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Individual Differences in Remembering

Colin M. MacLeod, Tanya R. Jonker, and Greta James

Everyone recognizes that memory ability differs across and even within individuals for different kinds of information and under different circumstances. Indeed, we know that these differences can be dramatic: Some people regularly struggle to remember phone numbers, names, and even faces; others, like the *Jeopardy* contestants on television, have a seemingly superhuman dexterity with enormous arrays of facts and knowledge. Ask someone how good their own memory is, though, and they likely will apologetically say "not very good," often followed by pointing to someone that does have a phenomenal memory – or more likely to someone who knows someone who has a phenomenal memory.

What underlies these apparently vast differences in memory? The common answer is *talent* – some people are just born with greater ability. There is indeed evidence of genetic contributions to memory (e.g., de Quervain et al., 2003; Egan et al., 2003), consistent with a role for memory "inheritance." But the fact that this "nature" explanation is very entrenched does not deny a very significant role for "nurture." Practice – intensive deliberate practice over extended time – is, on the evidence, a considerably more reasonable explanation, as Ericsson has persuasively argued (Ericsson & Moxley, Chapter 23, this volume; Ericsson, Krampe, & Tesch-Römer, 1993). Foer's (2011) recent popular book, *Moonwalking with Einstein*, also strongly makes the case for practice in the context of memory improvement techniques.

In this chapter, we address 12 questions about how and why people's memory abilities differ. We chose these 12 because, in our experience, they are the most frequently asked questions in university and public lectures on memory. We will argue overall that the two major factors underlying individual differences in memory are the operation of working memory and the knowledge stored in long-term memory, with additional contributions from motivation and personality. Our primary goals will be to show where the differences in memory ability are worthy of note, what might bring about the differences, and how what we know about these differences enhances our understanding of memory. Psychologists periodically call for better integration of individual differences research into our general theorizing (e.g., Cronbach, 1957): This need is at least as great in the domain of memory as elsewhere (see, e.g., Melton, 1967; Underwood, 1975). Surely the range of memory abilities constitutes a major element of memory that must be explained.

Table 22.1 shows the twelve questions about individual differences in memory that we will try to answer – or at least to summarize what we know. But before we begin answering these central questions, how can we measure memory in the first place?

MEASURING MEMORY

The best known psychometric test designed to measure different memory functions is the Wechsler Memory Scale. Originally developed in 1945 and now in its fourth edition (WMS-IV; 2009), it consists of seven subtests: brief cognitive status exam, spatial addition, symbol span, design memory, logical memory, verbal paired associates, and visual reproduction. These are then combined and reported as five Index Scores: Auditory Memory, Visual Memory, Visual Working Memory, Immediate Memory, and Delayed Memory. When factor-analyzed to determine the underlying traits, the two dominant factors are a general memory factor and an attention/concentration factor (Roid, Prifitera, & Ledbetter, 1988). WMS-IV was designed to accompany the Wechsler Adult Intelligence Scale, fourth edition (WAIS-IV; 2008), which also contains a working memory index made up of two subtests – digit span and arithmetic. The major use of the WMS is as a neuropsychological tool to evaluate people with suspected memory problems, but it can also be used to measure normal memory.

Table 22.1 Twelve questions about individual differences in remembering

Number	*Question*
1	Are memory differences just an outgrowth of intelligence differences?
2	Are some people better than others at holding more information in memory at one time?
3	Are some people quicker and more accurate than others at accessing memories?
4	Are some people better than others at dealing with interfering information in memory?
5	Do some people have photographic memories?
6	Do people differ in their use of mental imagery?
7	Do people differ in their susceptibility to false memories?
8	Do people differ in forgetting things that they are supposed to do later?
9	Do people differ in how effectively they study?
10	Do some people remember faces and names better than others?
11	Do some people have earlier or more detailed childhood memories than others?
12	Are men's and women's memories different?

The WMS provides a formal – reliable and valid – measure of memory. But most *research* on memory does not involve the WMS because the concern is often with memory quality, not memory quantity (Koriat & Goldsmith, 1996). This quality (or accuracy) issue pervades the questions that we address, whether we are investigating working memory or long-term memory. The short-term (working) versus long-term memory distinction has long been a key idea in theorizing about memory (Atkinson & Shiffrin, 1968; James, 1890). Working memory (Baddeley, 1986; Baddeley & Hitch, 1974; Cowan, 1988, 2005; Cowan, Rouder, Blume, & Saults, 2012) is the capacity-limited system that actively holds information in memory to permit performance of tasks and to make that information available for further processing. Long-term memory is the system that provides the continuing retention of information, outside of awareness. The information in working memory can come from the environment, from information already in long-term memory, or from their combination.

The longest standing measure of working memory capacity, again a measure of quantity, is span – the maximum amount of information that can be held at one time. This limitation was first identified by Ebbinghaus (1885) and the term "span" was coined by Jacobs (1887). Traditionally, this was digit span, involving repeating back a string of digits in order. An individual's digit span was taken to be the longest string that they could successfully recall. Digit span linked well with the idea of a short-term memory store that simply held a limited amount of information. But working memory is seen as more dynamic – as active, conscious memory where mental work is done – and so measures of span have changed. Beginning with Daneman and Carpenter's (1980) reading span – where the task was to read and understand a series of sentences while retaining the last word of each sentence – span measures have come to require computation in addition to retention. Conway, Kane, Bunting, Hambrick, Wilhelm, and Engle (2005) provide a good overview of these working memory span tasks.

Long-term memory measures are a much larger and more diverse set, as befits this vast network. We distinguish episodic (personal past) memory from semantic (general knowledge) memory and from procedural (skills) memory (see Tulving, 1985). Episodic memory is typically measured by recall and recognition. In recall, a person is presented with a set of information, and is asked to recollect that information, either without assistance (free recall) or with clues (cued recall). In recognition, items that were or were not studied are presented and the person tries to determine whether each is "old" or "new." These are explicit memory tests, in which the person is aware of trying to remember, as opposed to implicit memory tests, in which the person uses memory without awareness (Graf & Schacter, 1985). Implicit measures typically rely on priming – that prior experience facilitates subsequent experience without awareness. Examples would be faster reading of material previously read, or faster or more successful solution of word fragments (e.g., A - - A - - I N for ASSASSIN) seen previously. Similarly, procedural memory can be measured by more rapid or accurate performance of a previously performed skill. Semantic memory can be measured by priming as well, such as when earlier knowledge related to information currently being processed speeds that processing.

There are many other measures that can be used to assess remembering, from confidence judgments to autobiographical cues and beyond. Many of these also are aimed at quality rather than quantity of memory. It is good to have these measures in mind, and to realize how the richness of memory requires many types of measures.

QUESTION 1: ARE MEMORY DIFFERENCES JUST AN OUTGROWTH OF INTELLIGENCE DIFFERENCES?

In fact, it might be better to think of differences in intelligence as a consequence of memory differences. It is clear from the foregoing that memory and intelligence have to be related: Intelligence tests such as the WAIS-IV include subtests of memory, so that memory performance necessarily contributes to the measurement of overall intelligence. As we will show in Question 2, working memory measures – notably working memory capacity – consistently show a strong relation to intelligence. Indeed, Kyllonen and his colleagues (Colom, Rebollo, Palacios, Juan-Espinosa, & Kyllonen, 2004; Kyllonen, 1996; Kyllonen & Stephens, 1990) argue that working memory is the strongest predictor of intelligence, better than declarative or procedural knowledge or than processing speed. Colom et al. (2004) go further in suggesting that intelligence and working memory may actually be the same construct.

Whether we are remembering or solving problems, working memory is the cornerstone of our mental workspace and long-term memory provides our entire knowledge base. Consequently, memory must be crucial to our intellectual functioning. One could argue, in the context of Horn and Cattell's fluid/crystallized theory of intelligence (Horn & Cattell, 1966), that working memory underlies fluid intelligence (rapid manipulation of information) and long-term memory underlies crystallized intelligence (use of knowledge, or wisdom). Such a characterization makes it clear that memory is central to our intellectual functioning.

QUESTION 2: ARE SOME PEOPLE BETTER THAN OTHERS AT HOLDING MORE INFORMATION IN MEMORY AT ONE TIME?

This, of course, is the issue of working memory capacity, the subject of extensive research (see Andrade, Chapter 6, this volume; Bors & MacLeod, 1996). Certainly, at the extremes, memory span is smaller, as in the learning-disabled (e.g., Torgesen, 1988) and the elderly (Myerson, Emery, White, & Hale, 2003). Simple digit span can detect such extreme differences but is not very useful within the normal adult range (Matarazzo, 1972). Dempster (1981) argued that of the ten frequently considered sources of differences in memory span – rehearsal, grouping, chunking, retrieval strategies, item identification, item ordering, capacity, susceptibility to interference, search rate, and the output buffer – the major one was the speed of identifying presented items. This argument localizes the individual differences in the manipulation of the information rather than in pure storage capacity.

Most work on working memory capacity uses modern span measures, where span is measured during more complex processing, such as reading for understanding or performing complex arithmetic calculations. Engle and Kane (2004) summarize their extensive research as showing that these processing span measures do a very good job of predicting higher-order cognitive capabilities, among them comprehension and most notably general intelligence. Their research on working memory capacity has also implicated fundamental processes of attention and self-control (see, e.g., Kane, Conway, Hambrick, & Engle, 2007).

To illustrate their research program, consider a study by Kane and Engle (2000). They had two groups, one with high and one with low working memory capacity, view short lists and try to recall the items. They manipulated memory load by sometimes adding a finger-tapping task. Not surprisingly, under no load, individuals with low span showed more proactive interference (interference from earlier lists) than did those with high span. The interesting finding was that the two groups performed equivalently under load: Proactive interference increased under load for high-span individuals only, suggesting that they ordinarily use attention to overcome interference but that was not possible under load.

How big is working memory? Researchers agree that the capacity is less than Miller's (1956) "magical number" 7 ± 2, with Cowan's (2010) figure of 4 providing a modern benchmark. This number provides a rough index of how many coherent pieces of information can be held (or referenced in long-term memory) while carrying out computations in working memory, and it is this capacity and the associated executive control processes that vary across individuals. Indeed, capacity and control may not be separate: Greater control may confer greater capacity. The natural follow-up question is whether training can improve working memory – and whether transfer can extend beyond the specific training regimen, even influencing intelligence. There is debate on this (see Klingberg, 2010, for the more positive side; Redick et al., 2013, and Shipstead, Redick, & Engle, 2012, present the more skeptical view). Historically, it has proven very difficult to obtain transfer of training on cognitive skills, but it is early days yet regarding training of working memory and possible transfer to tasks other than the training task.

Kalyuga, Ayres, Chandler, and Sweller (2003) reasonably argue that our finite working memory is the limiting factor in learning new information. Schemas that chunk information into larger units help to reduce working memory load, improving retention of new information. Novices do not yet have these schemas, so detailed instruction helps them to organize the new information into a schema. Experts already have these schemas, so highly guided learning can be harmful – for them, the detailed instruction is redundant, increasing the load on working memory as they try to assimilate information into existing schemas. Kalyuga et al. (2003) dub this the expertise reversal effect (see also McNamara, Kintsch, Songer, & Kintsch, 1996).

We know that working memory capacity and skills relate to many other aspects of psychological functioning. Working memory is central to the development of cognitive abilities in children (Munakata, Morton, & O'Reilly, 2007) and to their decline in the elderly (Hasher & Zacks, 1988), and deficits in working memory may be a marker for early onset Alzheimer's (Rosen, Bergeson, Putnam, Harwell, & Sunderland, 2002). More depressed individuals show a deficit in working memory span but not in simple span, implicating effects of executive control (Arnett, Higginson, Voss, Bender, Wurst, & Tippin, 1999). Even the cost of stereotype threat is partially due to reduced working memory capacity (Schmader & Johns, 2003).

Overall, then, the capacity of working memory and the control processes that operate on its contents are sources of critical individual differences in memory with quite sweeping implications for other aspects of cognition.

QUESTION 3: ARE SOME PEOPLE QUICKER AND MORE ACCURATE THAN OTHERS AT ACCESSING MEMORIES?

This question addresses the communication between working memory and long-term memory. Essentially, working memory is constantly called on to access information in long-term memory both to process inputs from the world and to respond based on experience. Given the sharp limitation of working memory to holding only about four items, it is critical to select only the most relevant information and to minimize the capacity consumed by irrelevant information. Vogel, McCullough, and Machizawa (2005) have demonstrated that selection efficiency shows considerable variability and that high-capacity individuals are much better than low-capacity individuals at selecting only the relevant items. Intriguingly, low-capacity individuals may actually store more information in working memory, essentially wasting their capacity. This inefficiency could well contribute to diminished success in accessing long-term memory because working memory is "crowded."

In earlier work, Hunt (1978) and colleagues argued that accessing information in long-term memory – even highly familiar information – is an important source of individual differences. Their primary measure was the letter identification task (Posner, Boies, Eichelman, & Taylor, 1969), in which subjects verify as quickly as possible whether two letters have the same name. Physical identity trials (AA, ee) can be verified perceptually without accessing long-term memory, but name identity trials (Aa, eE) require retrieval from long-term memory. Individuals of lower verbal ability as measured by standardized tests showed larger response time differences between physical and name identity trials, indicative of slower access to well-learned information in long-term memory. This pattern was evident for common words as well as for letters (Hunt, Davidson, & Lansman, 1981). When even such overlearned information is slower to retrieve, this has serious consequences: Consider how much it would slow down reading (Palmer, MacLeod, Hunt, & Davidson, 1985).

In working memory, then, those with low spans have trouble selecting and manipulating the relevant information; in long-term memory, those with lower verbal ability (a proxy for fluid intelligence) are slower to access existing information, at least when that information is verbal. These findings articulate well with established findings that processing speed is a critical determinant of performance, and may be a major reason underlying the decline in cognitive ability with advanced age (see Salthouse, 1996).

QUESTION 4: ARE SOME PEOPLE BETTER THAN OTHERS AT DEALING WITH INTERFERING INFORMATION IN MEMORY?

Paradoxically, to remember, we sometimes must forget. Indeed, a critical feature of remembering involves filtering out intruding material, an issue raised in Question 2. Those with high working memory capacity better recall relevant information (Rosen & Engle, 1997; Unsworth, 2010), resist intrusions more effectively (Rosen & Engle, 1998), restrict encoding and maintenance to relevant information (Vogel et al., 2005), and suffer less from proactive interference (Kane & Engle, 2000; Unsworth, 2010). Thus, those with high working memory capacity tend to perform better on tasks that require the restriction of interfering information.

This raises another important question: Does performance differ between those with high and low working memory capacity because of differences in *capacity* or differences in *control*? If differences lie in capacity or available resources alone, one might expect high capacity individuals to be *more* susceptible to interference during retrieval because, in a sense, there is more "space" that can be filled with irrelevant information (for an analogue in attention, see Wilson, Muroi, & MacLeod, 2011). Alternatively, if working memory captures a dimension of executive control (as has been argued by Baddeley & Della Sala, 1996; Baddeley & Hitch, 1974), then one might expect high working memory capacity individuals to be *less* susceptible to interference during retrieval because they have better control over encoding and retrieval processes. In fact, the latter is supported by the data.

Based on the link between working memory and controlling interfering information, many have argued that inhibition of unwanted or interfering material is beneficial for efficient retrieval (see, e.g., Hasher & Zacks, 1988), and that those with higher working memory capacity have better control processes and are better at this suppression (e.g., Aslan & Bäuml, 2010; Rosen & Engle, 1998). Specifically, during retrieval processes, interfering information is suppressed to facilitate retrieval of the target information. Aslan and Bäuml demonstrated that those with high working memory capacity experienced more difficulties when trying to retrieve information that competed with targets on an earlier task (see also Conway & Engle, 1994; Rosen & Engle, 1998).

A recent study raises an alternative account to the suppression hypothesis. Delaney and Sahakyan (2007) demonstrated that, when instructed to forget a first list and remember a second list, individuals with higher working memory capacity forgot more items from the first list following a context change manipulation that made the first list contextually distinct from the second list. This suggests that individuals with higher working memory capacity might not rely on suppression to reduce interference; instead – or additionally – they might better use context information during encoding and retrieval.

Clearly, high-span individuals cope with interference more effectively than low-span individuals. Those with high working memory capacity may deal more effectively with interfering information because they can better suppress competing material, because they can better recruit critical contextual cues, or some combination of the two.

QUESTION 5: DO SOME PEOPLE HAVE PHOTOGRAPHIC MEMORIES?

In our opening paragraph, we alluded to someone knowing someone who knew someone with an exceptionally good memory. This definitely applies to photographic memory: We have all heard of people with this ability, but few have ever actually met such a person. What would it actually mean to have this ability? Is it just an exceptional memory, or should it be something uniquely pictorial with extraordinary resolution? Certainly, there are people with exceptional memories (see Ericsson & Moxley, Chapter 23, this volume): The most salient case recently is AJ (her initials), a woman who has a prodigious memory for the events of her lifetime, both personal and public (Parker, Cahill, & McGaugh, 2006). Other mnemonists, or memorists as they are sometimes called, have periodically been reported (e.g., Hunt & Love, 1972; Luria, 1968; see Foer, 2011), but none have been claimed to have photographic memory.

A truly photographic memory would contain representations isomorphic to the world that could be retrieved essentially perfectly. It is generally agreed that such an ability does not exist. Instead, what does appear to exist is eidetic imagery, which is more like exceptionally good visual imagery – accurate and detailed (for reviews see Crowder, 2003; Gray & Gummerman, 1975). This ability has long interested researchers (e.g., Allport, 1924, Carmichael, 1925; Kluver, 1928), but gained considerable profile with the work of Haber and Haber (1964, 1988). They studied 150 children in elementary school, briefly showing them a standard set of four pictures and then, after each picture was removed, asking them questions about what they "saw" in memory. About half of the children reported having images, but only 12 (8 percent) seemed to have eidetic imagery. Paivio and Cohen (1979), examining 242 children in grades two and three, produced an almost identical estimate of 8.6 percent. Subsequently, a common test for eidetic imagery became the ability to mentally overlap two meaningless pictures to produce a meaningful one (see Leask, Haber, & Haber, 1969).

Later studies showed this ability to be almost entirely restricted to children under age ten (Giray, Altkin, Vaught, & Roodin, 1976; Richardson & Harris, 1986), and even then to perhaps only 5 percent of children who can encode pictorial information and recover it, at least for a few minutes, with impressively high resolution (see Hochman, 2010). Intriguingly, there is evidence suggesting that eidetic imagery can "return" in the elderly (Zelhart, Markley, & Bieker, 1985), although the reliability and interpretation of these observations are unclear. It has been suggested that the presence of this ability is related to brain disorders (see Crowder, 2003). What is clear, though, is that whereas eidetic imagery appears to exist in a small subset of children, it is unrelated to – and hence there is no evidence for – photographic memory.

Those children with eidetic imagery may use working memory more effectively, access information in long-term memory more effectively, or both.

QUESTION 6: DO PEOPLE DIFFER IN THEIR USE OF MENTAL IMAGERY?

Mental imagery has always been of interest to those trying to understand memory, no doubt because imaging dramatically improves remembering. Imagery is, according to Intons-Peterson (1992, p. 46) "the introspective persistence of [a sensory] experience, including one constructed from components drawn from long-term memory, in the absence of direct sensory instigation of that experience." Galton (1880) collected and analyzed reports of how – or indeed whether – people experienced mental pictures, and recognized immediately the diversity of visual imagery experience (see also Griffitts, 1927). We know of individuals with extremely good imagery, including Luria's subject, "S" (Luria, 1962), whose overpowering images interfered with his daily functioning, and Stephen Wiltshire, the autistic British architectural artist who, after a single quite brief exposure, can do highly detailed and accurate city and landscape drawings. Moreover, it is well established that mathematics skill benefits from visual imagery ability (Battista, 1990; McGee, 1979).

In fact, there appear to be extensive differences in the ability to form and manipulate visual images in memory (see White, Sheehan, & Ashton, 1977). From the example of eidetic imagery as extremely good imagery, we can move to the self-reports of Galton's subjects, slightly over 10 percent of whom claimed to have no images at all – and were skeptical of others who did report imagery! Figures in the range of 2–5 percent for non-imagers are more routine now (see, e.g., Faw, 2009; Reisberg & Heuer, 2005). Of course, all such data are self-reported, so it could be that the individuals reporting no imagery are simply less willing to label their experience as imagery. Given, however, that the brain areas used in visual imagery correspond closely to those used in vision itself (Kosslyn, 2005; Kosslyn, Ganis, & Thompson, 2009), there is support for imagery being truly visual. At the least, these reports highlight the range of experience.

From Galton (1880) to Betts (1909) to the recent past (White et al., 1977), numerous tests have been developed to measure imagery ability. Some aim to measure ability to manipulate images; some aim to measure image quality (see, e.g., the Vividness of Visual Imagery Questionnaire; Marks, 1973, 1995; see McKelvie, 1995). This is, of course, a thorny measurement problem, given our fundamental inability to observe what is being measured, but tests such as the VVIQ do show some reliability.

Visual imagery is by far the most extensively studied, but other modes of imagery have also been investigated. Hubbard (2010) reviews the literature on auditory imagery, noting that auditory imagery test scores (e.g., the Auditory Imagery Scale of Gissurarson, 1992) correlate quite well with visual imagery test scores. Moreover, there are studies (e.g., Sharps & Price, 1992) to suggest that auditory imagery may benefit memory as much as visual imagery. This would be impressive, given the dramatic memory improvements that occur when people form images (Paivio, 1969).

In sum, there is a vast range in reported imagery ability, which may include a small proportion of individuals who do not experience visual imagery at all. Imaging improves memory substantially relative to rote rehearsal and, together with association, is the basis of almost all successful mnemonic techniques (see Higbee, 1977).

QUESTION 7: DO PEOPLE DIFFER IN THEIR SUSCEPTIBILITY TO FALSE MEMORIES?

False memory involves recollecting an experience or event that did not in fact occur (see Newman & Garry, Chapter 7, this volume). This intriguing field of research is important both theoretically and because it is especially relevant to applied areas such as eyewitness testimony (see Section 4, this volume). Knowing that a person is susceptible to falsely remembering events could prove useful in evaluating the reliability of that person's testimony.

In the experimental setting, a false memory can involve confidently "remembering" a word that was not studied, labeled an "intrusion." However, in a standard free recall test for a list of unrelated words, few intrusions typically occur. The Deese–Roediger–McDermott (DRM; Roediger & McDermott, 1995) paradigm encourages intrusions: Participants study a list of words (e.g., *thread*, *eye*, *sew*) that all are related to a critical unstudied word (e.g., *needle*) and then, on a later test, they frequently err and recall the critical unstudied word. This paradigm has shown strong test–retest reliability, making it is a useful tool for investigating individual differences in false memory (Blair, Lenton, & Hastie, 2002).

Individuals who show more false memory also have lower working memory capacity (e.g., Gerrie & Garry, 2007; Unsworth, 2007; Watson, Bunting, Poole, & Conway, 2005; however, see Salthouse & Siedlecki, 2007), use a more liberal response criterion across different memory tasks (Qin, Ogle, & Goodman, 2008), express more Need for

Cognition (Graham, 2007), and score higher on the Tellegen Absorption Scale, a measure of mental absorption in everyday activities (Drivdahl & Zaragoza, 2001). They also perform more poorly on a battery of intelligence, perception, memory, and face judgment tasks (Zhu et al., 2010). Indeed, Klein and Boals (2001) demonstrated that low working memory capacity individuals are more likely to experience intrusive memories.

Recent accounts concur that poor source monitoring underlies this tendency to experience false memory (e.g., Unsworth & Brewer, 2010a; Winograd, Peluso, & Glover, 1998; see Johnson, Hashtroudi, & Lindsay, 1993, and Lindsay, Chapter 4, this volume). It is a failure of source monitoring to deem an item "studied" when in fact it was not. Unsworth and Brewer (2010b; Unsworth, 2007) argue that high and low working memory capacity individuals differ in their ability to generate items but that they differ even more in their ability to discriminate generated items as being studied items versus intrusions. This editing process is a key part of source monitoring. Unsworth and Brewer (2010a) also demonstrated that working memory capacity and judgments of recency are related to false recall, but these relations were fully mediated by source-monitoring ability.

But is false memory a failure of source monitoring during encoding, retrieval, or both? Dehon, Larøi, and Van der Linden (2011) used the Encoding Styles Questionnaire to determine whether a participant was an "internal" encoder, relying more on schemata or expectations, or an "external" encoder, relying more on stimulus information. According to Dehon et al., high internal encoders rely more on their pre-existing schemata during encoding, leading to more false memories and implicating source monitoring failure during encoding rather than retrieval.

Although the locus of source monitoring differences is not yet clear, approaches to individual differences in false memory seem to converge on this explanation: Those who experience false memory in one domain will likely have difficulties monitoring source information in other domains, such that false memory will be a consistent problem for them.

QUESTION 8: DO PEOPLE DIFFER IN FORGETTING THINGS THAT THEY ARE SUPPOSED TO DO LATER?

Prospective memory refers to the ability to remember to do something at the appropriate time in the future (to differentiate it from retrospective memory, or memory for the past; see Kliegel, McDaniel, & Einstein, 2008; Einstein & McDaniel, Chapter 3, this volume). For example, we may rely on prospective memory to remember to call a family member later in the evening or to take a pill before bed. This ability is quite fundamental when it comes to completing day-to-day tasks.

Individuals differ greatly with respect to memory for future events (e.g., Marsh & Hicks, 1998), and there are clear differences in prospective memory ability between younger and older adults (e.g., Cherry & LeCompte, 1999; West & Bowry, 2005). To explain these differences, it has been argued that those who perform poorly in prospective remembering struggle to recruit preparatory or control attentional resources (Brewer, Knight, Marsh, & Unsworth, 2010; West & Bowry, 2005), and that attentional control declines as one ages (Rose, Rendell, McDaniel, Aberle, & Kliegel, 2010). Specifically, Rose et al. demonstrated that age differences were more pronounced in performance on novel prospective memory tasks and were reduced when tasks were repeated or when the ongoing task highlighted the features of the prospective task. Rose et al. saw this pattern as emphasizing the importance of controlling attention. Brewer et al. (2010) carried out a similar study involving participants with high versus low working memory capacity. The two groups performed similarly when the processing of the prospective task overlapped with the processing of the ongoing task, but those with high working memory capacity performed better when there was no task overlap.

In fact, there is evidence (Maylor, 1993, 1996; see also Hertzog & Pearman, Chapter 24, this volume) that older adults sometimes show superior performance on real-world prospective tasks, such as remembering to attend meetings. It would appear that this is because older adults do not rely as much as younger adults on internal cues, instead using external aids (calendars, diaries, etc.).

An alternative explanation to the attentional resource hypothesis is a monitoring explanation (Marsh & Hicks, 1998). It might not be available attentional resources per se that are crucial; instead, the ability to use efficient monitoring strategies might underlie individual differences in prospective memory (see also Brewer et al., 2010). Savine, McDaniel, Shelton, and Scullin (2012) demonstrated that both personality and cognitive factors underlie prospective memory performance; significantly, their cognitive factors included both the attention and monitoring elements just described. This monitoring deficit harks back to the explanation of false memory, and it is noteworthy that older people are more vulnerable to false memories as well (McCabe, Roediger, McDaniel, & Balota, 2009).

Indeed, prospective memory ability may actually result from the combination of two abilities. Specifically, Smith and Bayen (2004) propose a two-component model: prospective – remembering a task that must be completed, and retrospective – recognizing target events as they happen. In investigating these two components of an event-based prospective memory task, the personality dimension of conscientiousness was positively correlated with the retrospective component whereas working memory capacity was positively correlated with the prospective component (Smith, Persyn, & Butler, 2011; see also Cuttler & Graf, 2007; Smith & Bayen, 2005). Brain imaging data lend further support to roles for both prospective and retrospective components (Reynolds, West, & Braver, 2009).

Overall, it appears that the ability to remember to do things in the future does display significant individual differences. These differences rely in turn on differences in attention and monitoring, and are tied closely to working memory and its capacity.

QUESTION 9: DO PEOPLE DIFFER IN HOW EFFECTIVELY THEY STUDY?

Students and teachers certainly realize that students study differently and that their study regimens influence their learning of and subsequent memory for the material (see Metcalfe, Chapter 26, this volume). Of course, motivation matters: There is evidence that valuing the deep processing that improves memory (cf. Craik & Lockhart, 1972) is well connected to motivation, possibly more than self-reported ability or belief that studying is important (Nolen & Haladyna, 1990). But it is obvious, too, that cognition matters in terms of study strategies. Thomas and Rohwer (1986) identified four characteristics as central to effective studying: specificity (fit between strategies used and course and individual characteristics), generativity (increasing depth of processing), executive monitoring (metamemory used for appraising needs and for selecting and evaluating strategies), and personal efficacy (internal locus of control). With the possible exception of specificity, there are notable individual differences in each of these other factors that could certainly influence study effectiveness.

Although they get better as they move through their education, we know that most students do not employ planful and generative study strategies (Christopoulos, Rowher, & Thomas, 1987). Sadly, effective studying is the exception rather than the rule. Even the total study time that students report spending, although it changes significantly across grade levels, is essentially uncorrelated with achievement. This may well be a failure of metamemory – monitoring again – but likely also reflects insufficient motivation.

With recent moves to translate research on memory to the classroom (e.g., Roediger, Putnam, & Smith, 2011; Rohwer & Pashler, 2010), we can hope to see improved techniques for enhancing learning and memory in the educational system.

QUESTION 10: DO SOME PEOPLE REMEMBER FACES AND NAMES BETTER THAN OTHERS?

Everyone seems to believe that they can remember faces much better than names, but this is likely due to the fact that we ordinarily are recalling names and recognizing faces (Bahrick, Bahrick, & Wittlinger, 1975). Are there real individual differences in this important interpersonal domain? Woodhead and Baddeley (1981) identified subjects whose face recognition had been exceptionally good or bad a few years earlier and gave them three recognition tasks: faces, paintings, and words. Compared with those who had previously recognized faces poorly, those who had previously recognized faces well were better at recognizing faces and paintings but did not differ at recognizing words. This suggests that people who are good at face recognition generally have good visual memory that is separate from verbal memory.

Recently, Bindemann, Avetisyan, and Rakow (2012) have examined individual differences and consistency in identifying unfamiliar faces. By measuring performance repeatedly across several days, they showed that people often made different identification decisions to the same faces and that people who were very accurate on one day could be quite error-prone on another day. Nevertheless, there was a small subset of people who were consistently accurate across days. Their findings fit with the idea that accuracy and consistency are independent components of the ability to match faces, and both are required to predict a person's general face processing skill.

Franklin and Adams (2010) have argued that faces differ from other visual stimuli in that people read complex social meaning into faces. They found that people who were good at decoding emotional messages from expressive faces were more successful at encoding and retrieving neutral faces. Moreover, faces rated as higher in emotionality were better remembered. There are also well-established age differences in face–name association, with older people having considerably more trouble than younger people. Naveh-Benjamin, Shing, Kilb, Werkle-Bergner, Lindenberger, and Li (2009) taught face–name pairs to both age groups under either incidental or intentional learning instructions and found poorer performance by older people on faces, names, and their association under incidental learning, and a specific deficit in older people for the associations under intentional learning. Apparently, there are both general episodic memory deficits and more specific strategic deficits that arise with age.

Faces and names provide a natural testing ground for individual differences in memory. It appears that some people are very good at this, possibly because they encode more accurately and consistently than other people do. This may be a general visual memory superiority or it may hinge on better associative learning, or both of these may play roles. It would seem that both cognitive and social/personality factors are involved.

QUESTION 11: DO SOME PEOPLE HAVE EARLIER OR MORE DETAILED CHILDHOOD MEMORIES THAN OTHERS?

People often share – and hence compare – their earliest memories, and we have each been surprised by how far back some individual(s) can go and how many details they can recollect. We do, however, have to consider whether their memories are real: Apparent differences could reflect differing tendencies to endorse false memories as opposed to real differences in autobiographical memories (see Newman & Garry, Chapter 7; Goldsmith, Pansky, & Koriat, Chapter 27; and Fivush & Waters, Chapter 13, this volume). Reports of memories before the age of three or four likely are false, possibly because the use of relevant memory scripts has not yet developed (see Hudson, Fivush, & Kuebli, 1992). It remains difficult to determine whether reports of very early memories are of the original episode or arise from photographs or stories absorbed later in life.

Parental influence may affect the age of earliest memories. Haden, Ornstein, Rudek, and Cameron (2009) found that mothers who engaged their 18-month-olds with more open-ended elaborative questions, fewer elaborative statements, and more confirmations improved their children's memories for events, in turn leading both to more detailed recollections and to earlier memories. In accord with this, Jack, MacDonald, Reese, and Hayne (2009) found that the tendency of some mothers to elaborate memories rather than repeat them when their children were two to three years old led to earlier memories in their children when they were 12 to 13 years old. Usher and Neisser (1993) also suggest that children may tend to remember later in life only those episodes that the adults saw as important.

Regardless of the earliest age of recall, individuals certainly differ in their ability to recall early memories. A number of variables have been implicated as responsible for this variability. For example, females tend to have earlier memories than males (see Question 12), possibly because of the influence of testosterone on the development of memory ability early in life (Mullen, 1994). Birth order may also affect recall, with age of earliest memory later for younger siblings. A possible explanation could be that parents talk and socialize more with girls and first-born children. Finally, earliest memories tend to be earlier for Caucasians than for Asians, suggesting that culture may also exert some influence (Mullen, 1994).

Theories of how autobiographical memory develops also provide some explanation as to why individuals differ in the extent to which they recall early memories. For example, Howe (2000) argues that the development of autobiographical memory relies on the development of a sense of self, which acts as an organization principle used to reference a memory (but see Hyman & Billings, 1998, for a contrasting view). Indeed, organizational change with development does seem to be an important factor determining childhood memories (see Usher & Neisser, 1993). One reason that adults may forget early memories is because those memories do not fit into our mature organizations; this may also explain why 8-year-olds can remember earlier memories than adults can.

Investigations of infantile amnesia in adults are numerous, but researchers have only recently turned to studying children. Peterson, Warren, and Short (2011) asked children aged 4 to 13 years old for their earliest three memories and then asked them again two years later. Younger children rarely recalled the same memories – even when given cues about the memories that they had recalled previously. Older children were considerably more likely to recall the same memories, and cues to previously recalled memories were successful for them.

There certainly is room for more work on early memories and the extent of detail in those memories; we also need to understand what factors contaminate those memories, and how they do so. Of course, the young child's perceptual system also undoubtedly plays a role in how episodes are processed and hence retained, and the reconstructive nature of recollection also impacts how we remember the beginnings of our lives.

QUESTION 12: ARE MEN'S AND WOMEN'S MEMORIES DIFFERENT?

Differences in memory performance between the sexes do exist. Women generally perform better at verbal memory, episodic recall, and face recognition (e.g., de Frias, Nilsson, & Herlitz, 2006; Krueger & Salthouse, 2010). These sex differences begin early (e.g., Davis, 1999), and remain stable throughout adulthood, even prominent beyond age 85 (de Frias et al., 2006). Women are also better eyewitnesses, typically showing greater accuracy in person and location descriptions than men do (Areh, 2011). Although numerous studies have shown that women have better episodic and verbal memory, generally no sex differences are found in primary memory, semantic memory, or priming (Herlitz, Nilsson, & Bäckman, 1997; see also Maccoby & Jacklin, 1974). Furthermore, when episodic memory tests require visuospatial processing – processing that men are known to excel at – men outperform women (Lewin, Wolgers, & Herlitz, 2001).

Are these sex differences in the encoding or retrieval stage? Krueger and Salthouse (2010) examined memory gains and losses over multiple study-test trials and concluded that differences occur in memory acquisition, rather than in retention. This conclusion is further supported by examining recall and recognition tests where the difference between men and women is equal, suggesting that it lies in encoding processes, not in retrieval processes (Herlitz et al., 1997).

One prominent theory explaining these sex differences asserts that women have a more efficient declarative memory system (e.g., Ullman, 2004), allowing them to rely more heavily on previous experience with language when performing linguistic tasks. This theory is supported by the finding that women perform better than men on a verbal memory task involving familiar-sounding novel words, but do not outperform men when the task involves unfamiliar-sounding novel words (Kaushanskaya, Marian, & Yoo, 2011). Thus, women are better able to recruit their knowledge of language when the stimuli sound familiar. Lewin et al. (2001) argue that the observed sex differences in episodic memory are not the result of superior verbal ability; indeed, the sex difference in episodic recall remains when verbal ability is controlled (Herlitz, Airaksinen, & Nordström, 1999; Herlitz et al., 1997; Krueger & Salthouse, 2010).

Women also excel at recalling emotional memories (Canli, Desmond, Zhao, & Gabrieli, 2002). They tend to remember more childhood events, but this advantage is restricted to events associated with emotion (Davis, 1999). In general, people remember negatively valenced material better than neutral material, yet neutral material is better remembered if followed by negatively valenced unrelated material (e.g., watching a video with negative content) as opposed to neutral material (Nielson, Yee, & Erickson, 2005). Recently, Wang and Fu (2010) demonstrated that this effect occurs for females but not for males, suggesting that negative affect might influence the memory consolidation process in females only.

The risk in describing sex differences in memory is that this very act of description may make it seem that there are many such differences. But as far as we know, this is not true, and where there are differences, they are relatively subtle. They may also hinge not on differences in the memory system itself, but instead on factors such as motivation, interest, or experience. As is generally the case with group differences, there is much more difference in memory within each gender than there is between the genders.

CONCLUSION

In this chapter, we have endeavored to answer some of the most often asked questions about how people's memories differ. Certainly there are others that we could have included, but our coverage does indicate the richness of individual differences in memory – and their potential impact on everyday behavior. We have also tried to answer the critical theoretical question: What drives individual differences in memory? Our answer rests on the operation of working memory and the knowledge in long-term memory, with contributions from motivation and personality. First and foremost is working memory: It is our mental workspace so it is in constant use. Its capacity and its speed of operation dictate how fluently we can manipulate information, and we have seen its influence throughout the twelve questions. Likening it to fluid intelligence seems entirely appropriate. If we do so, then our crystallized intelligence corresponds to the knowledge in long-term memory. There is huge variation in what people know, and this will necessarily influence what they can do. What brings about that variation? Certainly, our own interests and motivation – our personalities – play pivotal roles in what we choose to learn and how well we learn it and can later recover it from memory. Our prior experience influences what we encode and what we retrieve, such that each of us has, in a very real sense, a different memory system. This is why, when faced with nominally the same event, each of us remembers it somewhat differently: We process it differently based on our experience, and we recollect it differently because what we have encoded, and how we go about retrieving it, is unique.

Cognitive psychologists and other researchers interested in memory should certainly be studying individual differences because it is unquestionably true that we can never have a complete theory of memory without meaningfully incorporating this variation. This is true at the level of explanation: As Underwood (1975) argued, predictions based on individual differences can often provide a test of a general theory. It is also true at the level of application: If we are to predict how an individual will behave when remembering, we need to be able to fine tune our broad understanding of memory by incorporating what we know about this person as opposed to people in general.

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