

## Memory

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### The Concept of Memory

Remembering seems, to philosophers and scientists, one of the most mystifying of human activities. Yet natural language users have no problem understanding what is meant by 'memory'. Memory is simply the ability to recall personally experienced events and certain kinds of information such as facts, names, or faces; or how to perform certain actions, like riding a bike or playing chess. It is on this basis that people sometimes make claims about themselves or others having a good or bad memory, especially for things like names, numbers, or faces. Why then is memory such a mystery? Because, firstly, of its diversity: memory enables us to perform a plethora of different tasks, including the continuous interpretation of every moment of consciousness. Secondly, different forms of memory have different standards of accuracy, and often dramatically different criteria for success.

Two major issues for the cognitive sciences of memory are about how nature has carved up different memory functions, and whether failures in memory reflect failures in the underlying psychological mechanisms responsible for their function. The first question has led to debate on whether different memory functions are supported by distinct memory systems, with responses ranging from one to many, and "zero to any" (Toth & Hunt, 1999). Research on the second issue has mainly addressed the nature of autobiographical memory, although lessons learned may be applicable to other forms of memory. Although these questions may ultimately have empirical answers they nevertheless raise many conceptual issues about the nature of memory. Philosophical analysis can provide a conceptual framework to guide empirical research, along with a basis for evaluating potential empirical answers to these

questions. So the philosopher of memory must be acquainted with the psychological literature on these questions. Here we introduce relevant psychological literature along with associated philosophical issues about the nature of memory. Our focus here is on individual memory, especially personal or autobiographical memory: this discussion can be complemented by treatments elsewhere of the situated aspects of remembering (Sutton 2009, 2010).

### **The Term ‘Memory’**

The term ‘memory’ is used in several different ways by both memory theorists and natural language users. Three primary uses of the term are memory as a store of information, memory as information both within and retrieved from that store, and memory as a specific neurocognitive capacity to perform certain tasks involved in the processing of this information, such as the encoding, storage, or retrieval of information (Tulving, 2000).

Tulving (2000, p.36) also lists three further less common uses of the term ‘memory’, namely memory as a property of information, memory as a component process of retrieval, and memory as the phenomenal awareness associated with remembering.

While application of the term ‘memory’ to different concepts brings the possibility of confusion, the context in which the term is used is often enough to mark which use is in play. For example the phrases ‘in memory’ and ‘from memory’ clearly refer to memory as a store of information, whereas the phrase ‘memory for’ refers to memory as information. This latter use of ‘memory’ is usually applied to different types of memory. For example the expressions ‘memory for personally experienced events’, and ‘memory for facts’ are common throughout the psychological literature (e.g. Stark & Squire, 2001; Spencer & Raz, 1994; Tulving, 2001a, 2002). The phrase ‘memory of’ is often used to refer to exemplars of autobiographical memory. One can have a memory *of* their first date, or a memory *of* going swimming at the beach on a particular occasion. With regard to factual or semantic memory, one may have a memory ‘that’ something is the case, as demonstrated in the locution ‘remember that’, as in “I remember that I went swimming last summer”. Finally, claims about the possession of a good or bad memory employ the term ‘memory’ as a mental capacity to retain, store, and retrieve information about one’s past.

With all the different potential uses of the term it is important not to assume that a function that satisfies one use thereby satisfies others. For example, there are several means for recording information, from notepads to computers. It does not follow however from the the

fact that computers store information that they also satisfy the use of the term as it applies to specific neurocognitive capacities.

### **Reproduction, Construction, and Reconstruction**

Three common terms in the psychological literature on memory are ‘reproduction’, ‘construction’, and ‘reconstruction’. There is a general consensus that memory does not reproduce prior experience in such a way that it is perfectly preserved. Yet theorists say that memory is false if errors arise in the encoding, storage, or retrieval of mnemonic information. Although this seems like an innocuous and even obvious point, it may involve an implicit commitment to ‘memory as reproduction’, or to an “archival model”, as Campbell (2004) puts it. This is because failures in processing are essentially seen as failures in encoding, maintaining, or retrieving the *same* information as in the experience from which this information is derived. Failure in preservation is therefore equated with failure in function. In what sense then are these still constructivist theorists? Well, the idea is that the cognitive processes underlying the very act of memory retrieval are inherently constructive in the sense that they literally build memories (Schacter, Norman, and Koutstaal, 1998).

This however is not what the experimental psychologist F.C. Bartlett meant by ‘construction’ and ‘reconstruction’ in his seminal work, *Remembering: A Study in Experimental and Social Psychology*. In this constructivist manifesto, Bartlett (1932) employs these terms interchangeably in order to describe cognitive processes that, in facilitating the conscious act of remembering, produce representations of the past that may be entirely different from those initially incorporated into memory. For Bartlett this naturally follows from the claim that memory traces of individual and specific events are not maintained in memory, but are rather incorporated into a mass of representations, referred to (albeit reluctantly) by Bartlett as a ‘schema’. Bartlett characterised a schema not as a combination of inert static representations, but as a constantly active and dynamic set of representations, constantly informing and changing with each new experience. Bartlett (1932, p.213) considered memories to be the result of “imaginative reconstruction, or construction” on the basis of these representations. Following Bartlett, the terms ‘construction’ and ‘reconstruction’ have been incorporated into recent memory literature in opposition to the idea that memory is a simple reproduction of prior experience. Theory must both specify and justify the extent to which memory processing may be constructive in nature.

### **Kinds and Systems of Memory**

Several philosophers recognised distinctions between different forms of memory. For example, Bergson (1908/1911) and Russell (1921) distinguished ‘recollective memory’ from ‘habit memory’. Again Broad (1925) and Furlong (1948) distinguished recollective memory from propositional memory. Both distinctions are reflected in the major taxonomies of memory systems in cognitive science today. Contemporary psychologists distinguish propositional and skill memory, and then, within propositional memory, memory for facts from memory for personally experienced events. Cognitive psychologist Endel Tulving (1972) described this latter distinction as that between semantic and episodic memory; and Larry Squire (1986) described the former as that between declarative and procedural memory. Although both distinctions remain in common theoretical and scientific use, the distinction between declarative and procedural memory has proved to be less controversial.

### **History of Memory Systems**

The idea of memory systems was originally posited by Tulving as “an orienting attitude or a pretheoretical position” (1972, p.384), rather than as an ontological claim about the structure of human psychology. With respect to the distinction between semantic and episodic systems however, some ten or so years on it had become possible, as Tulving (2002, p.3) puts it “to entertain the thought that the heuristic distinction was useful for the simple reason that it corresponded to biological reality”, with Tulving (1983, p.66) making this very proposal in his monograph *Elements of Episodic Memory*.

Now, thirty years on, it is generally accepted at least in the cognitive neurosciences that memory can be subdivided into distinct functional capacities, each reliant upon a distinct neural system. ‘Memory systems’ are thought to exist at both a cognitive functional level, and at a neural structural level, with systems at the functional level mapping directly onto systems at the structural level. For systems theorists, the relation between functional and structural levels is identity (Tulving, 1999, p.17), with certain mnemonic states of mind being considered identical to certain brain states—the prevailing view within cognitive neuroscience.

The influence of systems theory on memory research has been significant in two ways. First, systems theory has driven the endeavour to realise a neurocognitive understanding of memory. It has been instrumental in the creation of new research programs, and setting research agendas. Secondly systems theory has generated a standardised terminology in

memory theory, also adopted by theorists who do not endorse the systems approach. Given this state of affairs, an understanding of systems theory is essential for understanding the language and motivation for theories of memory construction in the cognitive sciences.

### **Leading Taxonomies**

The distinctions between propositional and skill memory and between fact and experiential memory underlie both of the two leading taxonomies of memory systems in cognitive science. These have been proposed and developed by Tulving and Schacter (Schacter & Tulving, 1994; Schacter, 1990; Schacter et al, 2000; Tulving, 1984, 1987, 1985a), and by Squire and Zola-Morgan (Squire, 1986; Squire & Zola, 1996; Squire & Zola-Morgan, 1991; Zola & Squire, 2000; Squire, 1992). There is substantial overlap between the two taxonomies: the major differences between them relate to the theoretical line between systems and subsystems, and the place of short term memory in the taxonomy.

Whereas Schacter and Tulving distinguish systems primarily on the basis of the type of content they process, Squire and Zola-Morgan distinguish primary systems on the basis of whether or not the output of the content they process is available to consciousness. The term ‘declarative’ designates cases in which the output is available to consciousness. Earlier versions of their taxonomy used the term ‘procedural’ to refer to nonconscious forms of memory: but widespread usage of the term ‘procedural’ specifically to designate skill memory, or the system supporting it, necessitated a change in terminology, and in later versions of the taxonomy nonconscious systems are simply termed ‘nondeclarative’.

Schacter and Tulving (1994) posit five primary memory systems: the procedural, perceptual representation (PRS), working, semantic, and episodic memory systems. Each is presented by Schacter and Tulving (1994) as an independent psychological entity able to process information independently of other systems despite being able to receive and transmit information to other memory systems. In brief, the procedural memory system is thought to be responsible for processing memory for skills; the PRS, the early processing of information related to the form and structure of stimuli; working memory, information either in or very recently passed from consciousness (see Baddeley 1986, 2000 for a detailed account of working memory); episodic memory, memory for personally experienced events; and semantic memory, memory for facts.

Squire and Zola-Morgan's taxonomy is a little more complicated. Rather than considering each of the above to be reliant on their own memory system, they posit two primary *forms* of memory, namely 'declarative' memory, reliant on a single brain system; and 'nondeclarative' memory, including several independent brain systems (Squire, 1994). On this account, semantic and episodic memory are subsystems of the same declarative memory system, whereas nondeclarative memory is made up of four subsystems, namely skills and habits, priming, simple classical conditioning, and non-associative learning.

### **Challenges to Systems Theory**

Despite the general acceptance of systems theory in cognitive neuroscience, many other cognitive scientists, particularly in cognitive psychology where systems theory began, reject the notion. One controversial issue is whether memory systems can operate independently of one another. Systems theorists maintain that different memory systems process the different types of information involved in different types of remembering. But certain types of remembering, such as autobiographical remembering, seem never to involve just one type of information, and thus may not rely on a single system alone as systems theorists claim. Theorists opposing systems theory emphasise the role of interacting cognitive processes, rather than apparent observable and conceptual differences between memory types (Toth & Hunt, 1999). Process theorists reject taxonomies of independent memory systems based on such differences. They also claim that interacting processes provide significant insights into both an understanding of the nature of memory, and its role in normal cognitive processes such as reasoning, planning, and belief fixation and evaluation. Critiques of the systems approach have ranged from those that reject the definitional criteria of memory systems (Kolers & Roediger, 1984; Roediger et al, 1990; see also Bechtel, 2001), to those that also reject the notion of systems altogether (see Foster & Jelicic, 1999 for both sides of the argument). The issues at stake here are conceptual, and require a thoroughgoing account of what exactly cognitive neuroscientists should be looking for.

### **Autobiographical and Episodic Memory**

Although the terms autobiographical and episodic are often used interchangeably in the literature to refer to memory for personally experienced events, only the former term pertains exclusively to memories involving the self. Early research into episodic memory relied heavily on word-list experiments in which participants were simply required to remember as many words as possible from lists presented earlier in the experiment. Such experimentation

did not seek to examine the relation between memory and the self. Moreover, not all autobiographical memories are episodic, in that one can state certain autobiographical facts about one's past without experientially remembering the events in question. For example, one can recall the date of one's anniversary without experientially remembering the wedding day. Although the content pertains to the self, this type of remembering is consistent with semantic rather than episodic memory as they have been defined in the literature. Episodic remembering then is consistent with John Locke's definition of memory as a power of the mind "to revive Perceptions, which it has once had, with this additional perception annexed to them, that it has once had them before" (1690/1975; see also Owens 1996). When this type of remembering connects with one's past, it can create and define the self, as a powerful tool in the construction of personal identity.

### **What is an Autobiographical Memory?**

Autobiographical memory requires a rememberer, an agent capable of mental states that represent experiences. Over and above producing such mental states, a rememberer must also experience these mental states as representing previous experiences of this kind. That is, in order for memory to be considered autobiographical, a rememberer must recognise mental states that represent the past as belonging to their own past. Autobiographical memory thus requires not just a rememberer, but a remembering self. Moreover, the fact that these states represent periods of time occurring before the time of remembering indicates that our remembering self must also have a sense of subjective time (Tulving, 2002).

This is not to claim that there is one stable psychological self across the lifetime, as pointed out by Barclay (1986). Rather, autobiographical memory appears to be a means by which individuals are able to contrast present selves with past selves. As Ross (1989) points out, individuals may either connect who they are now with whom they have been in the past, or alternatively, distance themselves from their own past depending on the current needs of the self. Two competing pressures in this regard are coherency and self-enhancement. Whereas coherency needs related to personal identity may cause one to seek consistency with past selves (Ross, 1989), self-enhancement pressures may cause individuals to remember past selves in a critical light in order to generate the impression of improvement over time (Ross & Wilson, 2003).

According to this view of memory, the self is not fixed in the past, but rather subject to the constructive pressures of the present self. Autobiographical memory then is memory of how

past selves are currently conceived, with specific memories concerning specific experiences of the remembering self. The flexibility of autobiographical memory to adapt to the present needs of the self suggests that the primary role of episodic memory mechanisms is not to preserve the past, but rather to preserve the self (see below). In addition to its backward-looking functions, memory therefore has a forward-looking aspect, underlying our capacities for the simulation or imagination of future episodes and experiences (Dudai & Carruthers, 2005; Schacter, Addis, & Bucknor, 2008).

### **Content and Acquisition**

A key question concerns the causal relationship between experience and subsequent memory. Is it necessarily the case that the mental states resulting from an experience need to be laid down in memory and retrieved at some later date in order for successful remembering to occur? The issue at stake here is not memory accuracy (discussed in the next section), but rather whether the concept of memory involves a commitment regarding the proper causal flow of information from experience to remembering. The reason this issue cannot be reduced to memory accuracy is that it is possible in principle for mental states that satisfy this causal criterion to fail to accurately represent the past; and conversely for those that fail, to accurately represent the past. For example, mental states derived from a remembered experience may be ordered in the wrong way, or may have failed to accurately represent events at the time. Likewise, potential similarities between the basic elements of experience, such as colours, shapes, objects, and settings, make it possible for mental states that represent the past to be drawn from multiple sources of information other than a remembered experience, and yet at the same time accurately represent that experience.

Although we might want to restrict the concept of memory to mental states that do accurately reflect the past, we might also want to restrict it to mental states that accurately reflect the past for the right reasons. Specifying this set may not only involve claims about proper causal flow (Martin and Deutscher, 1966), but also about proper psychological function – that in the course of remembering, the mechanisms involved in producing representations of the past have operated in a particular kind of way as to ensure the former has been achieved. There may be differences of opinion regarding the way in which psychological mechanisms function in achieving accurate reflection of the past. But it may also be the case that the mechanisms involved in the production of autobiographical memories function in such a way that they do not necessarily achieve this end at all. In assuming that they do, one has assumed

the very thing at stake here. One should not, however, define memory in a certain way, and then expect that psychological mechanisms behave accordingly. In the absence of scientific evidence yet to become available, it could yet turn out that proper psychological function neither requires nor achieves a particular causal flow of information in the construction of autobiographical memories.

There are four possible positions on the relationship between the proper causal flow of mnemonic information, and proper psychological function. First, psychological mechanisms may only be considered to have functioned properly when their operation has successfully achieved the repetition of previous mental states; second, proper function may result in the repetition of mental states only similar to, yet derivative of those resulting from the remembered experience; third, proper function may include both mental states that are derived from the original experience, and those that are not; and finally, proper psychological function in the construction of autobiographical memories does not require that any mental states derived from an experience be active at the time of remembering that experience. Only the first two of these positions involve a commitment to a necessary causal relationship, restricting the content of autobiographical memories to the original remembered experience; whereas the latter two do not, suggesting that autobiographical memory content may come from other sources (compare Michaelian, in press).

Note that these four possibilities exist for psychological explanation, with respect to providing a scientific account of the information processing of psychological mechanisms. As mentioned above, this differs from an analysis of how psychological terms are defined with respect to natural language users. Just as it would be a mistake to assume some psychological fact purely on the basis of the terminology employed by theorists, so it would also be a mistake to accept uncritically the way the terms ‘memory’ and ‘remembering’ have been defined in ordinary language. The term memory is often used as a success word, where instances of memory that do not accurately reflect the past are not considered memory at all (Sutton, 2010). This usage is also evident in legal and moral contexts in which a person is only considered to be ‘remembering’ when what they remember did in fact occur. On this basis it might be concluded that remembering only occurs when past perceptions are revived. But this does not follow. In terms of underlying psychology it may turn out that psychological mechanisms behave in the same way in the construction of both true and false memories. If this turns out to be the case then in terms of a scientific understanding of the mind, it would be a mistake to claim that remembering only occurs when that which is

retrieved from memory is veridical. Moreover it would also be a mistake to claim that remembering requires the retrieval of original perceptions derived from an experience.

Another reason for avoiding this folk commitment to the success of memory is that from a methodological perspective our understanding of veridical remembering may be significantly enhanced by treating it and false memory together. Based on observations relating to the constructive nature of autobiographical memory, Mitchell and Johnson (2000, p. 179) claim that “it has long been clear that similar mechanisms produce both accurate and inaccurate memories”. If this is so then an understanding of the way in which these mechanisms sometimes fail to produce accurate representations may provide insights into the way in which on other occasions they do achieve this end. In effect this is also the motivation for the methodology employed in neuropsychological research, where inferences about proper function are made on the basis of observations of memory impairment after brain damage.

### **The Phenomenology of Remembering**

Another issue that theories of autobiographical memory must address is the feeling that accompanies autobiographical remembering. An unmistakable feature of autobiographical memories is the feeling of remembering, and recognition of oneself in the past differs from recognition of oneself in the present. Perhaps this is necessary for these mental states to be differentiated in experience. That is, it may be the case that it must feel different to remember than to perceive in order for remembering selves to know that they are remembering and not perceiving, and vice versa.

It may be thought that phenomenology does not exhaust the difference between memory and perception in this regard, given that memories are also normally accompanied by the belief that one is remembering (Tulving, 1983). If this type of belief could ground such a difference, then a particular kind of phenomenology would not be a necessary condition of autobiographical remembering. It is not clear however that the belief one is remembering could be sustained in the absence of such a phenomenological difference, even if this belief plays a causal role in bringing about the phenomenology of remembering in the first place. Although it might be possible to sustain for memories of one-off personal experiences, it is difficult to see how such a belief could ground differences in mental states resulting from repetitive tasks occurring on either the same or different days, such as brushing one’s teeth, driving to work, or sitting at one’s desk. Given the potential overlap between mental states in

memory and those resulting from perception, phenomenology appears to play a necessary role in distinguishing one from the other.

One source of phenomenological difference between memory and perception is the vividness associated with the mental images constituting the two (Brewer, 1996), with those constituting perception normally being more vivid than those constituting memory. This is despite the fact that certain memories, or certain instances of imagination, may seem on occasion just as vivid as perception. Even so, vividness does not capture all there is to the phenomenology associated with autobiographical remembering. Indeed most authors on the topic agree that the mental states that represent one's own past are also normally experienced differently to other mental states such as imagination, general beliefs, and general thought (Brewer, 1996). This opens the possibility that the phenomenology of remembering may also rely on cognitive factors.

The type of phenomenology associated with autobiographical memory has also been termed 'autonoesis' (Tulving 2001b, 2002), and 'recollective experience' (Tulving, 1983; Brewer, 1996; Heaps & Nash, 2001; Conway & Dewhurst, 1995). Whereas autonoesis is concerned with the experience of self in the past, present, and future (Tulving, 2002), the term 'recollective experience' is only employed to refer to the experience of the self as in the past. Proponents of recollective experience have suggested that it is in fact concerned with 're-experiencing' the self in the past, claiming that the defining feature of autobiographical memory is "the reliving of the original experience" (Rubin et al, 2003, p. 887). But this seems too strong. Although recollective experience does involve a re-experiencing of the past insofar as previous personal experience constitutes the content of the memory, it seems too strong to say that it *is* a re-experiencing of the past, given the phenomenal differences between perception and memory described above. We do not experience the past in the present in the same way that we experience the present, else once again there would be no way of clearly differentiating the two. Moreover, the emotion associated with an autobiographical memory may be different from that associated with the original remembered experience, and may also change over time, as our interpretations of their past also change. This suggests that emotion is a result of the cognitive content constituting an autobiographical memory, rather than being a fixed attribute of the memory itself.

### **Necessary and Sufficient Conditions on Remembering**

If we grant that it feels different to remember personally experienced events, the question arises as to whether this type of phenomenology is both necessary and sufficient for autobiographical remembering. With respect to the former Tulving has claimed that auto-noesis is a necessary condition of autobiographical remembering: as he puts it, “No auto-noesis, no mental time travel” (Tulving, 2002, p. 2). Tulving does not really mount an argument for this, but simply claims that the consciousness associated with remembering is “plainly and recognizably different” (p. 2) from that associated with other mental activities. Even so, this claim can form the basis of an argument if we consider the possibility of memory without recollective experience.

In this regard, the philosophers C.B. Martin and Max Deutscher (1966) present a thought experiment in which a painter paints an imaginary scene that turns out to be a memory. Although the painter does not remember the scene, his parents recognise the picture as an accurate representation of a scene the painter witnessed as a child. Even so, the painter sincerely believes the picture to be purely imaginary. Although this thought experiment may seem far fetched to some, the possibility of such an instance of remembering is supported by cases of what has been termed ‘cryptomnesia’ or ‘implicit plagiarism’ (Schacter, 2001), in which remembering occurs outside of awareness. In such cases mental states retrieved from memory are experienced as original thoughts. Famous cases include the tune to George Harrison’s “My sweet Lord”, and sections from Nietzsche’s “Thus Spoke Zarathustra”, Helen Keller’s “The Frost King”, and James Mackay’s biography of William Wallace. Although such cases are controversial, the possibility of implicit plagiarism is generally accepted by memory researchers (see Schacter, 2001), with Brown and Murphy (1989) devising an experimental paradigm to induce the phenomenon.

But despite the fact that the hypothetical case proposed by Martin and Deutscher may count as a case of remembering as they claim, there is no way in which it could count as a case of autobiographical remembering given that it is not associated with a recognition of the self as the subject of the experience from which the image is derived (compare Debus 2010). Note that where remembering is concerned, self as the subject of experience differs from self as the subject of memory. Where the latter refers to the content of memory, the former refers to the carrier or possessor of mental content arising directly from experience. Thus in Martin and Deutscher’s hypothetical, there is nothing autobiographical about the painter’s memory, even though it was derived from his own experience.

The thought experiment also highlights the fact that the painter would have felt entirely different whilst crafting the painting if he had thought that he was painting a scene from his own past, as opposed to one simply from imagination. In the former scenario the painter would have experienced a connection with the picture resulting from the fact that it belonged to his own past. As a product of imagination however there is a quite different, present-centred sense of ownership or closeness with the image, despite the fact that the actual content of the picture would be the same in both cases. Thus, the mere presence of the self as the subject of remembered experience makes autobiographical memories feel different to memories that do not involve the self. So recognition of self-as-subject may play a causal role in bringing about the phenomenology associated with autobiographical remembering. But regardless of whether such recognition plays this causal role or not, the discussion above suggests that recollective experience is indeed a necessary condition of autobiographical remembering.

The question of whether recollective experience is also sufficient for autobiographical remembering is in effect the question of whether it is possible to experience recollective experience without actually remembering. One possibility is *déjà vu*. If we grant that *déjà vu* is a type of recollective experience for the present, albeit an inappropriate one, then it follows that recollective experience is not sufficient for autobiographical remembering, since the former could occur in the absence of the latter. There are however marked differences between recollective experience and the phenomenology of *déjà vu*. Whereas the former is usually characterised by a strong sense of assurance that one's recollection is veridical, the latter is not. Instead, *déjà vu* is normally characterised by a sense of doubt, or surprise. In this way the belief that one is remembering, and the feeling that one is remembering seem to be intimately connected. Just as the belief that one is remembering may be difficult to maintain the absence of the appropriate phenomenology, so the phenomenology of remembering may be reciprocally dependent on the appropriate beliefs.

Moreover, remembering is normally experienced as a general cognitive capacity that one can exercise at will, despite the fact that it may also occur unintentionally, as when a memory pops into the head as it were. *Déjà vu* on the other hand is a strange experience, and not a capacity that is experienced as part of one's own cognitive repertoire. For this reason *déjà vu* does not rule out recollective experience as sufficient for normal remembering. Note that our discussion here is restricted to remembering in normally functioning individuals. The demonstration of inappropriate recollective experience in brain damaged patients, such as that

occurring in the phenomenon of *déjà vecu* (Conway, 2005), does not rule out the possibility that recollective experience is sufficient for autobiographical remembering in cognitively healthy individuals.

Another phenomenon that may demonstrate recollective experience without autobiographical remembering is false memory. If autobiographical remembering is restricted to memory for actual experiences, as Martin and Deutscher (1966) suggest, then false memory research demonstrates that recollective experience is not a sufficient condition for remembering. This is because research in this domain has shown that recollective experience can be associated with memory for events not experienced by the self (Conway, Collins, Gathercole, & Anderson, 1996; Sheen, Kemp, & Rubin, 2001; Koriat et al, 2000). In this regard Conway et al (1996, p. 69) even suggest that “the quality of phenomenal experience ... may be critical in leading a rememberer to accept a memory as true”.

But given that we are yet to establish a necessary causal connection between experience and remembering, it is too early to rule out recollective experience as a sufficient condition. The best we can do at this stage is to rule it out as a sufficient condition for *veridical* remembering, despite the fact that it may yet prove to be a sufficient condition for remembering in general. This may turn on whether one can feel like one is remembering without believing that one is remembering. If it turns out that the belief that one is remembering a personally experienced event is a necessary condition for autobiographical remembering, then recollective experience in the absence of this belief would demonstrate that recollective experience is not sufficient.

### **Truth, Accuracy, and Veridicality**

Another major conceptual issue concerns truth in memory. Common terms in the memory literature are truth, accuracy, and veridicality, with the latter term often employed interchangeably with the former two (see Koriat et al, 2000, p. 502, and Kopelman, 1999, p. 208 for examples). But despite their similarity in meaning these terms may refer to different things. Consider the following: “It appears that most autobiographical memories are true but inaccurate” (Barclay 1986, p. 97). Barclay’s point is elucidated by the following claim (p. 82):

If most autobiographical memories are reconstructions, then they are not often exact in detail even though these memories are true in the sense of maintaining the integrity and gist of past life events.

So Barclay (1986) associates accuracy with detail, whereas truth, as in the quote above, is associated with the gist of autobiographical memories. Although Barclay's usage of these terms is by no means standard, it does highlight two important theoretical issues: whether truth and accuracy should be distinguished in autobiographical memory, and what the actual requirements should be for a memory to be considered either true or accurate.

With respect to the first issue, it is generally agreed that autobiographical memory is better at preserving the gist of an event rather than its details (Barclay, 1986; Brainerd & Reyna, 1993; Koriat et al, 2000). Despite agreement on this, there is ambiguity about the type of information in question. Both gist and detail could refer to the same type of information, such as beliefs or the sensory perceptual details of past events; or alternatively, each may refer to only one of these types of information. In the main, we suggest, theorists treat 'gist' as more abstract beliefs about the event, and 'detail' as sensory detail, matching the distinction between semantic and episodic information, respectively—where episodic memory is taken to exclude what Tulving, Schacter, McLachlan, & Moscovitch (1988, p. 15) refer to as 'personal semantic memory', that is, semantic memory directly derived from and representing personal experiences.

In discussing the distinction between verbatim (detail) and gist memory traces in the context of their fuzzy trace theory, Brainerd and Reyna (1993, p. 45) state: "... gist traces preserve the meaning of input ... whereas verbatim traces are richly specified with respect to context, containing detailed episodic information"; and again "... background inputs function as retrieval cues that allow reasoners to gain access to core gist in semantic memory." So the finding that gist is better preserved than detail indicates that semantic memory is more robust than episodic memory, in that it is more resistant to both forgetting and distortion resulting from interference (Reyna & Lloyd, 1997).

But since both semantic and episodic memory may vary in accuracy, there seems to be no principled reason to apply the term 'truth' to one type of information, and the term 'accuracy' to the other. The memory literature has proceeded without reference to philosophical theories of truth (such as, correspondence, coherence, and pragmatism), which might prove fertile for philosophical input. Here we suggest that the term 'veridicality' may be helpful. Whereas the term 'truth' is beset by a range of philosophical difficulties, 'veridicality' has been employed to refer to the correspondence between memory and actual events in the world, broadly within a correspondence view of truth. For example, the following definitions of veridicality

are offered by Koriat et al (2000, p. 484). They state: “Forgetting is conceived as a loss of correspondence between the memory report and the actual event, that is, as a deviation from veridicality”; and again in describing memory as a form of perception of the past, “... interest lies in the correspondence between what we perceive and what is out there (i.e. veridicality), and in the various ways in which percepts may deviate from reality ....”

The term veridicality also allows for degrees. That is, although it does not make sense to talk of degrees of truth, it does make sense to talk of degrees of correspondence. This is because truth is a categorical variable in that a memory is only either completely true or else false, whereas correspondence is a continuous variable in that a memory may correspond to the world to varying degrees. For these reasons where correspondence with affairs in the world is concerned, the term veridicality is a better candidate for describing the relation between memory and the past.

Although where memory is inaccurate it will also be non-veridical, it does not follow that accurate memories will always be entirely veridical. This is because as far as memory processes are concerned, the only information that may be retrieved from memory is the information that has been successfully encoded into memory in the first place. Given that not all of the information available at the time of experience may be successfully encoded it is possible for memory to be accurate in that all of the available information is successfully retrieved, yet not totally veridical due to the absence of some salient feature of an event that failed to be successfully encoded at the time of experience. In other words, memory and actual events in the world may come apart even in the absence of failures in memory retrieval.

In this regard, all of the major theories of memory in the psychological literature have it that only consciously apprehended information can be consciously remembered at a later time, suggesting that items not noticed at the time of experience cannot be later remembered. Thus if one fails to notice a blue car in an eye-witnessed accident, one will be unable to retrieve this information from memory later regardless of how central the blue car was to the way in which events actually unfolded. Note that the possibility of individuals failing to both notice and subsequently report highly salient features of visual scenes is well documented in the change blindness literature (see Simons & Levin, 1997). In such cases it is possible for memory retrieval to be entirely accurate in that encoded and retrieved information may be

identical, and yet for memory to be non-veridical in that it fails to correspond with actual events in the world due to a failure to notice salient features of an event.

Given that autobiographical memory is memory for personal experience, philosophers of memory should focus on memory accuracy rather than veridicality. There are two reasons for this. First, as discussed above it is possible for experience to deviate from reality; and second, because psychological mechanisms only encode that which is experienced, regardless of the degree to which experience overlaps with actual events in the world. Moscovitch's (1992, 1994a) component process model, for example, has it that encoding mechanisms encode all consciously experienced information. This view allows for identity between that which is encoded and retrieved, that is for entirely accurate memories, even in cases where such memories are non-veridical.

Although there are certain (theoretical) contexts in which the term 'accuracy' is indeed suitable, there are others in which the term 'veridicality' is a better candidate. These include discussion of theories that assign a causal role to beliefs about the world in the construction of autobiographical memories, such as schema theories (see Alba & Hasher, 1983). This is because beliefs about personal experiences nearly always concern states of affairs in the world, rather than what may have been encoded into memory. In contexts where the content of autobiographical memory is considered to be causally related to these beliefs, it is just as appropriate to discuss the truth value of this content in terms of veridicality.

The potential disparity between accuracy and veridicality raises the issue mentioned above: how accurate is accurate? If for the moment we assume a perfect correlation between an event and information encoded into memory, then accuracy pertains to both quantity, to how much of the information originally encoded into memory is retrieved at the time of remembering, and secondly to quality, the extent that the information retrieved from memory matches or corresponds to that originally laid down in memory at the time of encoding. As mentioned, Koriat et al (2000) reject quantity approaches to memory, accusing traditional memory research employing the standard list-learning paradigm of adopting a storehouse approach to memory. In this paradigm participants are required to remember as many items as possible from lists of presented words. As Koriat et al (2000, p. 484) point out, "One begins with the input and asks how much of it was recovered in the output". Instead the correspondence approach to memory accuracy endorsed by Koriat et al aims at revealing the nature of memory errors, and their potential sources.

Although there are important differences in the methodologies employed in these approaches, at a conceptual level there is nevertheless overlap between the quantity and quality of retrieved information, in that differences between the two only emerge when memory is false. Thus, there is a sense in which the question of how well a memory corresponds to an event is also a question about how much of the information initially encoded into memory has been successfully retrieved. This is so even if it is a mistake to focus exclusively on the quantity of retrieved information as Koriat et al (2000) claim.

Note that although there may be differences in accuracy between semantic and episodic memory when considered in isolation, the fact that autobiographical memories are constituted by both types of information suggests that within any one autobiographical memory no such disparity may exist. For example, it is impossible sincerely to report seeing a blue car in an accident when in fact the sensory perceptual component of one's memory of the event is of a red car; assuming that one possesses the ability to correctly identify colours. This is not to say that one may not have conflicting memories of an event, but rather that there will always be consistency between the different types of information in any single memory. This principle is expressed by Tulving and Markowitsch (1988, p. 202) as "episodic remembering always implies semantic knowing", or better as 'remembering always implies believing.'

When considering the veridicality of the content of autobiographical memories, we are interested in the causal processes responsible for producing both memories that correspond to actual events in the world, and memories that do not; that is, in providing a causal account of veridicality in memory. Now if psychological processes determine the content featuring in autobiographical memories, then by that very fact they also provide the causal conditions for the occurrence of both veridical and non-veridical memories. This is not to suggest that psychological processes are truth-makers in any way in the sense that they are what make memories true. Rather, the truth-makers of memories are actual events in the world itself. The conditions under which psychological mechanisms can yield veridical memories is a source of ongoing research.

### **Epistemological Issues**

One potential consequence of the possibility of false autobiographical memory mentioned above, along with ongoing influences of the self on remembering, is that autobiographical memory is not an ideal candidate for providing knowledge of the past. This point, however, is rejected by the philosopher Andy Hamilton (1998).

According to Hamilton (1998) personal memory, as he refers to it, should be regarded as reliable, with the alternative position having the unacceptable consequence of memory scepticism. Hamilton's (1998) primary target is the work of Elizabeth Loftus, and the challenge it represents to the reliability of memory. For Hamilton (1998, p. 285) the threat posed to personal memory by psychological research is undermined by a fundamental error, namely neglect of the "philosophical and commonsense distinction between personal and factual memory". Now although Hamilton (1998) is correct in identifying the fact that much false memory research has been directed at the latter, he fails to discuss or even acknowledge the work by Loftus (Loftus and Pickrell, 1995) on the creation of entirely false memories for personally experienced events, which is now a robust empirical finding.

Hamilton (1998, p. 291) goes on to claim that "the general reliability of [personal] memory is a presupposition of scientific inquiry and human knowledge". Hamilton (1998) presents this as a self-evident truth, stating (p. 291):

Clearly there is no possible *empirical* justification of the reliability of memory, for how could this be achieved except through the resources of memory?

The inference is that empirical research must be entirely silent on the issue because by necessity it is restricted to relying on memory in order to evaluate the reliability of memory. But Hamilton's (1998) defence of reliability relies on the very conflation of personal and factual memory of which he accuses psychologists. When psychologists run experiments they do not rely on personal memory in order to remember the responses of experimental participants. Rather, they record their responses at the time, generally by way of computer or written text. They then rely on their factual memory in order to analyse these responses and subject them to statistical analysis. At no point is personal memory employed in the methods or procedures used to measure it. In the end then, Hamilton (1998) is unable to provide any basis for either the reliability of autobiographical memory, or for the claim that it cannot be studied empirically.

In contrast to Hamilton's position on the potential role of psychological investigation, empirical research suggests that the mere possession of a memory, no matter how vivid, is not enough to provide any guarantee that the remembered event actually occurred. Rather, it simply reflects the fact that either in the present, or at some point in the past, one has believed the event occurred. Although in most instances the autobiographical beliefs responsible for

the content of autobiographical memory have been derived from the experience that the memory represents, and thus are likely to be more or less veridical, it is also possible that they may have been acquired subsequent to this experience as a result of discussion, questioning, or suggestion. Although this does not exclude autobiographical beliefs from being veridical, it does render them subject to error.

Another reason that autobiographical beliefs may be more prone to distortion than semantic memory in general, is for the very reason that they concern the self. As mentioned above, psychological studies point to the ease with which motivations can distort beliefs and memories about one's past (Conway & Ross, 1984; Greenwald, 1980; Ross, 1989; Ross & Wilson, 2002, 2003; Sheen, Kemp, & Rubin, 2006). This is not to claim that autobiographical memory cannot act as a source of knowledge of the past. However simply possessing a memory or a belief is clearly not enough grounds for justification. An autobiographical memory may provide one source of converging evidence for such a knowledge claim: however in the absence of external corroborating evidence one cannot be said to know that a certain event occurred purely on the basis of having the memory.

In sum the cognitive science of memory is steeped in conceptual issues pertaining to the self, perception, truth, and knowledge. Each issue provides fertile ground for the contribution of philosophers to interdisciplinary memory research.

## References

- Alba, J. W., & Hasher, L. (1983). Is memory schematic? *Psychological Bulletin*, 93(2), 203-231.
- Baddeley, A. D. (1986). *Working memory*. Oxford: Oxford University Press.
- Baddeley, A. D. (2000). Short-term and working memory. In E. Tulving & F. I. M. Craik (Eds.), *The Oxford handbook of memory* (pp. 77-92). London: Oxford University Press.
- Barclay, C. R. (1986). Schematization of autobiographical memory. In D. C. Rubin (Ed.), *Autobiographical Memory*. New York, NY: Cambridge University Press.
- Bartlett, F. C. (1932). *Remembering: A Study in Experimental and Social Psychology*. Cambridge: Cambridge University Press.
- Bechtel, W. (2001). The compatibility of complex systems and reduction: A case analysis of memory research. *Minds and Machines*, 11, 483-502.
- Bergson, H. (1908/1911), *Matter and Memory*, N.M. Paul and W.S. Palmer (trans.). New York: Zone Books.
- Broad, C.D. (1925), *The Mind and its Place in Nature*, London: Routledge and Kegan Paul.
- Brainerd, C. J., & Reyna, V. F. (1993). Memory independence and memory interference in cognitive development. *Psychological Review*, 100, 42-67.
- Brewer, W. F. (1996). What is recollective memory? In D. C. Rubin (Ed.), *Remembering our past: Studies in autobiographical memory* (pp. 19-66). New York, NY: Cambridge University Press.
- Brown, A. S., & Murphy, D. R. (1989). Cryptomnesia: Delineating Inadvertent Plagiarism. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, 15(3), 432-442.
- Campbell, S. (2004). Models of minds and memory activities. In P. DesAutels, & M. U. Walker (Eds.), *Moral Psychology: Feminist Ethics and Political Theory*. Lanham, MD: Rowman and Littlefield.
- Conway, M. A. (2005). Memory and the self. *Journal of Memory and Language*, 53(4), 594-628.
- Conway, M. A., & Ross, M. (1984). Getting what you want by revising what you had. *Journal of Personality and Social Psychology*, 47(4), 738-748.

- Conway, M. A., Collins, A. F., Gathercole, S. E., & Anderson, S. J. (1996). Recollections of true and false autobiographical memories. *Journal of Experimental Psychology: General*, 125(1), 69-95.
- Conway, M. A., & Dewhurst, S. A. (1995). The self and recollective experience. *Applied Cognitive Psychology*, 9(1), 1-19.
- Debus, D. (2010). Accounting for epistemic relevance: a new problem for the causal theory of memory. *American Philosophical Quarterly* 47:1, 17-29
- Dudai, Y., & Carruthers, M. (2005). The Janus face of Mnemosyne. *Nature*, 434, 567.
- Furlong, E.J. (1948), Memory. *Mind*, 57: 16–44.
- Foster, J. K., & Jelicic, M. (Eds.). (1999). *Memory: Systems, process, or function?* Oxford: Oxford University Press.
- Greenwald, A. G. (1980). The totalitarian ego: Fabrication and revision of personal history. *American Psychologist*, 35, 603-618.
- Hamilton, A. (1998). False memory syndrome and the authority of personal memory-claims: A philosophical perspective. *Philosophy, Psychiatry, & Psychology*, 5(4), 283-297.
- Heaps, C. M., & Nash, M. (2001). Comparing recollective experience in true and false autobiographical memories. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 27(4), 920-930.
- Kolers, P. A., & Roediger, H. L. (1984). Procedures of mind. *Journal of Verbal Learning & Verbal Behavior*, 23(4), 425-449.
- Kopelman, M. D. (1999). Varieties of false memory. *Cognitive Neuropsychology*, 16(3-5), 197-214.
- Kopelman, M. D., & Kapur, N. (2001). The loss of episodic memories in retrograde amnesia: single-case and group studies. *The Philosophical Transactions of The Royal Society B.*, 356, 1409-1421.
- Koriat, A., Goldsmith, M., & Pansky, A. (2000). Toward a psychology of memory accuracy. *Annual Review of Psychology*, 51, 481-537.
- Locke, J. (1690/1975) *An Essay Concerning Human Understanding*. P.H. Nidditch (Ed.). Oxford: Clarendon Press.

- Loftus, E. F., & Pickrell, J. E. (1995). The formation of false memories. *Psychiatric Annals*, 25(12), 720-725.
- Martin, C. B., & Deutscher, M. (1966). Remembering. *Philosophical Review*, 75, 161-196.
- Michaelian, K. (in press). Generative memory. *Philosophical Psychology*.
- Mitchell, K. J., & Johnson, M. K. (2000). Source monitoring: Attributing mental experiences. In E. Tulving & F. I. M. Craik (Eds.), *The Oxford handbook of memory* (pp. 179-195). London: Oxford University Press.
- Moscovitch, M. (1992). Memory and working-with-memory: A component process model based on modules and central systems. *Journal of Cognitive Neuroscience*, 4(3), 257-267.
- Moscovitch, M. (1994). Memory and working with memory: Evaluation of a component process model and comparisons with other models. In D. L. Schacter & E. Tulving (Eds.), *Memory systems 1994* (pp. 269-310). Cambridge, MA: The MIT Press.
- Owens, D. (1996). 'A Lockean Theory of Memory Experience', *Philosophy and Phenomenological Research* 56, 319–332.
- Reyna, V. F., & Lloyd, F. (1997). Theories of false memory in children and adults. *Learning & Individual Differences*, 9(2), 95-123.
- Roediger, H. L., Rajaram, S., & Srinivas, K. (1990). Specifying criteria for postulating memory systems. *Annals of the New York Academy of Sciences*, 608, 572-595.
- Ross, M. (1989). Relation of implicit theories to the construction of personal histories. *Psychological Review*, 96(2), 341-357.
- Ross, M., & Wilson, A. E. (2002). It feels like yesterday: Self-esteem, valence of personal past experiences, and judgments of subjective distance. *Journal of Personality and Social Psychology*, 82(5), 792–803.
- Ross, M., & Wilson, A. E. (2003). Autobiographical memory and conceptions of self: Getting better all the time. *Current Directions in Psychological Science*, 12(2), 66-69.
- Rubin, D., Schrauf, R.W., & Greenberg, D.L. (2003). Belief and recollection of autobiographical memories. *Memory and Cognition*, 31, 887-901.
- Russell, B. (1921), *The Analysis of Mind*, London: Allen and Unwin.

- Schacter, D. L. (1990). Perceptual representation systems and implicit memory: Toward a resolution of the multiple memory systems debate. *Annals of the New York Academy of Sciences*, 608, 543-571.
- Schacter, D. L. (2001). *The seven sins of memory: How the mind forgets and remembers*. Boston, MA: Houghton, Mifflin and Company.
- Schacter, D. L., Addis, D. R., & Buckner, R. L. (2008). Episodic simulation of future events: concepts, data, and application. *Annals of the New York Academy of Sciences*, 1124, 39–60.
- Schacter, D. L., Norman, K. A., & Koutstaal, W. (1998). The cognitive neuroscience of constructive memory. *Annual Review of Psychology*, 49, 289-318.
- Schacter, D. L., & Tulving, E. (1994). What are the memory systems of 1994? In D. L. Schacter & E. Tulving (Eds.), *Memory systems 1994* (pp. 1-38). Cambridge, Mass.: MIT Press.
- Schacter, D. L., Wagner, A. D., & Buckner, R. L. (2000). Memory systems of 1999. In E. Tulving & F. I. M. Craik (Eds.), *The Oxford handbook of memory* (pp. 627-643). London: Oxford University Press.
- Sheen, M., Kemp, S., & Rubin, D. (2001). Twins dispute memory ownership: A new false memory phenomenon. *Memory & Cognition*, 29(6), 779-788.
- Sheen, M., Kemp, S., & Rubin, D. (2006). Disputes over memory ownership: What memories are disputed? *Genes, Brain and Behavior*, 5 (Suppl. 1), 9–13.
- Simons, D. J., & Levin, D. T. (1997). Change blindness. *Trends in Cognitive Sciences*, 1(7).
- Spencer, W. D., & Raz, N. (1994). Memory for facts, source, and context: can frontal lobe dysfunction explain age-related differences? *Psychology and Aging*, 9(1), 149-159.
- Squire, L. R. (1986). Mechanisms of memory. *Science*, 232(4758), 1612-1619.
- Squire, L. R. (1992). Declarative and nondeclarative memory: Multiple brain systems supporting learning and memory. *Journal of Cognitive Neuroscience*, 4(3), 232-243.
- Squire, L. R. (1994). Declarative and nondeclarative memory: Multiple brain systems supporting learning and memory. In D. L. Schacter & E. Tulving (Eds.), *Memory systems 1994* (pp. 203-231). Cambridge, Mass.: MIT Press.
- Squire, L. R., & Zola-Morgan, S. (1991). The medial temporal lobe memory system. *Science*, 253(5026), 1380-1386.

- Squire, L. R., & Zola, S. M. (1996). Structure and function of declarative and nondeclarative memory systems. *Proceedings of the National Academy of Sciences USA*, 93, 13515-13522.
- Stark, C. E. L., & Squire, L. R. (2001). Simple and associative recognition in the hippocampal region. *Learning and Memory*, 8, 190-197.
- Sutton, J. (2009). Remembering. In P. Robbins & M. Aydede (Eds.), *The Cambridge Handbook of Situated Cognition*. Cambridge: Cambridge University Press (pp. 217-235).
- Sutton, J. (2010). Memory. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy*. Retrieved August, 2010 from <http://plato.stanford.edu/entries/memory/>
- Toth, J. P., & Hunt, R. (1999). Not one versus many, but zero versus any: Structure and function in the context of the multiple memory systems debate. In J. K. Foster & M. Jelicic (Eds.), *Memory: Systems, process, or function?* (pp. 232-272).
- Tulving, E. (1972). Episodic and semantic memory. In E. Tulving & W. Donaldson (Eds.), *Organization of memory* (pp. 381-403). New York: Academic Press.
- Tulving, E. (1983). *Elements of Episodic Memory*. New York: Oxford University Press.
- Tulving, E. (1984). Multiple learning and memory systems. In K. M. J. Lagerspetz & P. Neimi (Eds.), *Psychology in the 1990's* (pp. 163-184). Holland: Elsevier.
- Tulving, E. (1985). How many memory systems are there? *American Psychologist*, 40(4), 385-398.
- Tulving, E. (1987). Multiple memory systems and consciousness. *Human Neurobiology*, 6(2), 67-80.
- Tulving, E. (1999). Study of memory: Processes and systems. In J. K. Foster & M. Jelicic (Eds.), *Memory: Systems, process, or function?* (pp. 11-30). London: Oxford University Press.
- Tulving, E. (2000). Concepts of memory. In E. Tulving & F. I. M. Craik (Eds.), *The Oxford handbook of memory*. (pp. 33-43). New York, NY: Oxford University Press.
- Tulving, E. (2001a). Episodic memory and common sense: how far apart? *The Philosophical Transactions of The Royal Society B. London: The Royal Society*, 356, 1505-1515.
- Tulving, E. (2001b). Origin of autoevidence in episodic memory. In H. L. I. Roediger, J. S. Nairne, I. Neath & A. M. Surprenant (Eds.), *The nature of remembering: Essays in honor of Robert G. Crowder* (pp. 17-34). Washington, DC: American Psychological Association.
- Tulving, E. (2002). Episodic memory: From mind to brain. *Annual Review of Psychology*, 53(1), 1-25.

- Tulving, E., & Markowitsch, H. J. (1998). Episodic and declarative memory: Role of the hippocampus. *Hippocampus*, 8(3), 198-204.
- Tulving, E., Schacter, D. L., McLachlan, D. R., & Moscovitch, M. (1988). Priming of semantic autobiographical knowledge: A case study of retrograde amnesia. *Brain and Cognition*, 8(1), 3-20.
- Zola, S. M., & Squire, L. (2000). The medial temporal lobe and the hippocampus. In E. Tulving & F. I. M. Craik (Eds.), *The Oxford handbook of memory* (pp. 485-500). London: Oxford University Press.