Topic 4: Memory

- Learning Objectives
  - Memory and the three processes of memory
  - Sensory memory
  - Short-term or working memory
  - Different types of long-term memory
  - Different causes of forgetting

How to improve our memory? Physical exercise?

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Lift weights, improve your memory, study shows

Date: October 1, 2014

Source: Georgia Institute of Technology

Summary: Here's another reason why it's a good idea to hit the gym: it can improve memory. A new study shows that an intense workout of as little as 20 minutes can enhance episodic memory, also known as long-term memory for previous events, by about 10 percent in healthy young adults.

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Minoru Shinohara, an associate professor in the School of Applied Physiology and one of the study's researchers, watches a student during a resistance exercise.

Credit: Image courtesy of Georgia Institute of Technology [Click to enlarge image]

Is there a link between memory and language skills?

Memory master shines despite being a poor student of English

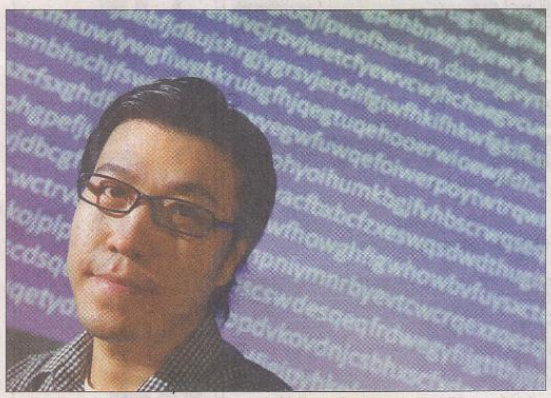
Ng Yuk-hang

Pneumonoultramicroscopicsilicovolcanoconiosis, otorhinolaryngology and pachyderm – just three of 20 random words that Roy Lam Kin-tung memorised in a five-minute display yesterday.

At the recent Welsh Memory Championship he memorised 42 random words in five minutes. Lam is now ranked 31st in the world in the "five-minute words" category – the highest-ranking Chinese.

In yesterday's demonstration for reporters, Lam memorised 20 words in order, including those listed above, in five minutes. Seven competitors – from Ireland, Britain and Sweden – took part in the Welsh championship. Other categories included memorising poker cards, binary number, dates and names.

> Take Ann, for example. I would link the name to 'ant', and would imagine an ant was crawling from Ann's ear
>
> Roy Lam, on his method for remembering names



Roy Lam memorised 42 random words in five minutes. Photo: Oliver Tsang

Although Lam, director-general of the Hong Kong Memory Study Association, finished last at the Welsh championship, he said he was proud of his efforts since he could memorise more words than many native-English speakers.

"My English has never been good. Unlike native speakers, I do not understand most of the words in the competition," he said.

Lam, 34, failed all English dictation exercises in school and has never been a top student. "In the past, I would forget people's names almost as soon as I met them," he said.

Frustrated by his forgetfulness, Lam decided to improve his memory skills when he was 30. He said memory could be improved in many ways, such as by stringing random words into a picture or story. He uses a similar method to remember names.

"Take Ann, for example. I would link the name to 'ant', and would imagine an ant was crawling from Ann's ear," he said.

Lam said his personal best was 80 words in five minutes. He aims to make it into the world's top 10 this year by memorising 62 words. The current world record is 109 words.

The World Memory Championships, the biggest of similar events, will be held in August in Guangzhou.

Lam said age was not an issue when it came to memory skills.

"One of my students is now 70 years old, but he is performing well," he said.

Models of Memory

- Information-processing model
  - Information is processed across three stages
  - Encoding, storage and retrieval

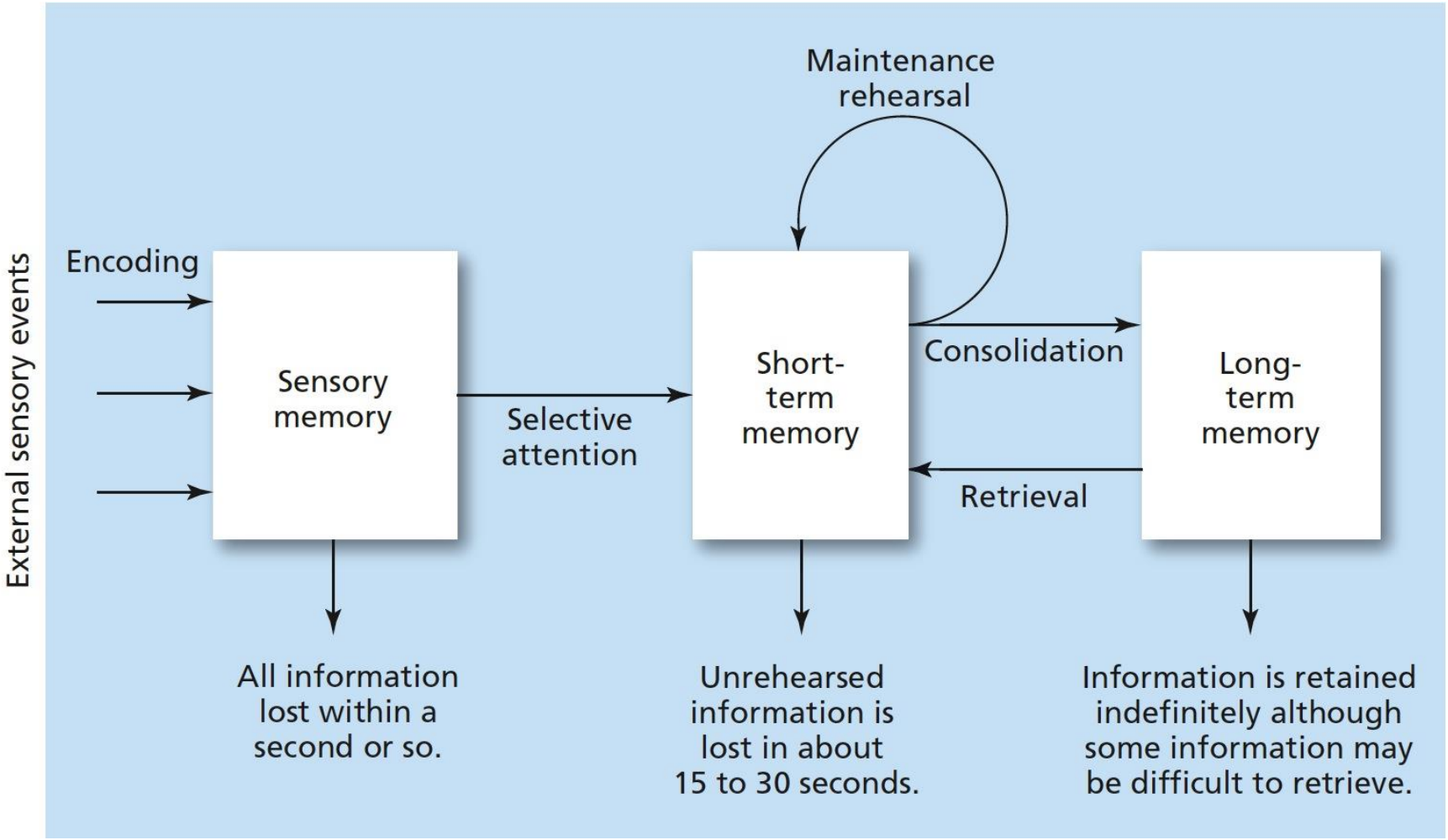
Memory and Its Processes

- Memory
  - Active system that receives information from the senses
  - Organizes and stores it
  - Retrieves information from storage

Memory and Its Processes

- Processes of Memory:
  - Encoding
    - Converts sensory information to a form usable in the brain's storage systems
  - Storage
    - Holding onto information for some period of time
  - Retrieval
    - Recalling stored information in a form that can be used

Figure 5.1 Three-Stage Process of Memory
Information enters through the sensory system, briefly registering in sensory memory. Selective attention filters the information into short-term memory, where it is held while attention (rehearsal) continues. If the information receives enough rehearsal (maintenance or elaborative), it will enter and be stored in long-term memory.



Models of Memory

- Levels-of-processing model
  - Information is "deeply processed"
  - Processed according to meaning rather than just sound or physical characteristics of words
  - How well item is remembered depends on depth remembered

Sensory Memory

- Two types of sensory memory studied:
  - Iconic
    - Visual sensory memory
  - Echoic
    - Auditory sensory memory

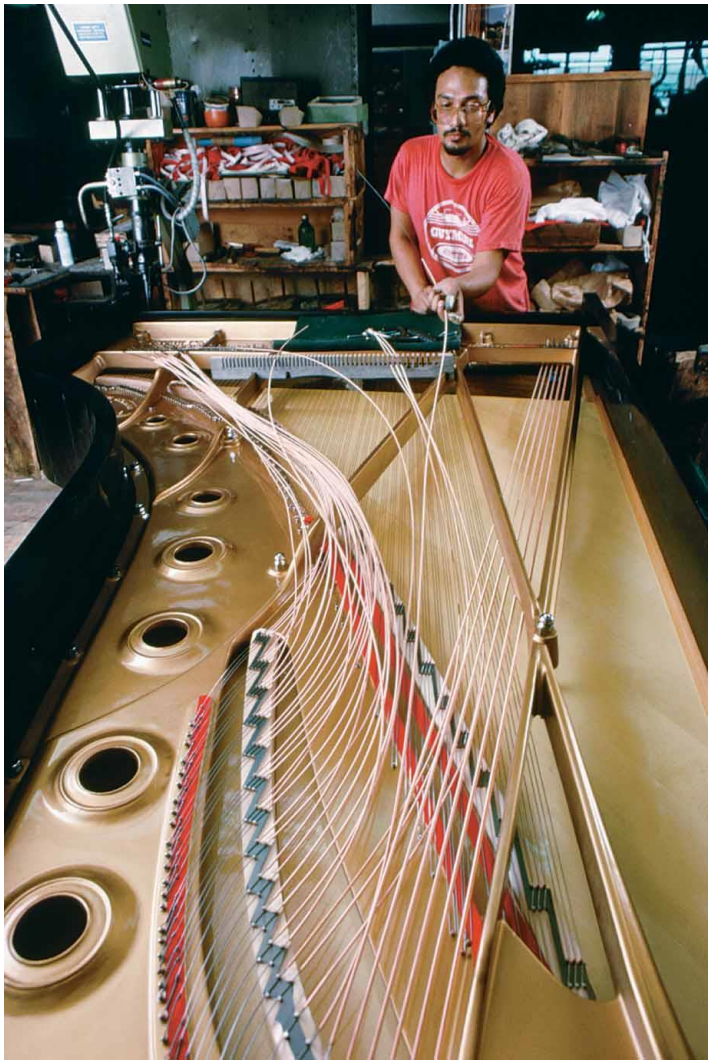
Iconic Memory

- Visual sensory memory
- Lasts only a fraction of a second
- Helps visual system view surroundings continuously
  - Long enough for brain stem to evaluate importance

Echoic Memory

- Allows memory to remain long enough for meaningful conversation
  - Duration
    - Lasts longer than iconic
    - 2 to 4 seconds

Once these piano strings have been attached to the tuning pins, the piano can be tuned. Tuning a piano requires the use of echoic sensory memory. What other occupations might find a good echoic memory to be an asset?



Short-Term Memory

- Memory system in which information is held for brief periods of time while being used
  - Selective attention
  - Ability to attend to one stimulus apart from total sensory input
    - "Cocktail party effect"
      - Able to hear own name mentioned across a noisy room

Short-Term Memory

- Memory system in which information is held for brief periods of time while being used
  - Selective attention
    - Two stage process
      - Stimuli filtered based on physical characteristics
      - Processed based on importance

Each person at this gathering is involved in a conversation with others, with dozens of such conversations going on at the same time all around. Yet if a person in another conversation says the name of one of the people in the crowd, that person in the crowd will be able to selectively attend to his or her name. This is known as the "cocktail party effect."

Short-Term Memory

- Working Memory
  - Not really short term memory but a process
  - Active system that processes information in short-term memory
  - Consists of three processes:
    - Central "executive" - controls other processes
    - "Sketchpad" - visual
    - "Recorder" - auditory

This woman must hold the phone number she is reading in short-term memory long enough to dial it on the phone next to her.

Short-Term Memory

- Capacity of short term memory is 7+/−2 chunks of information
- Young adults can hold three to five items without strategy to retain information

Short-Term Memory

- Unfamiliar words, information result in further reductions
  - Digit-span test
    - Series of numbers is read to subjects
    - Subjects are asked to recall the numbers in order

Figure 5.3 Digit-Span Test
Instructions for the digit-span test: Listen carefully as the instructor reads each string of numbers out loud. As soon as each string is ended (the instructor may say "go"), write down the numbers in the exact order in which they were given.

6 8 2 5

5 7 2 1 4

3 5 9 7 2 1

9 2 5 4 6 3 8

2 8 3 7 1 5 6 9

7 3 2 4 9 6 8 5 1

6 5 4 7 8 9 3 2 1 7

Short-Term Memory

- Unfamiliar words, information result in further reductions
  - Chunking
    - Combining information into meaningful units or chunks
    - More information can be held in STM

Short-Term Memory

- Maintenance rehearsal
  - information to be remembered is repeated over and over mentally
  - maintains it in short-term memory
    - STMs tend to be encoded in auditory form

Types of LTM

- Procedural (nondeclarative) memory
  - Includes memory for skills, procedures, habits, and conditioned responses
  - These memories are not conscious
    - Implied to exist because they affect conscious behavior

Procedural (Nondeclarative) LTM

- Implicit memory
  - Memory not easily brought into conscious awareness

These students are rehearsing for a concert. They will use maintenance rehearsal (repeating the musical passages over and over) until they can play their parts perfectly. The movements of their fingers upon the strings of their instruments will be stored in long-term memory. How is this kind of long-term memory different from something like the memorized lines of one's part in a play?

Procedural knowledge, such as tying one's shoes, often must be learned by doing, as it is difficult to put into words. Once this child learns how to tie shoes, the knowledge will always be there to retrieve.

Types of LTM

- Declarative memory
  - Contains information that is conscious and known
  - Memory for facts

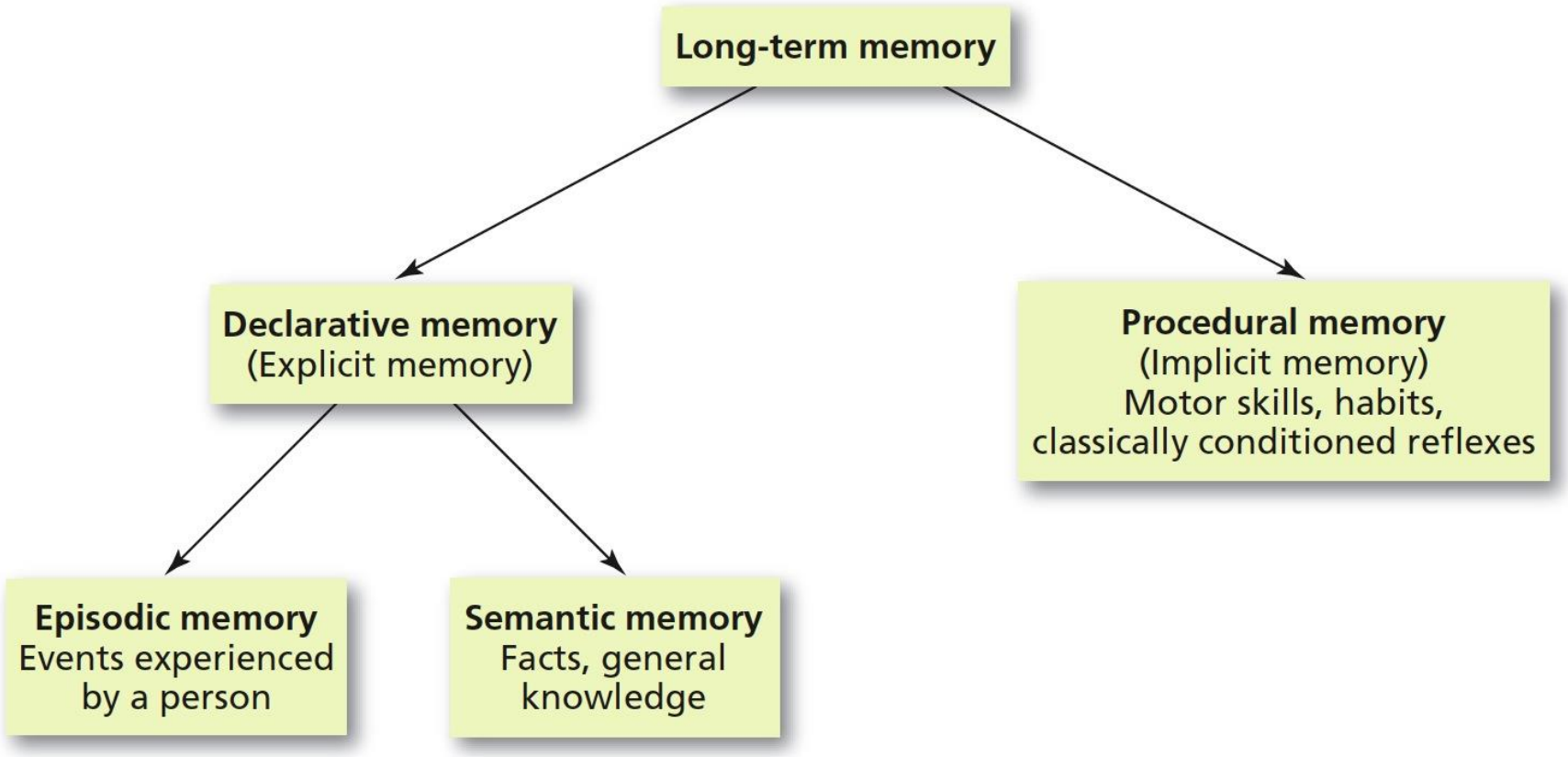
Declarative LTM

- Semantic and episodic memories are forms of ***explicit memory***
  - Memory that is consciously known

Declarative LTM

- All the things that people know
- Semantic memory
  - General knowledge, such as language and information learned in formal education
- Episodic memory
  - Knowledge of personal information
    - Not readily available to others
    - Includes daily activities and events

Figure 5.5 Types of Long-Term Memories
Long-term memory can be divided into declarative memories, which are factual and typically conscious (explicit) memories, and nondeclarative memories, which are skills, habits, and conditioned responses that are typically unconscious (implicit). Declarative memories are further divided into episodic memories (personal experiences) and semantic memories (general knowledge).



Retrieval Cues

- A stimulus for remembering
- Encoding specificity
  - Retrieval of information is improved
    - If related situation available when the memory is first formed is available when the memory is being retrieved
  - Example:
    - Best room to take a test in is the room the material was learned in

Retrieval Cues

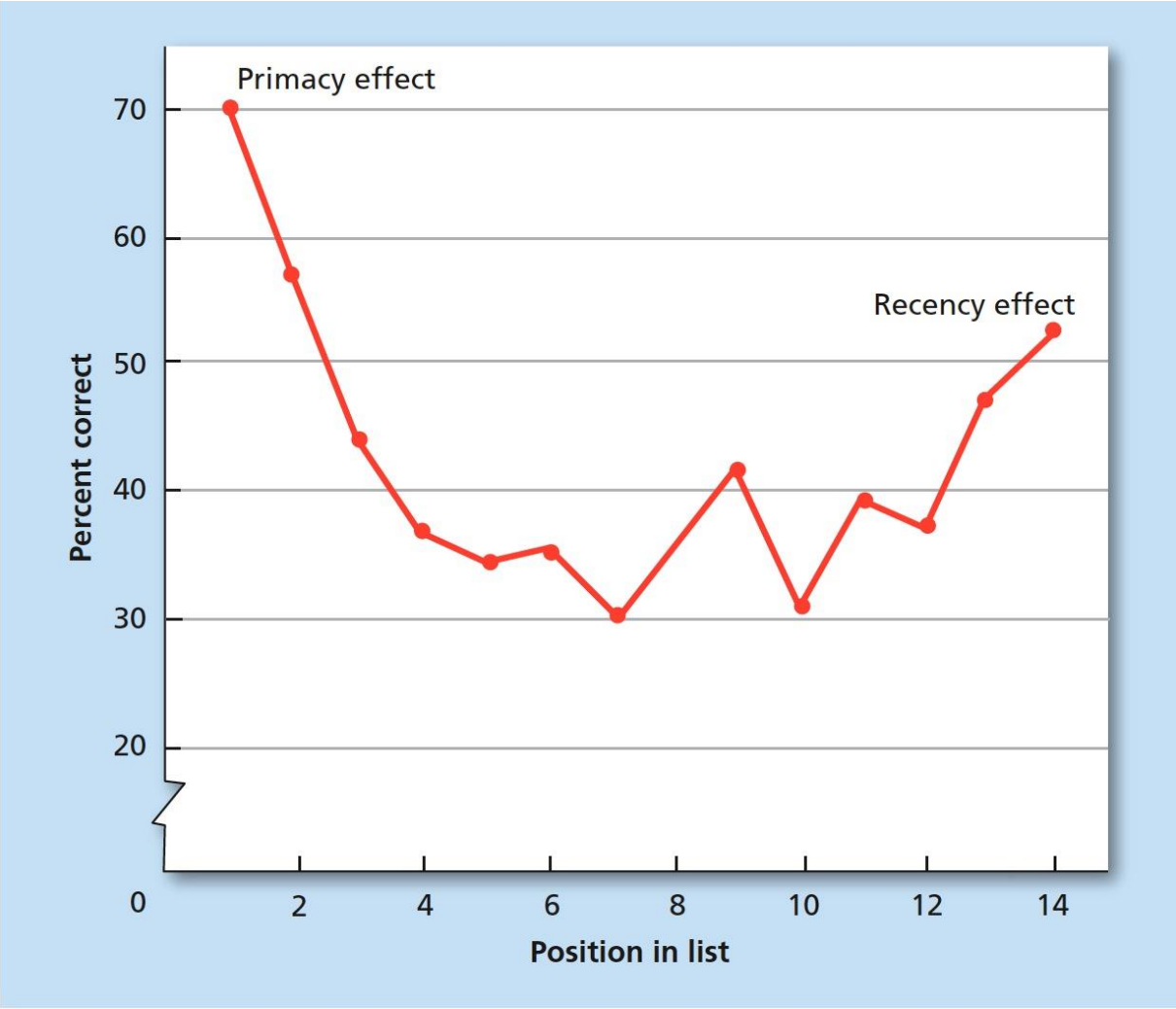
- Encoding specificity
  - State-dependent learning
    - Easier to recall memories if in same physiological or psychological state as in when memory was made

Recall

- Serial position effect
  - Remember information at the beginning and end more accurately than information in the middle
  - Primacy effect
    - Best remember information at the beginning of a body of information
  - Recency effect
    - Best remember information at the end of a body of information

These people are waiting to audition for a play. The person who auditioned first and the one who auditioned last have the greatest chance of being remembered when the time comes for the director to choose. The serial position effect will cause the impression made by the actors who come in the "middle" to be less memorable.

Figure 5.8 Serial Position Effect
In the serial position effect, information at the beginning of a list will be recalled at a higher rate than information in the middle of the list (primacy effect), because the beginning information receives more rehearsal and may enter LTM. Information at the end of a list is also retrieved at a higher rate (recency effect), because the end of the list is still in STM, with no information coming after it to interfere with retrieval.



Forgetting: Interference Theory

- Proactive interference
  - Older information prevents or interferes with retrieval of newer information
- Retroactive interference
  - Newer information prevents or interferes with the retrieval of older information

Figure 5.11 Proactive and Retroactive Interference
If a student were to study for a French exam and then a Spanish exam, interference could occur in two directions. When taking the Spanish exam, the French information studied first may proactively interfere with the learning of the new Spanish information. But when taking the French exam, the more recently studied Spanish information may retroactively interfere with the retrieval of the French information.

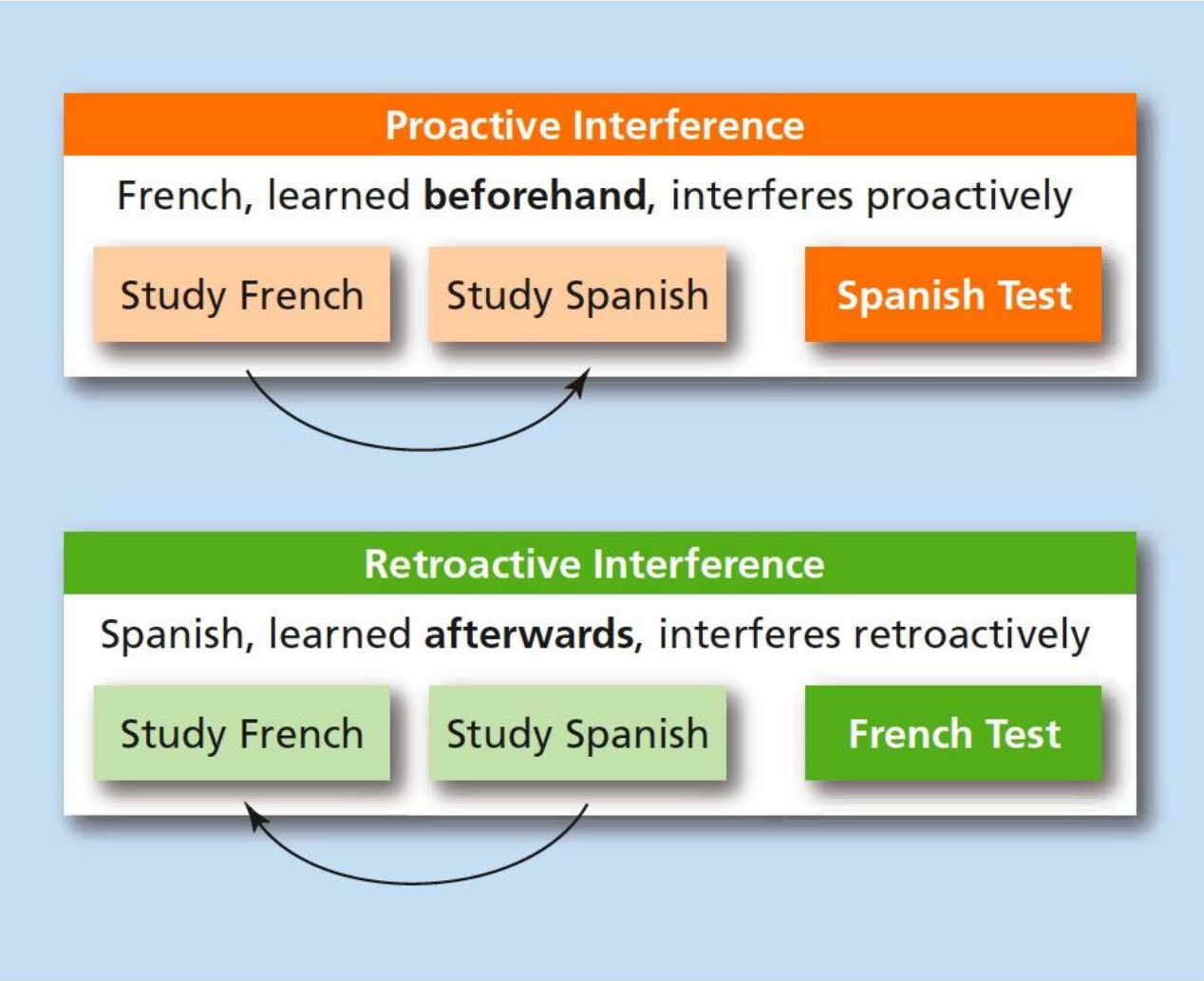


table 5.1 Reasons for Forgetting

REASON	DESCRIPTION
Encoding Failure	The information is not attended to and fails to be encoded.
Decay or Disuse	Information that is not accessed decays from the storage system over time.
Proactive Interference	Older information already in memory interferes with the learning of newer information.
Retroactive Interference	Newer information interferes with the retrieval of older information.