Chapter 8 Memory

**Memory**:

The structures and processes involved in the acquisition, storage and retrieval of information

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**Sensory Memory**:

Briefly hold sensory information that has been perceived for a very short period of time

This time period is less than a millisecond.

Sensory memory plays in a vital role to **take in information** and **interact with the world** around us.

Sperling’s experiment:

A series of letters only visible for a fraction of a second, let subjects report the letter they recognize

Among the 12 letters presented, subjects can report about 4.5 items

Problem:

During the time it takes for the subjects to report the letters, the rest of the information stored in the sensory memory starts to fade away

Additional experiment:

Letters were presented in rows and subjects were asked to only report the top, middle or bottom row.

There is a high-pitched, median or low-pitched tone associated with the corresponding row. The subjects are asked to report the letters in that row after hearing the corresponding tone.

This time the subjects were able to remember the prompted letters relatively easily.

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This one-third of a second indicates the time of the sensory memory.

Since the participants were focusing on the indicated tone before their visual memory faded, they were able to recall the information

**Iconic memory**:

Visual sensory memory, within 250-500 ms

**Echoic memory**:

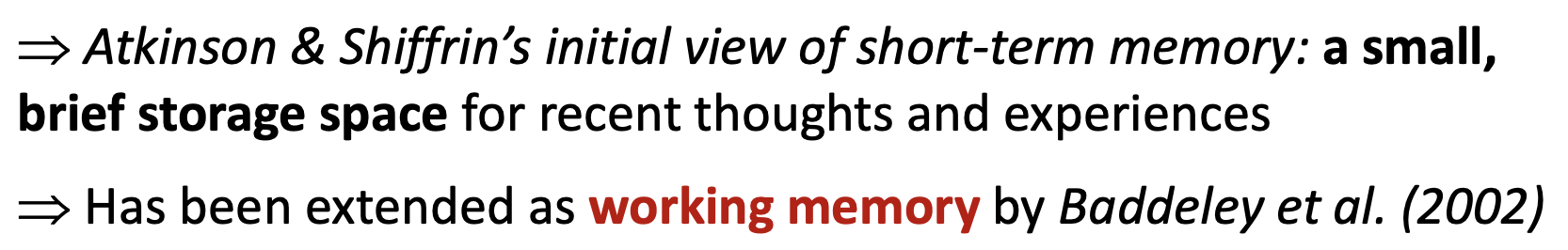
Auditory sensory memory, within 3-4 s

**Haptic memory**:

Tactile sensory memory, last 2 s

Sensory memory

* Automatic
* Large storage, high accuracy
* Very short duration
* Modality-specific (Iconic, Echoic, Haptic)

Short-term memory/ Working memory****

**Working memory**:

Maintains information available to perform tasks relative to calculus, reasoning, and learning

Making sense of the new input and linking it with long-term memory

Also works in opposite direction by processing already-stored information

Without **rehearsal** (focused attention), information often fades

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Memory span: numbers of stuff you can remember

**Chunking**:

Organizing items into **familiar, manageable** units. It can occur automatically or consciously

**Retention interval**:

In short-term memory, the period between exposure to information and the recall of that information

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(Peterson & Peterson; Brown)

Working memory **capacity varies**, depending on age and other factors

Working memory capacity is linked to intelligence level

Short-term memory:

* Conscious
* Limited storage: 4-9 chunks of information
* Short duration: < 1min

Improving working memory:

**Training**: grow memory capacity

**Chunking**: making chunks of very different items

**Mnemonics**: memory aids, especially techniques using vivid imagery and organizational devices

* Turn abstract words into image
* Use acronyms to remember lists
* Palace technique

**Hierarchies**: grouping words and concepts, organizing, making connections (eg: mental maps)

**Long-term memory**:

Unlimited Capacity, unlimited Duration

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**Encoding**:

**Effortful processing**:

Encoding requires **attention** and **conscious** effort.

Eg: learning course content

**Automatic processing**:

**Unconscious** encoding of **incidental** information

(strongly emotional event)

* Space (where the events happen)

Sit in the same spot during exam enhance your encoding process

* Time (sequence of events)
* Frequency (times it happen)

2 levels of encoding

**Shallow processing**:

Encoding based on the appearance of words

**Deep processing**:

Encoding semantically based on the **meaning of words**

**It tends to yield the best situation**

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How to improve Encoding?

**Ebbinghaus’ retention curve**

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The more repetitions you do on the first day when you practice a list of nonsense syllables, the less time you required to relearn it on Day 2.

Speed of relearning is one measure of memory retention

**Relearning**: relearning things gets easier and faster as the number of repetitions increase

**Ebbinghaus’ Forgetting curve**:

Chart, line chart

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More time has passed, the easier it takes to relearn

**Mass practice**:

cramming, speedy short learning but also forgets quickly

last-minute cramming gives less than stellar results in the exam

**Distributed practice**:

We retain information better when encoding is distributed over time

* **Spacing effect**

Distributed study yields better long-term memory retention

Forgetting curve

If you review on a regular basis, you can reactivate to the material, and it takes you less time to review it again

* **Testing effect**

Testing improves learning and memory

Use deep semantic processing

* **Makes a material meaningful**

When subjects know the meaning of the text, they remember much more compared to the time when they don’t find it meaningful

Learning meaningful material requires one-tenth of the effort

* **Self-reference effect**

Most people excel at remembering **personal relevant** information

We are more likely to remember the adjectives when they’re used to describe ourselves.

The self-reference effect is especially strong in individualist western culture

* **Active learning**

You remember the material deeper and better when you have to build it up yourself: from collecting the material to making associations with your life

**Storage**:

Memories are held in storage by a **web of associations**, each piece of the information are interconnected with others.

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**Retrieval**:

Getting information out of memory to use it

To a psychologist, evidence that learning persists includes these three measures of retention:

***Recall***:

***Retrieving*** information that’s not currently in your consciousness awareness but was learning earlier.

A fill-in-the-blank/short-answer question tests your recall

***Recognition*:**

***Identifying*** items previously learned.

A multiple-choice question tests your recognition

**Relearning**:

Learning something **more quickly** when you have learned it before.

In order to be prepared for an upcoming test, it’s better to use Recall (short-answer or fill-in-the-blank questions) rather than Recognition (multiple-choice questions).

Recalling is **harder than** recognizing material. If you can recall the information, that means your retention of the material is better than you could recognize it.

We recognize more things than we can recall

**Retrieval cues**:

**Stimuli** that help retrieve a certain memory

* **Priming**

The activation, often **unconsciously**, of certain associations, thus predisposing one’s perception, memory or responseTimeline

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Association makes priming also part of our memory

* **Context-dependent memory**

Putting yourself back in the context where you experienced something can prime memory retrieved

**Encoding specificity principle**:

**Cues and context** specific to a particular memory will be more effective in helping us recall it

**Ex**: after pigeon acknowledge that pecking at the bottom will evoke food feeding, it pecks more at the bottom

* **State-dependent memory**

What we learned in one state may be more easily recalled when we’re in that state again

**Mood congruent memory**:

Easier to recall experiences that are consistent with your current mood

* **Serial Position Effect**

Our tendency to recall best **the last (recency effect) and the first (primary effect) item** on the list

Chart, line chart

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Diagram

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Implicit memories are **non-conscious** and **automatic**

* You can’t change one person’s associations from the past easily
* Memory is **reconstructive**

Implicit memory is a type of automatic processing

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**Procedural memory**:

* Some process become automatic as they develop
* Implicit knowledge of skills

Eg: playing an instrument Doctor doing surgery

Tie shoelaces

For some of the skills, we remember the learning processes, for others, we forgot

* Knowledge built on motor experience
* Learned associations between movement and sensory effect

Eg: learning how to drive:

Associate movement and the result of movement

After you become a experienced driver, you focus on the road only

Procedural memory=> implicit knowledge = GOOD INTUITION

Best surgeons do surgeries intuitively

You have the ability to react very quickly, and you make smart judgements

If you try to consciously do a thing when your action is automatic, you will have worse performance than your ideal

Implicit memory

**Priming**:

Activating a concept through its associations with another concept

Propaganda effect:

We are more likely to rate something as being true simply because we have been exposed to it before

**Classical Conditioning**:

Classical conditioning is often linked to emotional reactions

* Can be considered as implicit memory **ONLY** when there’s no awareness of what is causing the conditional response

**Frontal lobe** + **hippocampus** (register and temporary holds the element of a to-be-remembered episode of memory)

Sleep reactivates recent experiences in the hippocampus and shift them to the permanent storage.

It supports the memory consolidation process

Emotions-related memories (eg: Episodic memory)

The amygdala releases stress hormones to remember certain events,

While this process can disrupt the memory forming of information

Emotional memories are stronger not because the emotions make it stronger. It’s the non-conscious processes that make the conscious memories stronger.

**Flashbulb memory**:

A clear memory of an emotionally significant event with the details unclear

Cerebellum and basal ganglia

**Cerebellum**: forming and storing implicit memories created by classical conditioning (forming associations)

**Basal ganglia**: involved in motor movement, facilitates of our procedural memories for skills

For conscious awareness of procedural learning, the basal ganglia receive input from the cortex but do not return the information.

Ex: you need basal ganglia to learn how to ride a bike

**Long-term Potentiation**

An increase in a cell’s firing potential after brief, rapid stimulation

As the signals travel back and forth the synapses increase, the synapse becomes stronger and more likely to be activated in the future.

**Forget**

If we remember everything, we’ll have difficulties to think abstractly:

Generalizing, organizing, evaluating

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**Attention-based**:

We remember things we focus, and forget the things we don’t care

Age can affect encoding efficiency

Ebbinghaus’s forgetting curve

Chart, line chart

Description automatically generatedif you don’t repeat the act regularly to reinforce the information, you might lose it entirely.

Retrieval Failure

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* Interference

**Proactive interference**:

Old learning disrupts the recall of new information

An old password prevents you from learning a new password

**Retroactive interference**:

New learning disrupts the recall of old information

A new password prevents you from recalling the old password

Chart, line chart

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Forgetting occurs more rapidly after staying awake and gets involved in other activities

Interference is different from positive transfer

**Positive transfer**:

Previously learned info often facilitates learning new information

Eg: learning French helps learning Italian

* **Motivated forgetting**

We succeed in forgetting **unwanted** neural information

Debatable concept:

Repression:

Our basic defense mechanism that banishes anxiety-arousing thoughts

Memory construction errors and false memories

We infer our past from stored information.

You can never remember what happened exactly

**Reconsolidation**:

The process of in which previously stored memories, when retrieved, are potentially altered before being stored again

**Misleading effect**:

Misleading info corrupt the memory of that event and cause false memory

**Imagined effect**:

Imagining an event may cause it to become memories. The more vividly our imagination is, the more likely it becomes memories.

When people are asked whether there was a car crush happening, if the questioner uses “smash” instead of “hit”, people are more likely to recall the hitting scene which actually did not happen.

If we want to avoid misleading effect, we should stop asking leading questions

**Source amnesia**:

Faulty memory of how, where and when information was learned or imagined

**Deja-vu**: the eerie sense of “I’ve experienced before”

Cues from the current situation may unconsciously trigger retrieval of an earlier experience

Memory is not only reconstructing but also reproducing

**Alzheimer’s Diseases**:

Age over 65

Decline in memory and other cognitive abilities

A good diet, aerobic exercise and social relations and keeping the brain active reduce the risk of having Alzheimer

**Anterograde Amnesia**:

Inability to form **new** memories

Have short-term memories, but can’t encode and pass to Long-term memories

The automatic processing remains active. They are able to form Procedural memories, meaning they can form implicit memories

A patient can trace a star better over repeated trials when he has no memories of the previous attempts.

His unconscious motor center remembers what his conscious mind had forgotten

Procedural memories rely more on the basal ganglia and Cerebellum

**Retrograde amnesia**:

Inability to retrieve info from one’s past

**Hyperthymesia syndrome**:

Superior episodic memory

For them, time does not heal pain. They can’t explain things happened in the past well

**Savant Syndrome**:

Limited in mental ability and they have an exceptional skill (computer science, math, memory…)

About half of the cases are associated with Autism

Improving Memories

1. Rehearse repeatedly
2. Make memories meaningful
3. Activate retrieval cues
4. Use mnemonic devices
5. Minimize pro and retroactive interferences
6. Test yourself
7. Sleep
8. Do aerobic exercises
9. Eat well
10. Fina a good balance in stress