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Memory

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Glossary

dt0010 **Category** An organized set of conceptual entities (objects, events, concepts. etc.) that are treated as similar to one another in some respect.

dt0015 **Episodic memory** Memory for knowledge localized in time and place.

dt0020 **Explicit memory** Memory that involves a deliberate and conscious act of remembering (e.g., recognition and recall).

dt0025 **False memories** Belief in having a memory, when in fact, it did not occur or is altered from what was first encoded.

dt0030 **Implicit memory** Memory that operates through unconscious mechanisms.

dt0035 **Long-term memory** A large-capacity portion of memory where information is stored for long periods of time, possibly lasting a lifetime.

dt0040 **Memory** The mental systems, representations, and processes involved in the retention of information.

dt0045 **Procedural memory** Memory for performance activities, including stimulus–response associations (e.g., knowledge of how to ride a bike or drive a car).

dt0050 **Schema** General world knowledge of well-defined common human experiences used to organize new information and reconstruct information that may have been forgotten.

dt0055 **Semantic memory** Memory for encyclopedic general world knowledge which does not refer to a specific event in the individual's life.

dt0060 **Short-term memory** A limited capacity portion of memory where information lasts for only a short period of time, sometimes referred to as working memory.

dt0065 **Spreading activation** The idea that the activation or availability of one conceptual entity spreads to other related conceptual entities through a complex of associative pathways.

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Introduction

p0010 Several characteristics of memory are of interest in how people encode, store, and retrieve information. The issues of concern include (1) the specification of different types of memories, (2) whether memories are permanent, and (3) how aspects of memory impact people's daily lives.

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Ways of Understanding Memory

p0015 Memory holds information as widely varied as knowledge of people's faces, how to drive a manual transmission, phone numbers, the names of the countries of Europe, and the smells of good home cooking. A complete account of memory must specify how memories are created, their organization and influence on one another, and how they are retrieved. Because memory cannot be directly observed, theoretical accounts make use of metaphors. Models of memory used metaphors based on technological innovations, starting with a filing cabinet or bin system. Later, with the expansion of the telephone, memory was referred to as though it were a switch board. With the advent of the digital computer, models of memory adopted a computer metaphor, along with the processes involved in encoding, storing, retrieving, and operating on information. Late in the twentieth century, there was an effort to consider how information might be represented neurally, with people using a brain metaphor. More recently, there has been a focus on how memory is used for living. This is a more functional approach that assesses the influences of embodied or grounded cognition. In essence, these approaches look at how people interact with the environment and consider how memory evolved and has been adapted to meet those environmental demands.

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Types of Memory

p0020 Memory exhibits different characteristics under different conditions. For instance, a person might have trouble recalling the names of people met at a party a few weeks ago, but might remember how to ride a bicycle throughout his life. A person can often repeat back what was just said immediately afterwards, but not a week later. Experiences such as these have led to the suggestion that there are different types of memory, and these types have different characteristics.

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Short- and Long-Term Memory

p0025 Many conceptualizations distinguish between long-term and short-term memory. Traditionally, long-term memory contains a lasting record of information, whereas short-term memory exists for only a short period of time (<30 s) unless actively maintained or transferred to long-term memory. Moreover, only a limited amount of information can be actively processed in short-term memory, typically described as an average of 3, 4, or 7 units of information, depending on the particular theory. So, while long-term memory contains information that has accumulated over a lifetime, short-term memory's limited capacity allows only a small set of information chunks. More details on how memory and brain structures are related are discussed elsewhere in this encyclopedia. In contrast, some Au2 theories suggest that short-term memory is only a portion of

long-term memory that is currently active rather than a separate memory itself. In these views, the limit on short-term memory capacity depends on the amount of long-term memory information that can be called into consciousness at any one time.

p0030 A more elaborate idea over short-term memory that has emerged is that of a *working memory*. This includes not only a short-term store aspect, but also the active processing of information. Working memory itself may be divided into subcomponents, such as a phonological loop for linguistic information, a visual–spatial sketchpad for visual–spatial information, an episodic buffer for integrating information from various modalities and long-term memory, and an overarching central executive that controls information processing. These subsystems may be semiautonomous. So, while one subsystem is actively processing information, another might be available for other tasks. For example, it is easier to read a paragraph (a phonological loop task) if one is simultaneously trying to remember the location of a dot on a screen (using the visual–spatial sketchpad) than if one is trying to remember a set of words (another phonological loop task).

p0035 In general, information remains in short-term/working memory until something comes along to force it out. Because capacity is limited, new information is likely to push out the old, leaving only the most recently encountered information available. This process is called interference. This leads to what is called the recency effect in which the recently acquired information is more available than earlier information. For example, if a person is given a list of names and then recalls them, the names at the end of the list will have a better chance of being remembered because they have not impinged upon by further information.

s0030 *Single versus dual processes*

p0040 One concern about memory is whether retrieval involves a single process, or two separate processes. At the crux of this issue is the subjective awareness of what it is like to remember in different ways. In some cases a person is consciously aware of having experienced something and is able to remember a number of details about an event, such as how it was learned, where people were, who told them, the sound of a person's voice, and so on. These vivid memories are called recollections. For example, if you can remember a lot of details about some event, such as a car accident you were in. Comparatively, in other cases a person may not remember many if any, details. The person simply knows that she knows something. For example, if you know what a platypus is, but have no memory of learning it, this would correspond to one of these types of memories.

p0045 According to a single process view, various parts of the brain act in concert in the service of a single unified search. The primary difference between recollections and known memories is how much information is recovered. The attraction here is that this has the advantage of being theoretically parsimonious. In contrast, for a dual process view there are two processes that operate in parallel to help retrieval. The first is a fast acting heuristic-like familiarity process that assesses how strong a memory is. The stronger it is, the more likely a person will say it is known. This is a largely unconscious process. The second process is a slower, more deliberative search which actively seeks various details in memory to consciously retrieve. These two types of memory processes may involve different neurological structures, and can be doubly dissociated. This suggests that memory uses different methods to retrieve different memories.

Organization of Long-Term Memory s0035

Information in memory is often organized on the basis of both its content and the context in which it was presented. However, not all types of information are represented in the same way. Theories of long-term memory postulate different systems and subsystems, each of which is dedicated to different types of information, and each exhibits properties that are not found in the others. Endel Tulving's monohierarchy of memory provides a useful framework for conceptualizing how different types of information are organized and remembered. Other types of organizations will be considered at the point in which they conform to the different levels of this hierarchy. p0050

Tulving's Monohierarchy s0040

Tulving's monohierarchy is a three-level organization, with one system at each level, and the higher systems being dependent on the lower ones. These systems are procedural, semantic, and episodic. p0055

Procedural memory s0045

Procedural memory, at the most basic level of the monohierarchy, contains memories for how to perform activities, including stimulus–response associations. Examples of procedural memories are knowledge of how to ride a bike or drive a car, how to play the drums, how to solve a puzzle, and how to walk. The procedures contained here can be activated without conscious awareness. Thus, the procedural knowledge that governs driving a car is applied with minimal attention to the specific sequence of steps needed to do this. As this observation implies, information in procedural memory is often difficult to articulate, but lasts for quite a long time. In addition, procedural knowledge is relatively resistant to deliberate changes to add, modify, or rearrange various components. p0060

Semantic memory s0050

Semantic memory, the second level of Tulving's monohierarchy, contains general knowledge that does not refer to a specific event in the individual's life. As such it is an encyclopedic knowledge. The contents of semantic memory are retained for a long time. Semantic memory differs from procedural memory in that people can often articulate the information that is stored. Semantic memory is typically conceptualized as being highly integrated in which related concepts are functionally stored together. This organizational structure of semantic memory can be seen in its use. For example, it exhibits effects of relatedness. Information is identified faster if it is preceded by information that has similar content. p0065

Some theories conceptualize semantic memory as an associative network of concepts. Each concept represents a separate entity that is associatively linked to other entities by pathways. Concepts that are more similar to one another are more closely p0070

associated in the network. So, when information from one concept is used, other concepts that are associated with it are also brought to mind. For more details on this process, see Au3 'Spreading Activation and Reminding.' There are also theories of semantic memory that suggest that it is composed of sets of features that define the nature of things, how they function, and how we relate to them. These feature-based views do not assume a structure to semantic memory, but assume that apparent structure is derived from how information is used. Two types of mental representations in semantic memory, schemas and categories, are worth noting. Further explanation on this is dealt elsewhere in this encyclopedia.

p0075 Schemas are semantic memory structures that help people organize new information they encounter. In addition they may help a person reconstruct bits and pieces of memories that have been forgotten. For example, if you remember going to a new restaurant, you may not actually remember reading the menu, but your schema for restaurant dining can fill this information in. Each schema is a structured representation of all the information that a person has, referring to a well-defined domain of common human experience, such as washing a car, applying to a school, or reading a newspaper. Schemas help people figure out things that they may have temporarily or permanently forgotten, or even missed entirely. Anyone who has begun watching a television show or movie from the middle of the story has had the experience of being able to figure out what has gone on previously without having actually seen it. People essentially fill in the gaps with what they know about similar situations. This reconstructive process can sometimes lead people astray. In James Bartlett's famous work on schemas, students in England were given a Native American folktale to read. This folktale possessed a structure quite different from the stories of English culture. Bartlett found that as time passed, the students forgot more of the details and structure of the original story. The forgotten portions were replaced with ideas that were Westernized transformations of the story. The students had filled in the gaps in their memory with schematic knowledge of what they knew about folktales and the topics covered in the folktale.

p0080 A special type of event schema, called a *script*, describes a temporally ordered sequence of events that frequently occur in the world and can be used both to explain new events one encounters and to predict future consequences. Moreover, they can be used as behavioral guides. For example, 'Asking for a menu' in a 'restaurant' script that precedes parts that pertain to ordering, eating, and paying the bill. So, the determinants and consequences of an individual's request for a menu can be inferred on the basis of the additional frames of the script that are used to interpret it. Moreover, one's own decision to leave a tip at a restaurant may be based on the perception that this behavior is appropriate, as implied by the same script.

p0085 In much the same way as people use scripts to benefit their memory, they also use categories. By having background knowledge about a category, people can use that knowledge to influence retrieval, or to fill in gaps in their memory. One example, is to be able to guess what ran in front of your car on the road at night. With limited perceptual information people can make assumptions that the animal may have been a deer, or an opossum based on knowledge of what animals cross the road at night, or the category of animals that cross the road at night. Each category is a memory structure made up of conceptual entities (objects, events, concepts, etc.) that are, in some respect, similar to one another. Categories help organize the various entities that are encountered. There are several different classes of theories of how mental categories are created and represented. A threefold classification of theories was proposed by Douglas Medin. According to the classical view, mental categories are defined sets of necessary and sufficient properties. Entities either have these features or not, and therefore either do or do not belong to a given category.

p0090 According to probabilistic views, mental categories are created with reference to a set of properties, without the criteria of necessity and sufficiency. Category members vary in the number and pervasiveness of their features, leading to a graded category structure. The defining features for a category in memory are either contained in a memory representation of the prototypical member (real or not) or are derived from an average of all of the separate exemplars of the category.

p0095 The third class of theories is knowledge-based. In many ways, this is similar to schema theories. Here, the organization of concepts into a mental category is based on knowledge of how the various members function in the world. In other words, entities are organized into categories in the sense that they are used in similar ways to explain things about the world. This is in contrast to the other theories which regard the presence or absence of various properties as the basis for categorization. For example, the category 'things to take out of the house in a fire' would be made of things that are combustible, easily transportable, and difficult or impossible to replace. This would include such diverse things as family members, money, photos, and pets, which do not share features that would cause them to be classified in memory together a priori except that they conform to a common goal. Further details are discussed elsewhere in this encyclopedia.

Episodic memory s0055

p0100 Episodic memory, at the highest level of Tulving's monohierarchy, is like semantic memory in that the information is easily articulated. However, episodic memory differs from semantic memory in that the subject matter is concerned with events from a person's life rather than general world knowledge. Thus, episodic memories are localized in time and place. For example, general knowledge of traffic law is in the domain of semantic memory, whereas knowledge of a particular incident of getting a speeding ticket is in the domain of episodic memory. Episodic memories, unlike procedural and semantic memories, are more influenced by the passage of time. That is, they exhibit the classic negatively accelerating forgetting curve outlined by Hermann Ebbinghaus at the end of the nineteenth century. Three specific aspects of episodic memory – mental models, autobiographical knowledge, and emotional experience – are worth special attention. Further discussion on this is dealt elsewhere in this encyclopedia.

p0105 Whereas schemas and categories refer to general knowledge, mental models represent specific events. An early conception of mental models was made by Philip Johnson-Laird. Mental models simulate the functional relations of elements in a situation. This often involves general knowledge, possibly from schemas. For example the statement 'the bike tire is flat' may simulate the construction of a mental model based on a

spatially organized schema concerning the physical state of an object that is a part of a bike. Alternatively, the model of a friend's story about the circumstances surrounding her wedding day might be constructed on the basis of several different schemas or scripts, each of which is applied to a different sequence of events in the narrative.

p0110 Mental models are stored and retrieved relatively independently of one another. For example, a set of related information (e.g., knowing about a group of people and the locations they are in) that refers to different situations is stored in several mental models in memory and produces interference during retrieval. This is because the related mental models interfere with one another during retrieval. However, if everything can be stored in a single integrated representation, there is no interference at retrieval. So, mental models help aggregate information in memory into single representations of unique situations.

p0115 Much of the information one receives in the world directly involves oneself as an active participant in the on-going events. This self-knowledge, or autobiographical memory, composes a large share of the episodic information that people accumulate. Autobiographical knowledge is distributed throughout episodic memory, although it may include semantic information as well, such as knowledge of what schools one has attended. Representations of this knowledge may initially be formed at different times and stored independently of one another. Later, these separate representations are retrieved and integrated into a single autobiographical memory that describes the sequence of events that occurred over a period of days, weeks, or even years. Thus, autobiographical memories often have a constructive quality. This interpretive and constructive has systematic effects on the memories for the event. For example, these memories tend to be remembered as closer in time to major events in a person's life, such as the start of a semester, losing a job, or the birth of a child. Once formed, these representations are 'theories' about oneself and one's behavior in the events in question. More details on this topic are dealt elsewhere in this encyclopedia.

p0120 Emotion can have a powerful influence on memory. For example, memories can be primed or made more available if they refer to events that evoked the same emotion as a person's current state (called mood congruent learning). Sad people find it easier to recall sad memories and happy people find it easier to recall happy memories. In addition, memory is generally improved for events that are emotional. Emotionally neutral events are not as well remembered as emotionally intense events. For example, if someone sees a traumatic event, the person is likely to remember the specific details about it well. However, this applies to the more central parts of the event. People are not as good at remembering unrelated, or peripheral, information that was also present. Possible causes of the memory benefit could be related to how emotion is processed neurologically. Activity, especially in the amygdala, serves to enhance basic memory processes, providing better memory for emotionally salient details.

s0060 *Relations among memory systems*

p0125 Although episodic and semantic memories are described as different systems here, it is clear that they influence one another in everyday use. For example, semantic representations may be formed on the basis of episodic ones and vice versa. A person who is asked directions to a restaurant might respond on the basis of an episodic memory of how that person drove there the previous day, or on the basis of more general knowledge that is not temporally localized and is not based on personal experience at all. In some instances, semantic memories may simply be episodic representations (e.g., mental models) in which situation-specific features denoting the time and place of occurrences (and of oneself as the experiencing agent) have somehow been forgotten. Consequently, the distinction between episodic and semantic memory is not as clear as Tulving's monohierarchical system might suggest.

Reminding s0065

One intriguing aspect of memory is that when people think of one thing, they are often reminded of something similar. This reminding is often of either information that the person may know or earlier experiences that are in some way similar to the current situation. The use of free association to bring otherwise inaccessible memories into consciousness is based on the idea that what is currently being thought about can remind a person of related pieces of knowledge that are more remotely associated with it. p0130

Spreading Activation and Priming s0070

A popular way of describing the reminding process is spreading activation. This idea assumes that memory is a network of concepts connected through a complex of associative links. When information in the network is used in some way, those concepts that are used are energized or activated. This activation spreads along the associative pathways from each of the activated concepts to other concepts, and when this activation build up exceeds some threshold, they are activated as well. p0135

This activation process occurs for both general and event-specific knowledge. For example, if you were in a conversation and someone brings up the topic of fire trucks, your concepts for fire trucks would become activated in long-term memory. The activation would also spread to related concepts, such as red, emergency, and Dalmatians. This activation could also spread to event-specific knowledge, such as the last time you saw a speeding fire truck, you were in your neighbor's Plymouth and the engine died in the middle of a busy intersection. p0140

Spreading activation is largely automatic, without deliberate intention. However, it can be controlled to some extent. When related information is irrelevant, or the activation has spread for some time with no benefit to the current goals, it can be dampened, and resources can be directed elsewhere. This helps people pursue their current goals, and keep them from constantly rattling through an endless series of irrelevant associative meanderings. p0145

The effects of spreading activation have been investigated in many experiments. In a typical study, people are asked to decide whether each of several letter strings are words or nonwords. People can identify 'nurse' more quickly after seeing the word 'doctor' than after seeing the work 'bread.' Encountering the word 'doctor' and accessing its meaning in memory caused p0150

activation to spread to the concepts related to it, including 'nurse,' thus making 'nurse' easier to identify. In other words, 'nurse' was primed by the word 'doctor.'

s0075 Explicit and Implicit Memory

p0155 Another important memory distinction is between explicit and implicit memory. Explicit memory involves conscious remembering. Recognition and recall tasks, in which a person deliberately tries to remember something, are examples of tasks that rely heavily on explicit memory. In contrast, implicit memory involves unconscious remembering. Typical tests of implicit memory test the unconscious influence of previously encountered information on an ostensibly unrelated task. For example, people might read a list of words, one of which is 'memoirs.' Later, they do a task that does not involve conscious recollection, such as a word stem completion task in which they complete a word stem such as MEM with the first word that comes to mind. People are more likely to complete the stems with words that they had seen earlier than are people who were not exposed to the original list.

p0160 Explicit and implicit memories respond to different influences. For example, explicit memory is affected more by conceptually driven strategies, imposed by a person, that help to organize the information. Conversely, implicit memory is more affected by data-driven strategies that rely on the physical properties of a stimulus, such as color or font. Some theories argue that explicit and implicit memories are distinct systems with different representations and processes. Proponents of these theories point to studies in which the two processes are put in competition. For example, suppose some people in a word-stem completion task are asked to try to complete the stems with words that they saw earlier, whereas others are asked to complete the stems with words they did not see. The differential rate of completing the stems with earlier seen items provides indices of the use of explicit and implicit memory. These indices vary with the tasks sued and the conditions in which they are done. For further information on this topic, see Au4 section 'Implicit Memory.'

s0080 Evidence from Amnesia

p0165 A great deal of knowledge about how memory works has come from studies of anterograde amnesics. These people have suffered some brain injury, typically due to head trauma, surgical mishaps, or chronic alcohol abuse. They have difficulty remembering new information they received after the time of their injury. (Some of the more severe cases need to be reintroduced to their doctors if they leave the room for a few minutes because they have no memory of them.) Although amnesics are unable to recollect some types of information, they retain other types quite well. For example, severe amnesics with deficits in semantic and episodic memories have largely intact procedural memories. Amnesics, who knew how to play the piano before their injury, could be taught to play a new song. When asked if they know how to play the song they would report no memory of it, yet they would be able to play it successfully if coaxed into trying. Amnesics also show deficits in explicit memory tasks, such as recognition and recall, which require active remembering, but have similar memories to normal people for implicit memory tasks, such as word-stem completion. More information on this is dealt elsewhere in this encyclopedia.

Permanence of Memories s0085

p0170 People encounter a great deal of information in their lifetime. They see lots of things, meet many people, read many things, and have lots of experiences. What happens to all of this information? Is all of it remembered forever? Or is it the case that once information has been lost from memory it is lost forever, and will never again be recovered and play a role in influencing behavior?

p0175 One view is that everything that is ever encountered is stored in long-term memory and remains there permanently in some form or another. These memories either can be retrieved into consciousness and/or exert an unconscious influence on behaviors and ideas throughout the lifespan. A well-known source of evidence for the permanence of memory comes from the work of the neurosurgeon Wilder Penfield. During the 1950s, he performed operations that involved cutting away part of a patient's brain in the treatment of some ailment, like epilepsy. Before actually removing part of the cortex, Penfield stimulated various areas with a mild electrical charge to determine the functions of various areas so as not to remove any vital functions. Sometimes the patient reported vivid experiences. One patient reported 'Yes, sir, I think I heard a mother calling her little boy somewhere' when receiving electrical stimulation in a specific area (Penfield, 1955, Au5 p. 54). These experiences, because of their mundane nature, led Penfield to suggest that the electrical stimulations caused a re-emergence of previously forgotten memories from the past and seemed to suggest that everything a person had ever experienced was stored in memory, and that all that is needed is a means to get it out; which in this case, was electrical stimulation of the cortex.

p0180 However, despite this convincing argument, this is not the complete explanation. First, only about 25% of Penfield's patients actually reported some experience, and only 3–7% of these reports were sufficiently clear to suggest that the patients were actually re-experiencing a previous life event. While cortical electrical stimulation may have brought back memories, it also may have just suggested experiences. No evidence was ever collected that suggested that the reported experiences actually happened to the patients.

p0185 Other positions have been put forward in support of some version of permanent memory storage. One is Harry Bahrick's permastore idea. According to this view, when information is first stored in memory, there is some forgetting over time. However, at some point (usually about 3 years later), the amount of forgetting ceases and what is left over stays in a stable state over long periods of time. The information that remains is said to be in a permastore, or permanent storage. In one study, Bahrick studied memory for college Spanish. For the first 3 years after college, there is a drop in the amount of information remembered. However, memory remained relatively constant for the next 40 years or so.

s0090 ## Forgetting in a Permanent Memory System

p0190 If memories are permanent, then how could forgetting occur? Two of the more prominent reasons are the lack of sufficient retrieval cues and retrieval interference.

s0095 ### *Retrieval cues*

p0195 Although information may be stored in memory, it may be destined for some dark and dusty corner of the mind that is inaccessible. One reason for this inability is that a person does not have the proper retrieval cues. Retrieval cues are the set of properties that allow for the appropriate selection and retrieval of the memory. If these cues are not available, the memory cannot be retrieved. A common metaphor that is used to describe this is that of a library. A book may be stored in the library shelves, and if it can be gotten, all of the information in it would be available. However, if its entry in the card catalog is missing, it becomes very difficult to retrieve, and might even be said not to exist in the library at all.

p0200 One of the factors that can influence the ability to remember is the amount of processing it received at encoding. Basically, the more time and effort that a person expends processing new information through elaboration or association with previously known information, the more likely it will be remembered later. This is called the level of processing hypothesis. According to this idea, information that is processed at a deeper level is remembered better because there are more cues that can be used to retrieve it. For example, if a person were to scan a newspaper article for certain letters, it is unlikely that much would be remembered. Whereas, if a person were to read the article in detail, thinking of related stories that have been reported earlier, or to other related topics, much of the information in the article would be remembered.

p0205 A related topic is the generation effect. Basically, information that was generated by people is remembered better than information that is merely presented. This occurs because all of the processing involved in the generation of the information is somehow associated with it in memory, thus allowing for a richer set of retrieval cues to access the information. While the information generation can greatly enhance memory, emerging research reveals something even more effective. Taking an evolutionary point of view, it has been found that people who try to relate knowledge to situations involved in a person's own survival, memory for that information is greatly improved. Moreover, this improvement is particularly strong if people imagine they are trying to survive in a grassland setting (as compared to, say, a city).

p0210 An extreme example of depth of processing is what are called 'flashbulb' memories. Flashbulb memories occur in situations of extreme surprise, shock, or other events that have a strong emotional impact. Common examples of flashbulb memories are highly detailed memories of what a person was doing, who the person was with, what the person was wearing, etc., when some surprising and important news was heard, such as the assassination of President Kennedy, or the 11 September terrorist attacks. It is as though a picture of the situation had been taken, hence the name flashbulb memory. The high degree of detail encoded in them would make them highly accessible because there would be many cues to retrieve them. However, there are other explanations for flashbulb memories, such as the idea that these are events that are retrieved over and over again. This constant usage of information, a process called overlearning, allows them to be easily retrieved. There is also some evidence that the information in flashbulb memories may be incomplete and inaccurate, but through rehearsing and talking about it people have great confidence about their memories' veracity.

p0215 In a more mundane vein, more accurate information retrieval has been shown to occur by providing the same sorts of contextual cues that were available when the information was first learned. This effect is called encoding specificity. Contextual factors that can influence memory can be just about anything, including the person's mood (as noted earlier), the room that the information was learned in, the person from whom the information was originally learned from, and so on. The effects of encoding specificity can be seen in daily life. How often have you thought of doing something when you were in one room of your home, and walked into another room to act on it and then you could not remember why you went in there. So, you return to the room in which you started and, all of a sudden, you remember why you went to the other room in the first place. This remembering presumably occurs because the room in which the original idea occurred provides a sufficient number of retrieval cues to access the information.

Retrieval interference s0100

p0220 Another reason for forgetting things that are actually stored in memory is retrieval interference. When a large number of pieces of information about an object are acquired at different points in time, they are stored independently of one another. In some cases, the more recent information appears to block or 'bury' the earlier information, making it more difficult to recall. This is *retroactive interference*. In other cases, the earlier information makes it difficult to remember subsequent information. This is *proactive interference*. Both types of interference are more pronounced when the memories contain content information that is similar and possibly conflicting. Then, the stronger memories are typically recalled instead of the weaker ones. Thus, the weaker memories appear to have been forgotten despite the fact they still exist in memory. For example, when people move, it may be difficult after a period of time to remember some of the streets in the town they lived in previously. This is because the names of the streets in the new town interfere with the retrieval of the street names in the old town.

Evidence for the Transience of Memory s0105

p0225 The arguments for permanent memories can be quite convincing. However, there is good reason to consider the possibility that, while some information may be retained throughout a person's lifetime, due to frequent use or strong encoding, most information is removed from long-term memory after a period of disuse. Two sources of evidence for the nonpermanence of memory considered here are reconstructive processing and misleading postevent information.

s0110 ## Reconstructive Processing

p0230 Reconstructive processing refers to situations where people have forgotten various details of an original set of information and substituted other pieces of information. Much of the research on schema and script usage has shown that these gaps in memory are filled in with information that is consistent with the original source of information in terms of the gist of the originally presented facts, but nevertheless, is inaccurate. Even though gaps in one's knowledge have been filled in with unoriginal information, people express high confidence that the reported information was actually presented.

p0235 However, although the schema-enhanced report did contain some reconstructed inaccuracies, the original information was retained. In such a case, the general world knowledge was used as a crutch to avoid an extensive and effortful memory search. Some memory research has shown that if people are encouraged to adopt a perspective that is different from the one originally adopted during encoding, their ability to recall the original information accurately improves. At first, this seems to run counter to the encoding specificity effects described earlier. However, in this case, people are able to access the information in memory. Rather than expending all the effort needed to retrieve that information, they choose to reconstruct the more detailed aspects of the memory by assuming various defaults for the type of situation that is being remembered. In the case of encoding specificity, the nature of the information is unavailable to the person, not the details.

s0115 ## Misleading Postevent Information

p0240 Other evidence that the information in memory is not permanent comes from research on misleading postevent information. In studies investigating this topic, people may watch a series of events, such as a scenario of a car accident, in a slide-show or videotape. After seeing the situation, people are presented with a description that provides misleading information. In the case of the car accident, for example, people might be asked whether one of the cars stopped before the yield sign, when in fact the sign in the scenario was a stop sign. Later, people are likely to report that the features of the postevent information were actually part of the original event. This could occur because the more recent information contains features that were never observed, but were added to the original representation after it had been formed. Or, it could occur because the more recently described features actually replaced the original features in the memory, thus modifying it forever. This second possibility suggests that information in memory will be discarded if it is superceded by other relevant and more recent information.

p0245 The question of how postevent information can affect memory is especially important outside the laboratory, for example, in legal cases involving eyewitness testimony. One problem is that over time, the information in the memory of an event may decay, be difficult to retrieve, be interfered with, and perhaps be reconstructed. The additional possibility that the information a person may encounter subsequent to an event can actually change the eyewitness's memory has enormous legal ramifications. Eyewitness testimony is often thought of as one of the most valuable sources of evidence. However, the fragility of the content of memory questions this assumption, as demonstrated by the fact that leading statements or questions by other people could cause the eyewitness to incorporate additional and extraneous information into their memory representation, thus corrupting their memory of the event. Further discussion on this topic is found elsewhere in this encyclopedia.

False Memories s0120

p0250 It is important to remember that memories are not infallible. Through the processes of reconstruction, misleading information, and assumptions that we make based on schemas, major changes can happen to memories. Various changes and inaccurate remembering have been studied under the category of false memories, that is, memories for things that did not happen. Such inaccuracies range from misattributing a source, believing an event has happened more recently than it actually did, and believing in an event that never actually happened, such as being abducted by a UFO, or being abused as a child. Moreover, even just imagining and reporting a made-up event will lead to the creation of false memories of that event actually happening.

Summary s0125

p0255 Human memory is a complex system. Information entering it is subject to different types of processing depending on whether it is in short-term or long-term storage. The question of how long information that is successfully stored in long-term memory will remain there is uncertain: it could remain throughout one's lifetime, or fade away permanently if it does not get used. Information is stored in different ways in memory depending on the type of information it is (whether it is knowledge of skilled action, general world knowledge, or knowledge of one's own life events). Information stored in memory has different effects on current processing goals depending on whether it was explicitly retrieved or whether it has an influence on behavior through some implicit, unconscious process.

See also: Alzheimer's Disease (00020); Amnesia (00021); Autobiographical Remembering and Self-Knowledge (00048); Categorical Perception (was Categorization) (00082); Episodic Memory (00152); Eyewitness Testimony (00166); Memory, Neural Substrates (00230); Semantic Memory (00315).

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Non-Print Items

Abstract:

Memory refers to the mental representations, and processes involved in the retention of information. The ability to remember plays an integral role in the comprehension of new experiences and in judgment and behavioral decision making. Indeed, the loss of memory (through amnesia, Alzheimer's disease, or other disabilities) is the most dehumanizing experience. Memory has been conceptualized using different systems. This article provides an overview of some of the more important aspects of these systems and related phenomena, particularly from the area of cognitive psychology.

Keywords: Categorization; Episodic memory; Explicit memory; False memories; Implicit memory; Long-term memory; Memory; Procedural memory; Schema; Semantic memory; Short-term memory; Spreading activation; Working memory

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