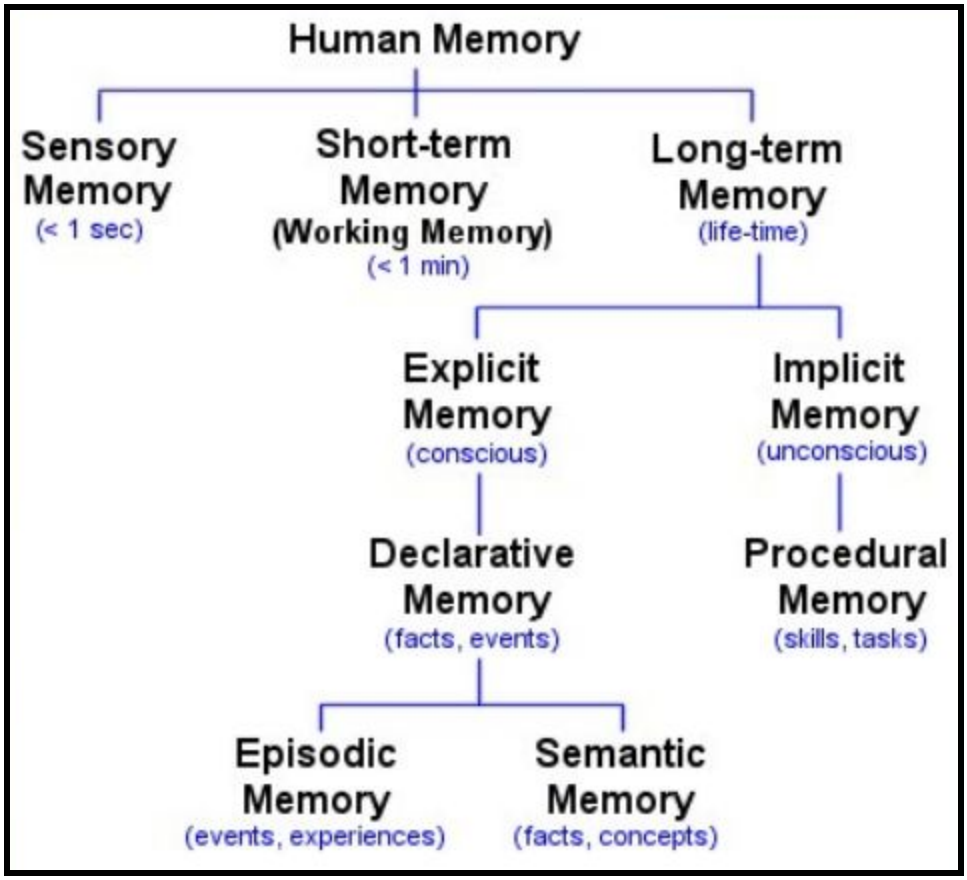
November 11:

- The brain has a number of different memory systems which sometimes do their own things and sometimes interact.



- There are 2 ways for a person to not have any memory:
  1. **Retrograde amnesia:** Losing your memory of past events.
  2. **Interior brain amnesia:** Inability to lay down any new memories.
- **Sensory Memory:**
  - Very short term.
  - Has the ability to retain impressions of sensory information after the original stimuli have ended.
  - Acts as a kind of buffer for stimuli received through the five senses of sight, hearing, smell, taste and touch, which are retained accurately, but very briefly.
  - Sensory memory was most extensively studied by a cognitive psychologist named George Sperling. Sperling's studies focused on visual sensory memory which he termed **iconic memory**.

- **Iconic Memory:**
  - A type of sensory memory.
  - Iconic memory involves the memory of a visual stimuli.
    I.e. It is how the brain remembers an image you have seen in the world around you.
  - Typically, iconic memories are stored for slightly shorter periods of time than echoic memories. While iconic memory disappears in approximately 1 second, echoic memory seems to last about 4 seconds.
- **Echoic Memory:**
  - A type of sensory memory.
  - Echoic memory involves the memory of an auditory stimuli.
  - Typically, echoic memories are stored for slightly longer periods than iconic memories. While iconic memory disappears in approximately 1 second, echoic memory seems to last about 4 seconds.
- **Short term Memory:**
  - Short term memory is very fragile and capacity limited.
  - It seems to require a great deal of mental effort to keep things in working memory and, once the leave, they are gone.
  - Sometimes we use this memory for short-term storage, though it also seems necessary for transferring information to long-term memory.

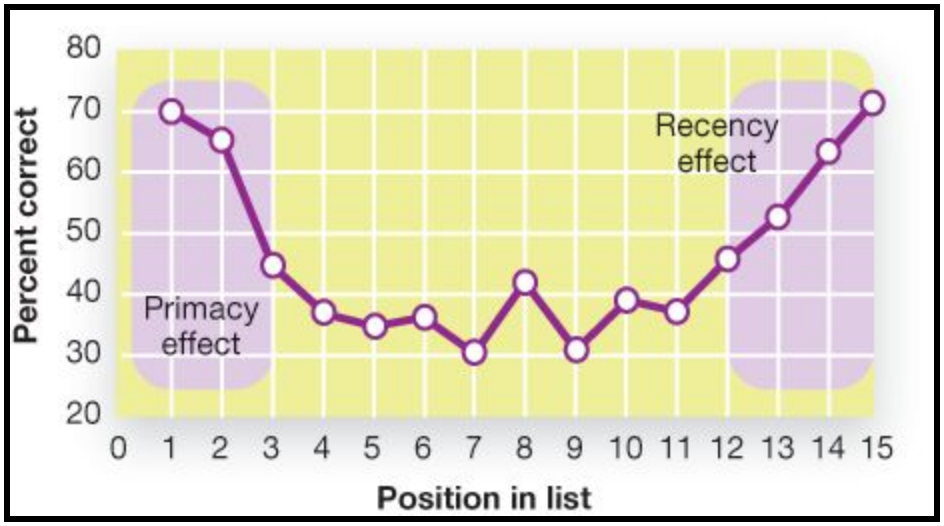
November 13:

- **Working Memory:**
  - The place where information and long term memory is being processed. We can take a variety of information from our long-term memory and combine it in our working memory to answer questions.
    E.g. Imagine you're in a library and putting books, that you'll need to read to write an essay, on a desk. In this analogy, the desk is your working memory and the books are your long-term memory.
  - Working memory also helps transfer information into long-term memory.
  - **Encoding** is the term we use when we're trying to get information into long-term memory.
  - **Retrieval** refers to the subsequent re-accessing of events or information from the past, which has been previously encoded and stored in the brain.
  - How quickly you find something in your memory depends on how you organize the information in your memory.
  - **Dual coding** is the process of combining verbal materials with visual materials.
- The frontal lobe is lateralized. The left hemisphere of the frontal lobe does encoding while the right hemisphere deals with retrieval.
- You do better on memory tests when your state during the test matches your state during studying.

Textbook:

- **Module 7.1 Memory Systems:**
- **The Atkinson-Shiffrin Model:**
- The Atkinson-Shiffrin model includes three memory stores.
- **Stores** retain information in memory without using it for any specific purpose. They essentially serve the same purpose as hard drives serve for a computer.
- The three stores include sensory memory, short-term memory (STM), and long-term memory (LTM). In addition, **control processes** shift information from one memory store to another.
- An important point is that our memory systems, although stunningly powerful, are not perfect. We lose, or forget, information at each step of this model. Information enters the sensory memory store through all of the senses and the control process we call **attention** selects which information will be passed on to STM. This is highly functional: the attention process selects some elements of our environment that will receive further processing and add to our experience and understanding of the world. However, this functionality comes at a cost, because a vast amount of sensory information is quickly forgotten, almost immediately replaced by new input. We selectively narrow the information we receive in STM even further through **encoding**, the process of storing information in the LTM system. We retain only some information and lose the rest. **Retrieval** brings information from LTM back into STM; this happens when you become aware of existing memories.
- **Sensory Memory:**
- **Sensory memory** is a memory store that accurately holds perceptual information for a very brief amount of time—how brief depends on which sensory system we talk about.
- **Iconic memory**, the visual form of sensory memory, is held for about one-half to one second.
- **Echoic memory**, the auditory form of sensory memory, is held for considerably longer, but still only for about 5–10 seconds. It is this form of sensory memory that will allow you to repeat back the words you just heard, even though you may have been thinking about something else.
- Attention allows us to move a small amount of the information from our sensory memory into STM for further processing. This information is often referred to as being within the “spotlight of attention”. Information that is outside of this spotlight of attention is not transferred into STM and is unlikely to be remembered.
- **Short-Term Memory and the Magical Number 7:**
- Although transferring information from sensory memory into short-term memory increases the chances that this information will be remembered later, it is not guaranteed. This is because **short-term memory (STM)** is a memory store with limited capacity and duration (approximately 30 seconds).
- Study after study showed that participants were able to remember seven units of information, give or take a couple and that STM can rehearse only seven units of information at once before forgetting something.

- **Chunking** is organizing smaller units of information into larger, more meaningful units. These larger units are referred to as chunks.
- **Long-Term Memory:**
- Encoding allows information to enter the final memory store in the Atkinson-Shiffrin model. This store, **long-term memory (LTM)**, holds information for extended periods of time, if not permanently.
- Unlike short-term memory, long-term memory has no capacity limitations that we are aware of. All of the information that undergoes encoding will be entered into LTM.
- Once entered into LTM, the information needs to be organized. Researchers have identified at least two ways in which this organization occurs:
    1. One way is based on the semantic categories that the items belong to. E.g. The mental representation of cat would be connected to and stored near the mental representation of other animals such as dog and mouse.
    2. A second way that LTM is organized is based on the sounds of the word and how the word looks. This explains part of the **tip-of-the-tongue (TOT) phenomenon**, when you are able to retrieve similar sounding words or words that start with the same letter but can't quite retrieve the word you actually want.
- It is important to note that having the information in LTM doesn't necessarily mean that you can access it whenever you want to. Instead, the likelihood that a given piece of information will undergo **retrieval**, the process of accessing memorized information and returning it to short-term memory, is influenced by a number of different factors including the quality of the original encoding and the strategies used to retrieve the information.
- There are many instances in which information that we didn't pay much attention to still seems to influence our later behaviour, suggesting that this information entered our memory without us putting effort into encoding it.
- **Working the Scientific Literacy Model Distinguishing "Short-Term from Long-Term Memory Stores":**
- Your STM lasts for approximately 30 seconds and usually contains 7 ± 2 units of information while your LTM has no fixed time limits or capacity.
- The distinction between STM and LTM can be revealed with a simple experiment. Imagine a group of people studied a list of 15 words and then immediately tried to recall the words in the list. The serial position curve, the image shown below, shows what the results would look like according to the **serial position effect**: In general, most people will recall the first few items from a list and the last few items, but only an item or two from the middle. The first few items are remembered relatively easily because they have begun the process of entering our LTM. The last few items are also remembered well because those items are still within our STM.

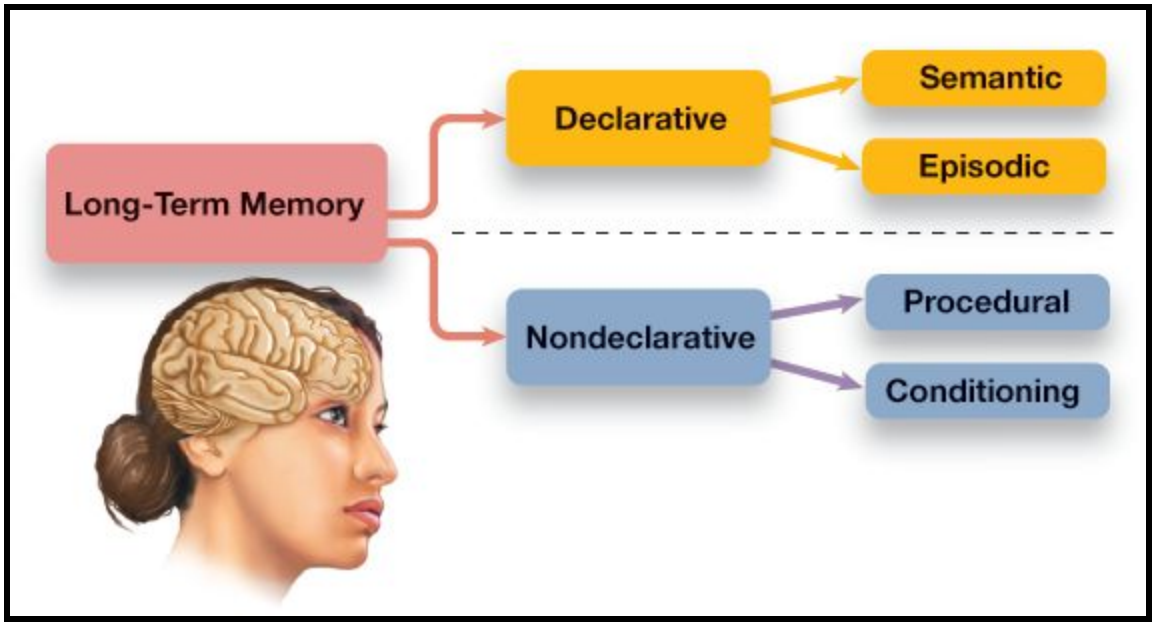


- Memory for the order of events is often superior for original items (the primacy effect) and later items (the recency effect). The serial position effect provides evidence of distinct short-term and long-term memory stores.
- Memory researchers suggest that the dip in the middle of the serial position curve is caused by two different mechanisms:
    1. The items that were at the beginning of the list produce **proactive interference**, a process in which the first information learned occupies memory, leaving fewer resources left to remember the newer information.
    2. The last few items on the list create **retroactive interference**, a process in which the most recently learned information overshadows some older memories that have not yet made it into long-term memory.
- The hippocampus becomes active when information from early in the serial position curve is remembered. This area is associated with the formation of LTM. By comparison, the brain areas associated with sensory information becomes more active when people recalled items at the end of the serial position curve.
- **The Working Memory Model An Active STM System:**
- **Rehearsal** is the repeating of information until you do not need to remember it anymore.
- **Working memory** is a model of short-term remembering that includes a combination of memory components that can temporarily store small amounts of information for a short period of time.
- A key feature of working memory is that it recognizes that stimuli are encoded simultaneously in a number of different ways, rather than simply as a single unit of information.
- The classic working memory model for short-term remembering can be subdivided into three storage components, each of which has a specialized role:
    1. The phonological loop
    2. The visuospatial sketchpad
    3. The episodic buffer
- These storage components are coordinated by a control centre known as the central executive. The central executive helps decide which of the

working-memory stores is most important at any given moment. It can also draw from older information that is stored in a relatively stable way to help organize or make sense of the new information.

- **The Phonological Loop:**
- The **phonological loop** is a storage component of working memory that relies on rehearsal and that stores information as sounds, or an auditory code.
- It engages some portions of the brain that specialize in speech and hearing, and it can be very active without affecting memory for visual and spatial information.
- Psychologists have found that working memory can only store as many syllables as can be rehearsed in about two seconds, and that this information is retained for approximately 15 to 30 seconds.
- **The Visuospatial Sketchpad:**
- The **visuospatial sketchpad** is a storage component of working memory that maintains visual images and spatial layouts in a visuospatial code.
- It keeps you up to date on where objects are around you and where you intend to go. To do so, the visuospatial sketchpad engages portions of the brain related to perception of vision and space and does not affect memory for sounds. Just as the phonological store can be gauged at several levels, such as in terms of the number of syllables, the number of words, or the number of chunks, items stored in visuospatial memory can be counted based on visual features such as shape, colour, and texture.
- Feature binding is the process of combining visual features into a single unit.
- After visual feature binding, visuospatial memory can accurately retain approximately four whole objects, regardless of how many individual features one can find on those objects.
- **The Episodic Buffer:**
- Recent research suggests that working memory also includes an **episodic buffer**, a storage component of working memory that combines the images and sounds from the other two components into coherent, story-like episodes. These episodes allow you to organize or make sense of the images and sounds.
- The episodic buffer is the most recently hypothesized working memory system. It seems to hold 7 to 10 pieces of information, which may be combined with other memory stores.
- **The Central Executive:**
- Finally, working memory includes one component that is not primarily used for storing information. Instead, the **central executive** is the control centre of working memory; it coordinates attention and the exchange of information among the three storage components. It does so by examining what information is relevant to the person's goals, interests, and prior knowledge and then focusing attention on the working memory component whose information will be most useful in that situation.
- **Long-Term Memory Systems Declarative and Nondeclarative Memories:**
- One way to categorize LTM is based on whether or not we are conscious of a given memory.

- **Declarative memories/explicit memories** are memories that we are consciously aware of and that can be verbalized, including facts about the world and one's own personal experiences.
- **Nondeclarative memories/implicit memories** include actions or behaviours that you can remember and perform without awareness.



- **Declarative Memory:**
- Declarative memory comes in two varieties:
    1. **Episodic memories** are declarative memories for personal experiences that seem to be organized around episodes and are recalled from a first-person perspective.
       Examples of episodic memories would be your first day of university, the party you went to last month, and that time you remember watching the Olympics on TV.
    2. **Semantic memories** are declarative memories that include facts about the world.
       An example of semantic memories would include knowing that Fredericton is the capital of New Brunswick.
- **Nondeclarative Memory:**
- Nondeclarative memory occurs when previous experiences influence performance on a task that does not require the person to intentionally remember those experiences.
- **Procedural memory** is a pattern of muscle movements such as how to walk, play piano, tie your shoes, or drive a car.
- **Memory At the Cellular Level:**
- Memory at the cellular level can be summed up in the following way: Cells that fire together, wire together. When neurons fire at the same time, it leads to chemical and physical changes in the neurons, making them more likely to fire together again in the future. This process, **long-term potentiation (LTP)**,

demonstrated that there is an enduring increase in connectivity and transmission of neural signals between nerve cells that fire together.

- However, this does not mean that LTP is memory.
- Lasting memories require **consolidation**, the process of converting short-term memories into long-term memories in the brain, which may happen at the level of small neuronal groups or across the cortex. When neurons fire together a number of times, they will adapt and make the changes caused by LTP more permanent, a process called **cellular consolidation**. This process involves physical changes to the synapse between the cells so that the presynaptic cell is more likely to stimulate a specific postsynaptic cell. Without the consolidation process, the initial changes to the synapse (LTP) eventually fade away, and presumably so does the memory.
- The initial strengthening of synapses (LTP) and longer-term consolidation of these connections allow us to form new memories, thus providing us with an ability to learn and to adapt our behaviour based on previous experiences. However, these processes are not performed in all areas of the brain.
- **Memory, the Brain, and Amnesia:**
- **Amnesia** is a profound loss of at least one form of memory.
- **Anterograde amnesia**, a subtype of amnesia, is the inability to form new memories for events occurring after a brain injury.
- Another subtype of amnesia is **retrograde amnesia**, a condition in which memory for the events preceding trauma or injury is lost.
- When the hippocampus is damaged, the injury interferes with consolidation, the formation of long-term memories. However, such damage does not prevent recall of pre-existing memories.
- The hippocampus is also essential for spatial memories.
- **Stored Memories and the Brain:**
- **Memory storage** refers to the time and manner in which information is retained between encoding and retrieval.
- Memory storage is an active process. Stored memories can be updated regularly, such as when someone reminds you of an event from years ago, or when you are reminded of information you learned as a child. In this way, memories undergo a process called **reconsolidation**, in which the hippocampus functions to update, strengthen, or modify existing long-term memories. These memories then form networks in different regions of the cortex, where they can be retrieved when necessary. These long-term declarative memories are distributed throughout the cortex of the brain, rather than being localized in one region, a phenomenon known as **cross-cortical storage**. With enough use, some of the memory networks will no longer need input from the hippocampus. The cortical networks themselves will become self-sustaining. The more that memory is retrieved, the larger and more distributed that network will become.
- Memories that were recently formed and have not had time to develop extensive cross-cortical networks are much more likely to be lost following a head injury than are older memories. Many people who have experienced a brain injury, including concussions, report that they cannot recall some of the events leading

up to their accident. This type of memory deficit is known as **retrograde amnesia**, a condition in which memory for the events preceding trauma or injury is lost.

- **Module 7.2 Encoding and Retrieving Memories:**
- **Rehearsal, The Basics of Encoding:**
- It is not how long we rehearse information, but rather how we rehearse it that determines the effectiveness of memory.
- **Maintenance rehearsal**, prolonging exposure to information by repeating it, does relatively little to help the formation of long-term memories. By comparison, **elaborative rehearsal**, prolonging exposure to information by thinking about its meaning, significantly improves the process of encoding.
- Although maintenance rehearsal helps us remember for a very short time, elaborative rehearsal improves long-term learning and remembering.
- **Levels of Processing:**
- Not all elaborative encoding is created equal. Instead, different types of elaborative encoding can produce markedly different levels of recall. The details surrounding this variability were first described by researchers at the University of Toronto, and led to a framework for memory known as **levels of processing (LOP)**.
- The LOP framework begins with the understanding that our ability to recall information is most directly related to how that information was initially processed. Differences in processing can be described as a continuum ranging from shallow to deep processing. **Shallow processing** involves more superficial properties of a stimulus, such as the sound or spelling of a word. **Deep processing** is generally related to an item's meaning or its function.
- The **self-reference effect** occurs when you think about information in terms of how it relates to you or how it is useful to you. This type of encoding will lead to you remembering that information better than you otherwise would have and is a type of deep processing.
- STM memory rates are unaffected by shallow or deep processing. They only affect LTM memory rates.
- **Retrieval:**
- There are two forms of intentional memory retrieval, both of which are familiar to long-suffering students like the readers of this textbook.
    1. **Recognition** involves identifying a stimulus or piece of information when it is presented to you. Examples of recognition memory would be identifying someone you know on the bus or answering standard multiple-choice test questions.
    2. **Recall** involves retrieving information when asked, but without that information being present during the retrieval process. Examples of this would be describing a friend's appearance to someone else or answering short-answer or essay questions on an exam.
- Recall is helped substantially when there are hints, or retrieval cues, that help prompt our memory. The more detailed the retrieval cue, the easier it is for us to produce the memory. Researchers have found that retrieval is most effective

when it occurs in the same context as encoding, a tendency known as the **encoding specificity principle**.

- The encoding specificity principle can take many forms. It can include internal contexts such as mood and even whether a person is intoxicated or not. It is usually not difficult to spot these context effects while they are occurring. Almost everyone has had the experience of walking into a room to retrieve something—maybe a specific piece of mail or a roll of tape—only to find that they have no idea what they intended to pick up. We might call this phenomenon **context-dependent forgetting**, if we believe the change in the environment influenced the forgetting. It is certainly frustrating, but can be reversed by the **context reinstatement effect**, which occurs when you return to the original location and the memory suddenly comes back. Research shows that your internal environment can serve as a retrieval cue for your memory as well.
- One of the most intuitive forms of encoding specificity is **context-dependent memory**, the idea that retrieval is more effective when it takes place in the same physical context as encoding.
- **State-Dependent Memory:**
- Research suggests that retrieval is more effective when your internal state matches the state you were in during encoding, a phenomenon known as **state-dependent memory**.
- **Mood-Dependent Memory:**
- Research of **mood-dependent memory** indicate that people remember better if their mood at retrieval matches their mood during encoding.
- As with context- and state-dependent memory, mood-dependent memory has some limitations. Mood has a very small effect on recognition memory; it has much larger effects on recall-based tests. Additionally, it produces larger effects when the participant must generate the to-be-remembered information (e.g., “an example of a musical instrument is a g_____“) than if the stimuli are externally generated (e.g., “remember this word: guitar”).
- **Emotional Memories:**
- Emotions act as a highlighter for memories, making them easier to retrieve than neutral memories, because emotional stimuli and events are generally self-relevant and are associated with arousal responses such as increased heart rate and sweating.
  I.e. Emotion leads to deep processing of information and involves powerful stimuli that can serve as retrieval cues.
- However, although it is intuitive to think that emotion will boost all forms of memory, psychology researchers have found that emotion has fairly specific effects. For example, people often focus their attention on the emotional content of a scene. This information, which typically forms the centre of one’s field of vision, is more likely to be remembered than peripheral information.
- Research has shown that the memory enhancing effect of emotion is strongest after a long period of time rather than short delays. This suggests that emotion’s largest influence is on the process of **consolidation**, when information that has recently been transferred from STM into LTM is strengthened and made

somewhat permanent. Emotion has less of an effect on STM and on recognition memory because these types of memory have much less variability than LTM and leaves less room for emotion to influence accuracy levels.

- Emotions can still influence memory consolidation even if the stimuli themselves are not emotional in nature.
- Brain imaging shows that emotional memories often activate the amygdala, whereas non-emotional memories generated at the same time do not. These studies have also shown that the amygdala can alter the activity of several temporal-lobe areas that send input to the hippocampus. As a result, the cells in these brain regions fire together more than they normally would, which may lead to more vivid memories. However, this coordinated neural activity still does not guarantee that all of the details of an experience will be remembered with complete accuracy.
- Activity in the amygdala influences the activity of nearby regions in the temporal lobes, increasing the degree to which they fire together. This alters the type of input received by the hippocampus from regions of the cortex.
- **Flashbulb Memories:**
- A **flashbulb memory** is an extremely vivid and detailed memory about an event and the conditions surrounding how one learned about the event.
- These highly charged emotional memories typically involve recollections of location, what was happening around oneself at the time of the event, and the emotional reactions of self and others.
- Although flashbulb memories are very detailed and individuals reciting the details are very confident of their accuracy, it might surprise you to learn that they are not necessarily more accurate than many other memories.
- **Mnemonics Improving Your Memory Skills:**
- A **mnemonic** is a technique intended to improve memory for specific information.
- The **method of loci** is a mnemonic that connects words to be remembered to locations along a familiar path. To use the method of loci, one must first imagine a route that has landmarks or easily identifiable spaces. Once the path is identified, the learner takes a moment to visually relate the each word on the list to a landmark encountered. The image doesn't need to be realistic, it just needs to be distinct enough to be memorable. When it is time to recall the items, the learner simply imagines the familiar drive, identifying the items as they relate to each location along the path.
- However, the method of loci can become a bit cumbersome. A more practical mnemonic is the use of **acronyms**, pronounceable words whose letters represent the initials of an important phrase or set of items.
- A related mnemonic, the **first-letter technique**, uses the first letters of a set of items to spell out words that form a sentence.
- A number of mnemonic devices are based on the premise of dual coding. **Dual coding** occurs when information is stored in more than one form, such as a verbal description and a visual image, or a description and a sound, and it regularly produces stronger memories than the use of one form alone. Dual coding leads to the information receiving deeper processing because the

additional sensory representations create a larger number of memory associations.

- The **testing effect** is the finding that taking practice tests can improve exam performance, even without additional studying.
- **Module 7.3 Constructing and Reconstructing Memories:**
- **The Schema An Active Organization Process:**
- The gist of a story gives us a general structure for the memory and details can be added around that structure. The gist is often influenced by **schemas**, organized clusters of memories that constitute one's knowledge or beliefs about events, objects, and ideas.
- Schemas affect encoding, storage and retrieval.
- Whenever we encounter familiar events or objects, these schemas become active and affect what we expect, what we pay attention to, and what we remember. Because we use these patterns automatically, it may be difficult to understand what they are, even though we use them throughout our lives.
- Schemas about the self are based on past experiences and are used to organize the encoding of self-relevant information in a way that can influence our responses. Furthermore, self-schemas may serve an additional role during development. Some evidence suggests that the ability to form schemas, particularly self-schemas, plays a critical role in our ability to form memories about our lives.
- **Infantile amnesia** is the inability of adults to retrieve episodic memories before the age of two to four years.
- Research indicates that self-schemas begin to develop around the ages of 18 to 24 months. Without these schemas, it is difficult and maybe even impossible to organize and encode memories about the self. This is not a universal phenomenon, however. Researchers have found that a sense of self emerges earlier among European Americans than among people living in eastern Asia, because European Americans put emphasis on developing a sense of self, which encourages thinking about personal experiences. In contrast, Asian cultures tend to emphasize social harmony and collectiveness over individualism, resulting in a schema that is more socially integrated than in Westerners.
- Research indicates that we remember events using **constructive memory**, a process by which we first recall a generalized schema and then add in specific details. The schemas are products of culture and experience.
- Recent brain-imaging studies suggest that schemas exist and likely help with the process of memory consolidation. Both encoding and retrieving information that was consistent with a schema learned during an experiment led to greater activity in a network involving parts of the medial temporal lobes and the frontal lobes. Additionally, adding new information to an existing schema actually changes the expression of genes in the frontal lobes in order to strengthen connections between this region and the hippocampus.
- **Memory Reconstruction:**
- While our memories are organized to a large degree by our schemas, including self-schemas, there is no guarantee that these schemas are 100% accurate.

Different motivations can influence which schemas are accessible to us in a given moment, thereby biasing our memory reconstruction. As a result of these motivational influences, the past that we remember is actually influenced by our mental state and by our view of ourselves in the present.

- Everyone has experienced a **false memory**, remembering events that did not occur, or incorrectly recalling details of an event. It is important to remember that these incorrect memories do not necessarily indicate a dysfunction of memory, but rather reflect normal memory processes, which are inherently imperfect.
- **The Perils of Eyewitness Testimony:**
- There are a number of minor factors can dramatically influence the details of our memories:
    1. The wording of the statement or question.
    2. The information that is encoded after the event has occurred, such as rumours, news reports, or hearing about other people's perceptions of the event. If such information was accurate, it could improve people's memories. However, this type of information is not always accurate, which explains why jury members are asked to avoid reading about or watching TV reports related to the case with which they are involved. Psychologists have shown that this legal procedure is a wise one, as a number of studies have demonstrated the **misinformation effect**, when information occurring after an event becomes part of the memory for that event.
- Children are particularly susceptible to misinformation effects and to the effects of a question's wording.
- While trying to identify the individual responsible for a crime, investigators often present a lineup of a series of individuals and ask the eyewitness to identify the suspect. Given the constructive nature of memory, it should come as no surprise to hear that an eyewitness gets it wrong from time to time. The consequences of this kind of wrongful conviction are dire, an innocent person may go to jail while a potentially dangerous person stays free. Here are the six main suggestions for reforming eyewitness identification procedures:
    1. **Employ double-blind procedures.** Elsewhere in this book, we discussed how double-blind procedures help reduce experimenter bias. Similarly, a double-blind lineup (i.e., the investigator in the room with the eyewitness has no knowledge of which person is the actual suspect) can prevent an investigator from biasing an eyewitness, either intentionally or accidentally.
    2. **Use appropriate instructions.** For example, the investigator should include the statement, "The suspect might not be present in the lineup." Eyewitnesses often assume the guilty person is in the lineup, so they are likely to choose a close match. This risk can be greatly reduced by instructing the eyewitness that the correct answer may be "none of the above."
    3. **Compose the lineup carefully.** The lineup should include individuals who match the eyewitness's description of the perpetrator, not the investigator's beliefs about the suspect.
    4. **Use sequential lineups.** When an entire lineup is shown simultaneously, this may encourage the witness to assume one of the people is guilty, so they

choose the best candidate. If the people in the lineup are presented one at a time, witnesses are less likely to pick out an incorrect suspect because they are willing to consider the next person in the sequence.

5. **Require confidence statements.** Eyewitness confidence can change as a result of an investigator's response, or simply by seeing the same suspect in multiple lineups, neither of which make the testimony any more accurate. Therefore, confidence statements should be taken in the witness's own words after an identification is made.
6. **Record the procedures.** Eyewitness researchers have identified at least a dozen specific things that can go wrong during identification procedures. By recording these procedures, expert witnesses can evaluate the reliability of testimony during hearings.

- **Imagination and False Memories:**
- Imagining events can often lead to **imagination inflation**, the increased confidence in a false memory of an event following repeated imagination of the event. The more readily and clearly we can imagine events, the more certain we are that the memories are accurate.
- Imagination inflation is very similar to **guided imagery**, a technique used by some clinicians to help people recover details of events that they are unable to remember. It involves a guide giving instructions to participants to imagine certain events. Like the misinformation effect, guided imagery can be used to alter memories for actual events, but it can also create entirely false memories.
- **Creating False Memories in the Laboratory:**
- Researchers have developed techniques that would allow them to study false memories in more detail. Several are listed below:
    1. In the **Deese-Roediger-McDermott (DRM) procedure**, participants study a list of highly related words that are associated by meaning. The word that would be the most obvious member of the list is missing. This missing word is called the **critical lure**. When the participants are given a memory test, a significant proportion of participants remember the critical lure, even though it never appeared on the list. When individuals recall the critical lure, it is called an **intrusion**, because a false memory is sneaking into an existing memory.
    2. Doctored photographs or videoes.
- **The Danger of False Remembering:**
- A **recovered memory** is a memory of a traumatic event that is suddenly recovered after blocking the memory of that event for a long period of time, often many years.
- The idea that we suppress traumatic memories is known as repression from Freudian psychoanalysis. According to this idea, a repressed memory could still affect other psychological processes, leading people to suffer in other ways, such as experiencing depression. This school of thought suggests that if a repressed memory can be recovered, then a patient can find ways to cope with the trauma. However, it is dangerous to recover these memories as people may plant false memories and recover those.

- Recovered memories, like many other types of long-term memory, are difficult to study because one can rarely determine if they are true or false. This uncertainty has led to the **recovered memory controversy**, a heated debate among psychologists about the validity of recovered memories.
- We can use brain imaging to differentiate true and false memories. Psychologists have found that when people recount information that is true, the visual and other sensory areas of the brain become more active. When revealing falsely remembered information, these same individuals have much less activity in the sensory regions because the brain is not drawing on mental imagery as it was not there in the first place. This method might be able to distinguish between true and false memories better than the participant himself. However, these studies did not use stimuli that were as emotional as the recovered memories patients report. Therefore, much more research is needed.

Definition:

- **Acronyms:** Pronounceable words whose letters represent the initials of an important phrase or set of items.
- **Amnesia:** A profound loss of at least one form of memory.
- **Anterograde amnesia:** The inability to form new memories for events occurring after a brain injury.
- **Attention:** Selects which information will be passed on to STM.
- **Central executive:** The control centre of working memory; it coordinates attention and the exchange of information among the three storage components.
- **Chunking:** Organizing smaller units of information into larger, more meaningful units.
- **Consolidation:** The process of converting short-term memories into long-term memories in the brain.
- **Constructive memory:** A process by which we first recall a generalized schema and then add in specific details.
- **Context-dependent memory:** The idea that retrieval is more effective when it takes place in the same physical context as encoding.
- **Control processes:** Shift information from one memory store to another.
- **Declarative/explicit memories:** Memories that we are consciously aware of and that can be verbalized, including facts about the world and one's own personal experiences.
- **Deep processing:** Memory processing related to an item's meaning or its function.
- **DRM procedure:** Participants study a list of highly related words that are associated by meaning.
- **Dual coding:** Occurs when information is stored in more than one form.
- **Echoic memory:** The auditory form of sensory memory.
- **Elaborative rehearsal:** Prolonging exposure to information by thinking about its meaning.
- **Encoding:** The process of storing information in the LTM system.

- **Encoding specificity principle:** Retrieval is most effective when it occurs in the same context as encoding.
- **Episodic buffer:** A storage component of working memory that combines the images and sounds from the other two components into coherent, story-like episodes.
- **Episodic memories:** Declarative memories for personal experiences that seem to be organized around “episodes” and are recalled from a first-person perspective.
- **False memory:** Remembering events that did not occur, or incorrectly recalling details of an event.
- **First-letter technique:** Uses the first letters of a set of items to spell out words that form a sentence.
- **Flashbulb memory:** An extremely vivid and detailed memory about an event and the conditions surrounding how one learned about the event.
- **Iconic memory:** The visual form of sensory memory.
- **Imagination inflation:** The increased confidence in a false memory of an event following repeated imagination of the event.
- **Long-term memory (LTM):** Holds information for extended periods of time, if not permanently.
- **Long-term potentiation (LTP):** Demonstrated that there is an enduring increase in connectivity and transmission of neural signals between nerve cells that fire together.
- **Maintenance rehearsal:** Prolonging exposure to information by repeating it.
- **Memory storage:** The time and manner in which information is retained between encoding and retrieval.
- **Method of loci:** A mnemonic that connects words to be remembered to locations along a familiar path.
- **Misinformation effect:** When information occurring after an event becomes part of the memory for that event.
- **Mnemonic:** A technique intended to improve memory for specific information.
- **Mood-dependent memory:** People remember better if their mood at retrieval matches their mood during encoding.
- **Nondeclarative/implicit memories:** Include actions or behaviours that you can remember and perform without awareness.
- **Phonological loop:** A storage component of working memory that relies on rehearsal and that stores information as sounds, or an auditory code.
- **Proactive interference:** A process in which the first information learned occupies memory, leaving fewer resources to remember the newer information.
- **Procedural memories:** Patterns of muscle movements.
- **Recall:** Retrieving information when asked but without that information being present during the retrieval process.

- **Recognition:** Identifying a stimulus or piece of information when it is presented to you.
- **Recovered memory:** A memory of a traumatic event that is suddenly recovered after blocking the memory of that event for a long period of time.
- **Recovered memory controversy:** A heated debate among psychologists about the validity of recovered memories.
- **Rehearsal:** Repeating information until you do not need to remember it anymore.
- **Retroactive interference:** The most recently learned information overshadows some older memories that have not yet made it into long-term memory.
- **Retrieval:** Brings information from LTM back into STM.
- **Retrograde amnesia:** A condition in which memory for the events preceding trauma or injury is lost.
- **Schema:** Organized clusters of memories that constitute one's knowledge about events, objects, and ideas.
- **Self-reference effect:** Occurs when you think about information in terms of how it relates to you or how it is useful to you; this type of encoding will lead to you remembering that information better than you otherwise would have.
- **Semantic memories:** Declarative memories that include facts about the world.
- **Sensory memory:** A memory store that accurately holds perceptual information for a very brief amount of time.
- **Serial position effect:** In general, most people will recall the first few items from a list and the last few items, but only an item or two from the middle.
- **Shallow processing:** Encoding more superficial properties of a stimulus, such as the sound or spelling of a word.
- **Short-term memory (STM):** A memory store with limited capacity and duration (approximately 30 seconds).
- **State-dependent memory:** Memory retrieval is more effective when your internal state matches the state you were in during encoding.
- **Stores:** Retain information in memory without using it for any specific purpose.
- **Testing effect:** The finding that taking practice tests can improve exam performance, even without additional studying.
- **Tip-of-the-tongue (TOT) phenomenon:** When you are able to retrieve similar sounding words or words that start with the same letter but can't quite retrieve the word you actually want.
- **Visuospatial sketchpad:** A storage component of working memory that maintains visual images and spatial layouts in a visuospatial code.
- **Working memory:** A model of short-term remembering that includes a combination of memory components that can temporarily store small amounts of information for a short period of time. It is composed of the phonological loop, the visuospatial sketchpad, and the episodic buffer.