 100. Search 'Major System' online. It turns numbers into consonant sounds, which gives you pegs for 00 to 99.

D.5 A card through the boxes

The Leitner Box has **five boxes**, reviewed daily, every 2 days, weekly, fortnightly and monthly. All new cards start in Box 1. Cards answered correctly move up to the next box, and cards answered wrongly go back to Box 1.



Flashcards sorted into five labelled boxes on a desk.

You recall one card on day 1, so it moves to Box 2, the 2-day box. You recall it again and it moves to Box 3, the weekly box. If you then miss it, it goes straight back to Box 1 and starts again.

> Exercise:
>
> Practice task. Write 15 flashcards on material you are studying now and **place them all in Box 1**. Once set up, the system takes less than 10 minutes a day.

D.6 Choosing review gaps

The best gap **grows with how long you want to remember** (Cepeda et al., 2008). For a test a week away, the best gap was 1 to 3 days. For a test a year away, it was about 3 to 5 weeks.

Work it for two goals. **For a quiz next Friday, review again 1 to 3 days after you study.** For a skill you want in a year, leave about 3 to 5 weeks between reviews.

> Key Concept:
>
> Card load. With a flashcard app, **the pace of new cards sets the load**. The Anki Manual says 20 new cards a day means about 200 daily reviews, and about 10 a day keeps reviews near 100.

> Exercise:
>
> Practice task. Name **one thing you must keep for a week** and one you must keep for a year, and write the next review date for each in your journal. Use the gaps above, 1 to 3 days for the week and about 3 to 5 weeks for the year.

D.7 A week on the scorecard

The lifestyle scorecard gives **each of four factors a score from 0 to 3**, for a total out of 12. Say you met the MIND targets on 3 days, which

scores 2. You had 4 aerobic sessions of 20 minutes or longer, which scores 3.

The rest of the week follows the same rules. **You slept 6 to 7 hours on 3 nights, which scores 2**, and used a stress technique on 2 days, which scores 1. The total is 2 + 3 + 2 + 1 = 8. The book suggests aiming for 9 or more, so this week falls one point short.

> Exercise:
>
> Practice task. Fill in **your own scorecard this Sunday** in Table B.6, then compare the total with your memory scores that week.

Key idea:

Watch a method work on the book's own material, then try it on yours and check the result from memory.

E. Progress Journal and Practitioner-Level Rubrics

Memory skill **builds in stages**, like learning to swim, from your first width of the pool to a long swim. A level is a record of your practice, and your journal holds the evidence for it. The sheets here are the level tables and the journal steps from Module 12, ready to copy.



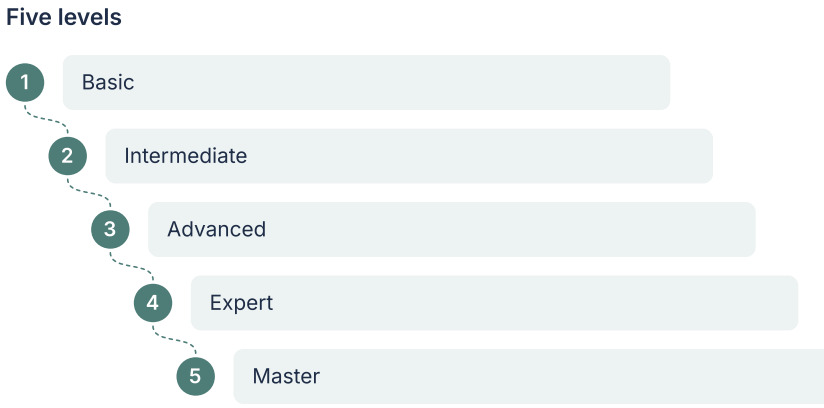
A learner writes in her Memory Journal, with the guidebook open beside her.

> **Key Concept:**
>
> How to use these sheets. **The five levels describe stages of practice, from Basic to Master.** No study has set norms for them, so treat them as a guide. You judge your own level, alone or with a partner, and a level does not predict success in any job.

The first table sets out **what you can do at each level**. Each one has its own typical methods, from simple strategies at Basic to several memory systems and teaching others at Expert.

Table E.1: The five levels (Module 12.1)

Level	What you can do	Main feature
Basic	Use simple memory methods on short lists	You use simple strategies reliably
Intermediate	Recall longer lists and keep them for days	You use chunking (grouping small bits into bigger pieces that mean something) and simple memory aids consistently
Advanced	Keep larger sets of material for weeks	You use a memory palace (places you walk through in your head, like rooms in a house, each one holding something to remember) and spaced review as routine
Expert	Keep large sets of material for months	You use several memory systems and teach others
Master	Recall large, well-organised bodies of knowledge quickly	You keep up all of the above over time



See the criteria for each level.

Expert memory tends to be **tied to one field** (Chase & Simon, 1973). Training also rarely carries over to unrelated skills (Sala & Gobet, 2017).

The criteria describe each level **in words**, like a ruler with marks and no numbers. Quick recall, long-term recall and recall speed are the three things to check at each level. The criteria have no exam behind them.

Table E.2: Level criteria (Module 12.2)

Level	Quick recall (just after study)	Long-term recall	Recall speed
Basic	A short list, recalled without error	A short list, kept for a short time	Steady, with some pauses
Intermediate	A longer list, using chunking	A longer list, kept for days	Faster, with fewer pauses
Advanced	A long list, using a memory palace	A large set, kept for weeks	Quick and sure
Expert	A very long list, using several systems	A large set, kept for months	Very quick
Master	Long lists, reliably, on separate days	A large body of material, kept for many months	Near the limit of your practice

Short-term memory holds **only about 4 chunks at once** (Cowan, 2001). Items you do not rehearse are mostly lost within about 18

seconds (Peterson & Peterson, 1959). Holding material for many minutes therefore draws on long-term memory.

Testing yourself

You check your level with **self-tests**, like timing your own run with a stopwatch. Alone, choose a quiet place with no notes or devices nearby, use a timer and get the test ready before you start. With a partner, your partner gets the test ready, times you and checks your answers.

A partner makes the test **fairer**, because you cannot pick easy material for yourself. Testing alone still works if you get the test ready well in advance. Use the same method each time, so your results can be compared.



A learner and a partner read through a table of levels together.

Table E.3: The full self-check (Module 12.3.2)

Part	Content	Time	My result and date
Short-term memory	Recall of numbers, words and visual patterns in order, against a timer	About 40 minutes	
Long-term memory	Recall of material from your first study session, checked in later sessions	Spread over follow-up sessions	
Finding information	Fast recall of specific items from large, mixed sets	About 40 minutes	

Space the long-term checks to **match the level** you are testing. A one-week check, for example, cannot test material you are meant to keep for months. The quick-recall tests fit in one sitting.

Module 4 opens its training with **a baseline test** you can repeat later with your full toolkit. It is a simple first entry for the journal below.

> Exercise:
>
> 4.1, Day 1 Baseline Assessment.
>
> 1. Set a timer for 2 minutes. Study the 30 words below. piano, cloud, justice, salmon, umbrella, centenary, bronze, whistle, cathedral, parliament; asteroid, lemon, violin, democracy, eclipse, marble, hurricane, portrait, labyrinth, compass; telegraph, cinnamon, volcano, sapphire, theorem, glacier, lantern, mosaic, pendulum, meridian.
> 2. Look away from the list. Write every word you can recall. Score yourself out of 30.
> 3. Save this score. At the end of Week 4, you will repeat this list with your full toolkit.

4. Record your score, the date and any notes in your Memory Journal.

The journal

Record every result **in your journal on the day**. Over time, the record shows where you are improving and where to practise next. It is also the evidence for the level you claim.

Table E.4: A journal page

Date	Test or activity	Material and method	Result	Alone or with a partner	Notes
	Optional Cleverini game (no game scores count for any level, see 12.3.2 and Appendix C)				

The Cleverini strand is **optional**. Your level rests on your self-checks and journal, never on game results. If you play, record your results in your journal, with the date.

Keeping your level

A level is like a lawn, which **stays neat only while you keep mowing it**. There is no expiry date and nothing to renew. Recheck your level from time to time with the self-check, and if a result slips, practise that skill and test again.

Table E.5: Activities that keep a level (Module 12.3.3)

Activity	What to record	Date
Regular practice with my methods	The method, the material and your score	
Teaching a session on memory methods	The topic, the length and who attended	
Reading a research article on memory	A short summary of what you learned	
Taking part in a memory competition	The event and your results	
Repeating the self-check for your level	The date and your result for each part	

Your journal shows **when you last met each part of your level**. Reaching a level is a sign of progress, and the work goes on after it.

Key idea:

Test yourself the same way each time, with new material, and write every result in your journal on the day.

F. A Short Glossary

THIS GLOSSARY GATHERS **the key words of the book** in one place, like the index cards a student keeps on a desk. Each meaning comes from the book's own glossary or from a definition box in a module, with a pointer to the section where you can read more.

> 🔑 **Key Concept:**
> How to use this glossary. **Look up a word when it stops you, then go back to your practice.** The pointer shows where the idea is explained or used in full.

Memory runs in **three stages**, encoding, storage and retrieval. The first table covers encoding and retrieval, the consolidation that makes new memories last, and the kinds of memory the book describes.

Table F.1: Stages and kinds of memory

Term	Meaning	Where to read more
Encoding	The first stage of memory. Experience is turned into a form the brain can store.	1.2.1
Consolidation	The process that makes new memories stable and lasting. Sleep plays a large part (Rasch & Born, 2013). Quiet waking rest after learning can also help (Dewar et al., 2012).	1.2.2
Retrieval	The third stage of memory. Stored information is found and rebuilt, guided by cues and context.	1.2.1
Sensory memory	The briefest kind of memory. It holds raw sense impressions for a fraction of a second, and most are lost.	1.2.2
Short-term memory	A brief store that holds information for a short time without rehearsal. Miller (1956) gave the classic figure of 7, plus or minus 2. Today's best estimate is closer to 4 chunks (Cowan, 2001).	1.2.1 and 12.2
Working memory	A small, active system that holds and works on information during a task. It is closely related to short-term memory, with more focus on processing.	1.2.2
Declarative memory	Memory for facts and events that you can recall on purpose and put into words. It includes episodic and semantic memory.	1.2.2
Episodic memory	Memory for events you lived through, tied to a time and a place. The hippocampus is central to it.	1.2.2
Semantic memory	Memory for general knowledge, such as facts, ideas and language. It is not tied to a personal event.	1.2.2
Non-declarative memory	Memory that shapes behaviour without conscious recall. It includes skills, priming and conditioning.	1.2.2
Procedural memory	Memory for skills, habits and learned sequences. Separate brain systems, including the basal ganglia and cerebellum, support it (Squire, 2004). It is often spared in amnesia.	1.2.2

The second table names **the parts of the brain and its chemical messengers** that Module 1 describes. Some of these terms carry open questions in the research, and the meanings say so.

Table F.2: The brain and memory

Term	Meaning	Where to read more
Acetylcholine	A chemical messenger in the brain that helps with attention. It also helps store new memories, including in the hippocampus (Hasselmo, 2006). It falls in Alzheimer's disease.	1.3.3
Amygdala	An almond-shaped area deep in the brain. It processes emotion and strengthens memories of emotional events.	1.3.1
Anterograde amnesia	The loss of the ability to form new long-term memories after brain injury or disease. Memories from before the injury are often kept.	1.3.2
BDNF (brain-derived neurotrophic factor)	A protein that helps brain cells grow, work and survive. In rats, running raised it in the hippocampus (Neeper et al., 1996). In people, it has been measured in blood (Erickson et al., 2011).	1.3.3
Dopamine	A chemical messenger tied to reward and motivation. It helps store memories of rewarding events.	1.3.3
Glutamate	The main chemical messenger that excites brain cells. It is needed for long-term potentiation, a key process in learning.	1.3.3
Hippocampus	A curved area deep in the brain. It is key for forming new memories of facts and events. It also supports finding your way. It is sensitive to stress and ageing, and it responds to aerobic exercise.	1.3.1
Long-term potentiation (LTP)	A lasting increase in the strength of links between brain cells after repeated activity. It is thought to be a cellular basis of learning.	1.3.3
Neurogenesis	The growth of new brain cells. Whether it continues in the adult human hippocampus is disputed. One study found none in adults (Sorrells et al., 2018), while another found it into old age (Boldrini et al., 2018).	1.3.3
Neuroplasticity	The brain's ability to rewire itself. It forms and changes links in response to learning and experience.	Module 12 glossary

Prefrontal cortex	The front part of the brain's frontal lobe. It supports working memory, planning, decisions and the search for stored memories.	1.3.2
Serotonin	A chemical messenger involved in mood. A major review found no consistent link between serotonin and depression (Moncrieff et al., 2023).	1.3.3
Synaesthesia	A condition in which one sense triggers another, such as numbers having colours. People with synaesthesia tend to show better memory than matched controls (Rothen et al., 2012). In one group study, the gain stayed within the normal range (Rothen & Meier, 2010).	1.1.2

The third table covers **the methods you practise** in the exercises of Appendix C. Each one has its own steps in the modules.

Table F.3: Memory methods

Term	Meaning	Where to read more
Active recall	Bringing information back from memory without looking at the source. A major review rated self-testing among the two most useful study methods (Dunlosky et al., 2013).	3.4.7
Chunking	Grouping single items into larger, meaningful units. This gets around the small capacity of working memory.	3.1.1
Dual coding theory	Paivio's (1971) theory that material stored as both words and images is remembered better. Material stored in one form is remembered less well.	3.2
Elaborative encoding	Linking new information to what you already know, through association, explanation and meaning. It produces deeper, longer-lasting memories.	3.3.1
Memory palace (method of loci)	A method that places items at vivid spots along a familiar route in your mind. A review of 13 trials found a medium-sized benefit (Twomey & Kroneisen, 2021).	3.2.2 and 3.4.5
Spaced repetition	Reviewing material at growing intervals. It uses the spacing effect to improve long-term memory.	3.4.2

Graphic organisers	Diagrams that sort ideas.	3.1.2
SQ4R	An active reading system of six steps, Survey, Question, Read, Recite, Record and Review.	3.4.4
PAO system	A system that gives each card or two-digit number a Person, an Action and an Object.	Module 4, Advanced Memory Techniques

The last table covers **words for practice and progress**, from your first baseline score to the level you judge for yourself in Appendix E. Each of these words comes from a definition box in Modules 4 to 12.

Table F.4: Practice and progress

Term	Meaning	Where to read more
Baseline	Your first score, which later scores are measured against.	Module 4, Daily Memory Exercises
Depth of processing	How deeply you work with information, from noticing how a word looks to understanding its meaning.	Module 4, Why Memory Training Fails, and How to Succeed
Shallow processing	Taking in only the surface of information, so it is stored weakly.	Module 8, Targeted Steps for Specific Memory Problems
Savings	Relearning something faster than it took to learn the first time.	Module 8, Targeted Steps for Specific Memory Problems
Digital tool	An app or program on a phone or computer.	Module 9, Digital Tools and Apps
Lifestyle	How you live each day. It is how you eat, move, sleep and deal with stress.	Module 10, opening
Currency	Here, how well your knowledge matches the world now.	11.2
Model revision	A change to a framework or theory you use.	11.3.2
Information diet	The mix of things you read, watch and listen to.	11.5.1

Level	A stage of memory practice that you judge for yourself.	Module 12 opening and 12.1
Self-assessment	Checking your own level yourself.	12.3.1

Key idea:

Every meaning here comes from the book, and the pointer leads you back to the full explanation.

G. Further Reading

Every work below is **already cited in the book**, so you can follow up any idea from the modules. Each one has a single line on why it is worth your time, and a pointer to the section where the book uses it.

> **Key Concept:**
> How to use this list. **Start with the group that matches what you want to practise next.** The papers go further into the evidence, and the book for general readers is the easiest place to begin.

The first group holds **the classic studies** of how memory works, from Ebbinghaus in 1885 to today's estimate of short-term memory. Five of the eight are used in Module 1.



Ebbinghaus at his desk, testing his own memory for a list, again and again.

Table G.1: How memory works

Work	Why read it
Ebbinghaus, H. (1885). Über das Gedächtnis: Untersuchungen zur experimentellen Psychologie [Memory: A contribution to experimental psychology]. Duncker & Humblot. English translation by H. A. Ruger & C. E. Bussenius, 1913, Teachers College, Columbia University.	The work of the first scientist to study his own memory in a planned, step-by-step way, and the start of the forgetting curve the book returns to in Module 1 and 3.4.2.
Bartlett, F. C. (1932). Remembering: A Study in Experimental and Social Psychology. Cambridge University Press.	The study of how people retell a story and bend it to fit what they know, used in 11.1.
Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. Psychological Review, 63(2), 81-97.	The classic paper on the limits of short-term memory, discussed in 1.2.2 and 3.1.1.
Peterson, L. R., & Peterson, M. J. (1959). Short-term retention of individual verbal items. Journal of Experimental Psychology, 58(3), 193-198.	The finding that items you do not rehearse are mostly lost within about 18 seconds (12.2).
Atkinson, R. C., & Shiffrin, R. M. (1968). Human memory: A proposed system and its control processes. In K. W. Spence & J. T. Spence (Eds.), The Psychology of Learning and Motivation (Vol. 2, pp. 89-195). Academic Press. https://doi.org/10.1016/S0079-7421(08)60422-3	The first careful description of sensory, short-term and long-term memory (1.2.2).

Cowan, N. (2001). The magical number 4 in short-term memory: A reconsideration of mental storage capacity. Behavioral and Brain Sciences, 24(1), 87-114.	The best current estimate of short-term memory, about 4 chunks (1.2.2, 3.1.1 and 12.2).
Baddeley, A. D. (2000). The episodic buffer: A new component of working memory?. Trends in Cognitive Sciences, 4(11), 417-423.	The paper that added the episodic buffer to the working memory model (Module 5, Applied Memory Masterclass).
Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. Journal of Verbal Learning and Verbal Behavior, 11(6), 671-684.	The levels of processing idea behind depth of processing (1.3.1 and Module 4, Why Memory Training Fails).

The second group covers **the memory methods** you practise in Appendix C, and the people who use them at the top level. Three rows look at top memorisers, from brain scans of champions to a journalist's own year of training.

Table G.2: Memory methods and memory experts

Work	Why read it
Paivio, A. (1971). Imagery and Verbal Processes. Holt, Rinehart & Winston.	The founding work on dual coding, storing ideas as both words and images (3.2).
Twomey, C., & Kroneisen, M. (2021). The effectiveness of the loci method as a mnemonic device: Meta-analysis. Quarterly Journal of Experimental Psychology, 74(8), 1317-1326.	The review of trials on the Memory Palace, with its medium-sized benefit and its warning about bias in the studies (1.1.1 and 3.2.1).
Maguire, E. A., Valentine, E. R., Wilding, J. M., & Kapur, N. (2003). Routes to remembering: the brains behind superior memory. Nature Neuroscience, 6(1), 90-95.	The brain scans of top memorisers using the Method of Loci (1.1.1 and 3.2.3).
Dresler, M., Shirer, W. R., Konrad, B. N., et al. (2017). Mnemonic training reshapes brain networks to support superior memory. Neuron, 93(5), 1227-1235. Table S2: the method-of-loci group recalled 26.5 ± 16.2 words out of 72 before training and 62.5 ± 11.1 after, on 20-minute free recall.	The study of memory champions, and of beginners given six weeks of Memory Palace training (1.3 and Module 4, Competition-Style Training).
Chase, W. G., & Simon, H. A. (1973). Perception in chess. Cognitive Psychology, 4(1), 55-81.	The classic study of expert chunking in chess (3.1.1).
Foer, J. (2011). Moonwalking with Einstein: The Art and Science of Remembering Everything. Penguin Press.	A journalist's own story of a year of training before the 2006 USA Memory Championship (1.1.2).

The third group shows **why testing and spacing work**, and how to build cards and reviews that last. Every work here is used in Module 3, 4 or 5.

Table G.3: Study, review and recall

Work	Why read it
Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective study techniques: Promising directions from cognitive and educational psychology. Psychological Science in the Public Interest, 14(1), 4-58.	The major review that rated rereading low and self-testing high among study methods (1.2.1 and 3.4.7).
Roediger, H. L., & Butler, A. C. (2011). The critical role of retrieval practice in long-term retention. Trends in Cognitive Sciences, 15(1), 20-27.	The review of the testing effect, one of the most repeated findings in learning research (Module 5, Memory and Learning).
Karpicke, J. D., & Roediger, H. L. (2008). The critical importance of retrieval for learning. Science, 319(5865), 966-968.	The word-pair study in which testing beat restudying a week later (Module 5, Memory and Learning).
Cepeda, N. J., Pashler, H., Vul, E., Wixted, J. T., & Rohrer, D. (2006). Distributed practice in verbal recall tasks: A review and quantitative synthesis. Psychological Bulletin, 132(3), 354-380.	The large review in which spacing beat cramming, the basis for spaced review in 3.4.2.
Bjork, E. L., & Bjork, R. A. (2011). Making things hard on yourself, but in a good way: Creating desirable difficulties to enhance learning. In M. A. Gernsbacher et al. (Eds.), Psychology and the Real World (pp. 56-64). Worth.	The idea of desirable difficulties, practice that feels harder and helps you learn (Module 4, Daily Memory Exercises).
Wozniak, P. (1999). Effective learning: Twenty rules of formulating knowledge. SuperMemo. (Practitioner guidance, not a study.)	The card-writing rules behind the tip of one fact on each card (Module 4 and Module 7).
Godden, D. R., & Baddeley, A. D. (1975). Context-dependent memory in two natural environments: On land and underwater. British Journal of Psychology, 66(3), 325-331. https://doi.org/10.1111/j.2044-8295.1975.tb01468.x	The divers study showing that recall can depend on where you learn (Module 4 and Module 8).

The last group covers **sleep, exercise, food and training** in later life. Some of these studies only observed people, and the book says so where it uses them.

Table G.4: Health and lifelong memory

Work	Why read it
Rasch, B., & Born, J. (2013). About sleep's role in memory. Physiological Reviews, 93(2), 681-766.	The long review of sleep's role in memory, cited for consolidation in the Module 12 glossary.
Walker, M. (2017). Why we sleep: Unlocking the power of sleep and dreams. Scribner. (A book for general readers.)	A book for general readers on sleep. Module 10 notes that it is often quoted, and the book takes its own figures from the original studies.
Erickson, K. I., et al. (2011). Exercise training increases size of hippocampus and improves memory. Proceedings of the National Academy of Sciences, 108(7), 3017-3022.	The trial in which a year of aerobic exercise grew the hippocampus in older adults (Module 10, Physical Activity and Memory).
Morris, M. C., et al. (2015). MIND diet associated with reduced incidence of Alzheimer's disease. Alzheimer's & Dementia, 11(9), 1007-1014.	The observational study behind the MIND diet, with the limits the book points out (Module 10, Nutrition and Memory).
Willis, S. L., Tennstedt, S. L., Marsiske, M., et al. (2006). Long-term effects of cognitive training on everyday functional outcomes in older adults (ACTIVE trial). JAMA, 296(23), 2805-2814.	The large trial of mental training in older adults and its 5-year results (Module 8, Memory and Ageing).
Sala, G., & Gobet, F. (2017). Does far transfer exist? Negative evidence from chess, music, and working memory training. Current Directions in Psychological Science, 26(6), 515-520.	The evidence that training rarely carries over to unrelated skills (12.1).



A bookshelf of the year’s books beside a reading log.

Key idea:

Pick one work from the group you need next, and use the section pointer to see how the book drew on it.

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