

PSYC 441

Cognitive Psychology II

Session 12 – History and Subject Matter of Imagery

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Session Overview

- This section helps you to understand the historical context in which imagery has been studied over the years. This background is important to enable you appreciate the renewed interest in the study of imagery as a cognitive process. We will also discuss the subject matter of imagery.

Session Objectives

- At the end of the session, the student will be able to
- Discuss the antecedents of modern studies of imagery
- Discuss the subject matter of visual imagery
- Think about what you should do when you want to improve your memory
- Discuss the mnemonic strategies available (both imagery and non-imagery mnemonics)
- Contrast imagery and non-imagery mnemonic techniques

Session Outline

The key topics to be covered in the session are as follows:

- Topic One: Historical Overview
- Topic Two: Characteristics of Mental Imagery
- Topic Three: Mnemonics and Memory Codes
- Topic Four: Use of Visual Imagery in Mnemonics



Reading List

- Ashcraft, M. H. (2013). *Cognition* (6th edn.), London: Pearson Education Int.
- Eysenck, M. W. (2012). *Fundamentals of Cognition* (2ed). Psychology Press, Sussex.
- Galotti, K. M. (2017). *Cognitive Psychology: In and out of the laboratory* (6th edn.). Belmont, CA: Wadsworth.
- Hunt, R. R. & Ellis, H. C. (2004). *Fundamentals of Cognitive Psychology* (7th edn.), New York: McGraw-Hill.
- Willingham, D, B. (2013). *Cognition: The thinking animal* (*International edn.* NJ: Prentice-Hall).

Topic One

HISTORICAL OVERVIEW



Historical Overview

- Historically, three stages of mental imagery can be identified:
 - the philosophic (prescientific) period,
 - the measurement period,
 - the cognitive and neurocognitive period.
- During the philosophic period, mental images were taken to be a principal ingredient in the composition of the mind and sometimes were believed to be the elements of thought.
- The topic was an integral part of the philosophies of classic Greek philosophy, notably Aristotle and Plato and more recently, the British Empiricists John Locke, George Berkeley, David Hume and David Hartley.

Historical Overview

- The most noted qualitative assessment of mental imagery is traced to Sir Francis Galton (1907) who circulated questionnaires to 100 people in which he asked them to recall some experiences and images about them.
- He later developed measures of imagery that were related to sex, age and other individual differences.
- The testing of imagery drew the interest of several researchers, such as Titchener (1909) and Betts (1909).
- Their investigations consisted in having participants rate their ability to visualize an object such as an apple, the contour of a face, or the sun sinking below the horizon.

- When behaviourism swept introspectionism aside, visual imagery was swept aside as well. Visual imagery went largely unstudied from 1920 until 1960.
- In the 1960s visual imagery re-entered experimental psychology, mostly through Alan Pavio's ingenious demonstrations of the importance of visual imagery.
- This work showed not only that imagery affects memory but that imagery also serves a function related to memory.

- The renewed interest in the study of visual imagery may also be explained based on the fact that we cannot understand and explain how people perform cognitive tasks of forming “mental pictures” without talking about visual images and also memory research has shown that people who report using imagery are better able to recall information than those who do not.
- Ignoring research on visual imagery will amount to overlooking one of the fundamental aspects of human cognition.
- Presently therefore, research on visual imagery has regained credibility as a worthwhile enterprise among cognitive psychologists.

Subject Matter of Imagery

- If you were asked: Where is your Television positioned in your sitting room? Where is the stereo located? How many doors enter the sitting room or exit the sitting room?
- These questions draw on your memory. When people are asked questions of this nature, they answer or respond after some amount of mental work. Many people don't have the answer "off the top of their heads".
- They mentally picture the sitting room, start from one end to the other, scanning mentally by counting doors, arrangements in the room etc.
- Such activities or processes are normal with human beings and they are commonly used in everyday life.

What is Visual Imagery?

- By **Visual imagery** therefore, we are looking at the role of images in memory and how images are used in techniques known as mnemonics (strategies designed to aid or improve memory).
- Visual imagery is also about investigating how people construct and use visual images and what the findings suggest about cognition.
- Lastly, visual imagery is about understanding the mental representations used to create imagery and how they are stored in memory.
- Visual imagery like visual perception has received the most attention in cognitive psychology and our attention will be focused on it just like we focused on visual perception when we were treating perception.

- Note that mental imagery occurs when we access perceptual information from memory and experiences it in an indirect way (e.g., “seeing with the mind’s eye”).



Other kinds of Mental Images

- There are other kinds of mental images. Although we will not discuss them, they are:
- **Auditory images** (e.g., the imagined sound of your dog's barking, the voice of your relations etc)
- **Olfactory images** (e.g., the imagined smell of fresh-baked bread, your special perfume, special odors etc).
- **Cutaneous images** (e.g., the imagined feeling of certain kind of pain, for example, your toe being stubbed into the wall, imagined pain of tooth extraction etc.) Cutaneous sense – are sense receptors lying in the skin that responds to touch, pressure, temperature (warm and cold), pain and common chemical senses.

Topic Two

CHARACTERISTICS OF MENTAL IMAGERY



Characteristics of Imagery

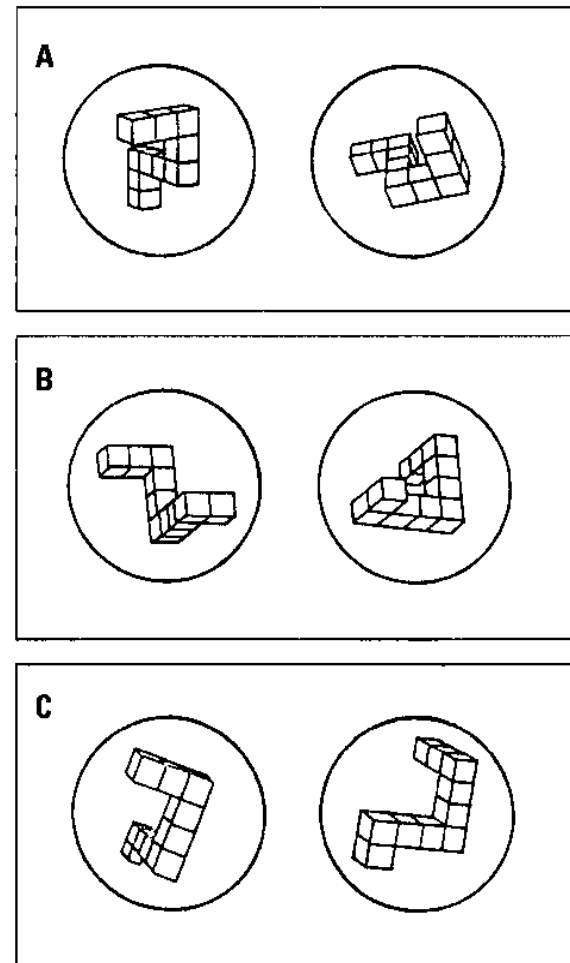
- Research on mental imagery is difficult to conduct, especially because mental images are not directly observable and because they fade so rapidly.
- However, recently, psychologists have applied some of the research techniques developed for studying visual perception. Consequently, the investigation of imagery has made impressive advances.
- Figure 6.1 illustrates an important research technique that may be used to assess rotation of images.
- Which of these pairs of objects are the same and which are different?

Techniques used to assess rotation of images

Figure 6.1 illustrates an important research technique that may be used to assess rotation of images.

Which of these pairs of objects are the same and which are different?

Figure 6.1 Shepard & Metzler (1971). Mental rotation of three-dimensional objects



Analog or Propositional codes

- One major controversy in the study of mental image is the debate about whether images are stored in **analog** or **propositional** codes. Many theorists in the area argue that information about a mental image is stored in analog code.
- An **analog** (also called depictive representation or a pictorial representation) is a representation that closely resembles the physical object. The word analog suggests the word analogy, such as analogy between the real object and the mental image.
- According to the **analog-code approach**, mental imagery is a close relative of perception. Think about looking at a photograph of a triangle, the physical features of that triangle are registered in the brain in a form that preserves the relationship among the three lines.

Analog or Propositional codes

- Those who support analog coding argue that your mental image of a triangle is registered in a similar fashion, preserving the same physical relationship among the lines.
- In contrast to the **analog-code position**, other theorists argue that we store images in terms of a **propositional code**.
- A propositional code (also called **descriptive representation**) is an abstract, language-like representation; storage is neither visual nor spatial and it does not physically resemble the original stimulus.

Analog or Propositional codes

- From the **propositional-code perspective**, mental imagery is very much related to language, not perception.
- For example, if you try to create a mental image of a triangle, your brain will register a language-like description of the lines and angles, though the precise nature of the verbal description has not been specified.
- Although most researchers are closely aligned to the analog position, both approaches to some extent are partially correct.

Topic Three

MNEMONICS AND MEMORY CODES



Mnemonics

- For thousands of years, people have wished for “better” memories – they have wished to learn more quickly and to remember more accurately.
- Motivated by these wishes, a number of techniques have been designed to “improve” memory referred to generally as **mnemonic strategies**.
- Some of these mnemonics are modern inventions, but most are very old, dating back to ancient Greece. Let us look at some of the techniques.

- The Greek poet Simonides (around 500BC) is known to have used this method effectively. He was called out of entertaining diners' banquet. While he was out of the hall, the roof caved in, crushing the guests so badly that they could not be identified by members of their families. Simonides by recalling where each guest sat was able to help relatives find the remains of their family members.
- By this, the first mnemonic technique called **Method of Loci** was invented. It requires the learner to imagine a series of places (loci or locations) that have some sort of order in them.
- For example, you may use the land marks from your hostel to the psychology department to remember the names of your friends, objects, reading material and so on.

- Bower (1970) has suggested the following principles to apply in the use of the Method of Loci.
- Use list of cues that you know well. You can't retrieve any associations if the cue images aren't available at both presentation and recall.
- The cues must be memory images of geographic locations.
- Associations must be formed between the items to be remembered and the cue locations at the time you originally encounter the items.

- The associations between the cue locations and the items must be one to one.
- Use imagery, especially visual imagery, to form associative links.
- Use interactive images to link the item and its cue location.
- If you study the items more than once, the same cue location should be used for a given memory item.
- During recall, cue your own memory by using the list of locations.
- Use the same recall cues (locations) that you used during the study.

Technique of interacting images

Technique of Interacting Images

- Another technique for improving memory is the **Technique of Interacting Images**. This method shows that recall of concrete nouns on a list is improved when subjects are asked to form images of the words, in comparison to when they are not given such instructions.
- Bower (1970) confirmed the usefulness of this technique in a paired-associate experiment.

Pegword Method

Pegword Method

- Another mnemonic technique that also involves imagery is the **Pegword Method**. Like the method of Loci, the memorizer uses the components of a previously learned system as “pegs” upon which to “hang” new material. As a device using visual imagery, the method involves picturing the to-be-remembered items with another set of ordered “cues”.
- Note that the, cues are not locations as in Method of Loci but rather nouns that come from a memorized rhyming list. A very popular example used by children to learn the numbers is:
 - One is a Bun
 - Two is a Shoe
 - Three is a Tree
 - Four is a Door
 - Five is a Hive
 - Six is Sticks
 - Seven is Heaven
 - Eight is a Gate
 - Nine is Wine
 - Ten is a Hen

Non-imagery Mnemonic Techniques

- The method calls for the subject to picture the first item interacting with bun, the second with a shoe, third with a tree and so on (note the method works best for lists of only ten items or fewer).

Non-imagery Mnemonic Techniques

- Some mnemonic techniques however, do not use imagery as described earlier. We may have **recoding** – which involves reorganization of the material to aid memory.
- One other familiar method which is very popular among students is also to use the first letters of each word to form words or sentences. For example, to remember the colour of the spectrum you may use the mnemonic:

Non-imagery Mnemonic Techniques

- **ROY G. BIV:** Red, Orange, Yellow, Green, Blue, Indigo, Violet.
- Research results about the usefulness of the two strategies are however mixed even though such strategies are so popular among students.
- Both techniques are called **mediators** – internal codes that connect the items to be remembered and your later responses (very close to S-R theory).
- Various ways of categorization and organization of material may also improve recall. For example, arranging material into categories in terms of their similarity, likeness and differences help to organize the material, which may facilitate recall.

- Some of the techniques we have discussed are very common that almost everyone knows them. For example, if you are trying to recall the number of days in the month you may recite:
 - thirty days hath September”. Or
 - children learning the numbers 1 2 3 may recite 1 2 3 4 5 “once I caught a fish alive”
 - 6 7 8 9 10and so on.

Topic Four

USE OF VISUAL IMAGERY IN MNEMONICS



Visual imagery in Mnemonics

- We may ask several questions about the use of visual imagery: Why do many mnemonic techniques use visual imagery? How do imagery-based mnemonics function differently from non-imagery-based mnemonics? Is there something about visual images that make them especially memorable?
- In order to answer these questions, we will consider two opposing views on the issue. These are **Paivio's Dual-Code Hypothesis** and **Bower's Relational-Organizational Hypothesis**.

Allan Paivio

- Allan Paivio (1969, 1971, 1983) created the dual-code hypothesis to explain the working of mnemonics.
- The theory has become significant in explaining how information is represented in memory.
 - According to Paivio, information in long-term memory contains two distinct coding systems for representing information to be stored. The two forms are: **verbal or imagery** (visual) codes.
 - Any event or object which can be **described** may be stored in a verbal code. *Verbal code contains information about an item's abstract linguistic meaning.*
 - Any event or object which can be **visualized** can be stored in an imaginal code (*mental pictures of some sort that represent what the item looks like*).

- This position argues that the memory system will work better when both verbal and imaginal systems are brought to bear on a specific memory.
- Again, It argues that pictures should be better remembered than words, because pictures can be represented both visually and verbally.
- According to Paivio, visual images will produce better memory because the visual image retains more detail than the verbal code.

Assumptions

- ***Striking experimental findings that support these contentions.***
 - Every to-be-remembered items can be coded either verbally or visually and in some cases both.
 - Pavio's idea is that **pictures and concrete words** give rise to both verbal labels and visual images, that is, they have two possible internal codes or mental representations.
- This seems to confirm the saying that pictures are best remembered than words.
- **Abstract words** on the other hand, have only one kind of code or representation – *verbal code*. (*Abstract words are difficult if not impossible to code visually compared to concrete words.*)

Experiment

- One study by Paivio (1965) provided evidence to support the hypothesis.
- *Experiment*
 - Subjects were randomly assigned to four conditions in an experiment. They were to learn one of four lists of noun pairs.
 - First list included pairs in which both referred to concrete objects (e.g., **book/table**).

- First list included pairs in which both referred to concrete objects (e.g., **book/table**).
- The second list included pairs in which the first noun was concrete and the second abstract (e.g., **chair/justice**)
- The third list was converse of the second (e.g., **freedom/dress**)
- The fourth contained pairs of abstract nouns (e.g., **beauty/truth**)

- Of possible 16 correct responses, participants averaged 11.41, 10.01, 7.36, and 6.05 for concrete/concrete, concrete/abstract, abstract/concrete and abstract/abstract lists respectively.

By explaining this, Paivio assumed that the more concrete the noun, the richer the image and the more elaborated the internal code. That is, where possible, participants formed visual images of the noun pairs, whereas it was difficult in the case of verbal materials or in their combinations.

Bower's Relational-Organizational Hypothesis

Relational-Organizational Hypothesis

- Bower (1970) has proposed an alternative to the dual-coding hypothesis that is called the **Relational-organizational hypothesis**.
- He believed imagery improved memory not because images are richer than verbal labels but that imagery produces more associations between the to-be-remembered items.

Experiment

Experiment

- Bower (1970) performed an experiment to distinguish between the dual-coding and the relational-organizational hypothesis. Subjects were divided into 3 groups and each given different instructions for a paired-associates learning task.
- Group 1 was told to use “overt rote repetition” (i.e., to rehearse aloud).
- Group 2 was told to construct two images that did not interact and were “separated in imaginal space”.

- Group 3 was asked to construct an interactive scene of the two words in a pair.
- Results of the experiment showed that all participants recognized about 85% of the previously seen words. However, recall of the words differed greatly among the groups.
- Those who used rote memorization recalled about 30% of the paired associates. Those who used the non-interactive imagery recalled 27% and those who formed the interacting images recalled about 53%.
- The question is if imagery leads to more elaborated coding of the paired associates as predicted by the dual-coding hypothesis, then participants in the two conditions that involved instructions to form two images ought to have performed better than they did. In fact, those who formed interacting images showed an improvement over the rote memorizers

- Apparently, it is not imagery per se that helps memory but rather the way in which imagery is used. Interacting images probably create more links or hooks between the target information and the other information, making the to-be-remembered information easier to retrieve.
- Although the dual-coding hypothesis is popular and continues to attract proponents, there are still unresolved difficulties especially with regards to how well it explains the workings of imagery mnemonics and second, the explanation it provides for non-imagery mnemonics.
- Notwithstanding these difficulties and problems involved in theory building, imagery mnemonics work and there is little doubt that they aid memory.

Sample Questions

1. Summarize the two theories of the characteristics of mental image: the analog code and the propositional code.
2. What really is the subject matter of imagery?
3. Why is it important to distinguish between imagery and non-imagery mnemonics?
4. Explain the conceptual issues in the Dual-coding hypothesis.
5. Is there something about visual images that makes them especially memorable?

References

- Bower, (1970). Imagery as a relational organizer in associative learning. *Journal of Verbal Learning and Verbal Behaviour*, 9, 529-533.
- Shepard, R. N., & Metzler, J. (1971). Mental rotation of three-dimensional objects. *Science*, 171, 701-703.
- Paivio, A. (1983). The empirical case for dual coding. In J. C. Yuille (Ed.). *Imagery, memory and cognition*. Hillsdale, NJ: Erlbaum.