1 What do people believe about memory and how do they talk about memory?

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> Memory is a central part of the brain's attempt to make sense of experience, and to tell coherent stories about it. These tales are all we have of our past, so they are potent determinants of how we view ourselves and what we do. Yet our stories are built from many ingredients. Snippets of what actually happened, thoughts about what might have happened, and beliefs as guide us as we attempt to remember. Our memories are the powerful but fragile products of what we recall from the past, believe about the present, and imagine about the future.
>
> Schacter, 1996, p. 308

INTRODUCTION

A Norwegian newspaper (Dagbladet, Magasinet, 27 March, 2004) recently told the story of Dodo, a young man of Asian origin who in January 2003 woke up on the freezing ground in a small village in Switzerland with his well-equipped rucksack nearby, stuffed with expensive clothes and a money belt containing $5000, but no identity papers or tickets and with absolutely no personal memory. Dodo wandered around in Europe for some weeks, and somehow managed to travel to Oslo, Norway, for reasons he cannot explain; there he is currently being studied at the University Hospital. His memory loss of the time before he woke up in Switzerland is massive; he has no idea who he is, and he did not recognize his own face in the mirror. He has even lost his native language – he speaks heavily accented English but not any Asian language. All he has is a picture of a young girl, taken in Paris, but he has no idea who she is. Dodo's memory now goes back roughly a year – the rest is speculation. The only thing he knows about himself is that he smokes Camel and likes pop music. "I was nobody", Dodo says, "Now I tell myself I was born one year ago".

The story of Dodo, fanciful as it may seem, illustrates well the central role of memory in human life. This young man has lost not only his personal past – his autobiographical memories – but he has also lost large parts of his general knowledge of the world and even his ability to speak his native language.

Thus, the systems or forms of memory that we term episodic and semantic memory are, in Dodo's case, heavily affected. True, there is more to memory than general knowledge and the recollection of personal episodes, but episodic memory is assigned a special role in human life. Episodic memory is unique in that memories are associated with a place and a time, an association that even if incorrect gives the memories a sense of personal historical truth, and contributes to the person's self-identity. Episodic memory is, in the words of Tulving (2002), the only known example of a process where the arrow of time is turned back and the past can be re-experienced. While some form of episode-like memory may be demonstrated in non-human primates (Hampton & Schwartz, 2004), genuine episodic memory is probably unique to humans as it may depend upon linguistic capacities. Without episodic memory, the mental representation that psychologists call the self – the organization of personal memories in an historical context – is lost. Apparently this is what has happened to Dodo.

Dodo suffers from the condition of retrograde amnesia. That is, he has lost his memory in the sense people usually use the term memory. When we talk about memory in everyday life we refer to the recollection of private experiences and facts we have learned about the world. But obviously Dodo remembered many things; he remembered what cigarettes were for, the workings of photographic equipment, he understood the value of money, was able to buy food, and mastered the skill of travelling by public transport. So he could make use of many of the things he had learned. This type of selective memory impairment, which has been reported in many patients exhibiting large individual differences in memory profiles, is the main evidence cited by memory researchers in support of the idea that memory, rather than being a single cognitive process or system, is a collective term for a family of neurocognitive systems that store information in different formats (Schacter, Wagner, & Buckner, 2000; Tulving, 2002).

Varieties of human memory

Most current taxonomies of human memory (see Figure 1.1) distinguish between several forms of memory. For example, most memory researchers agree that in addition to episodic-semantic memory, which supports explicit recollection of previous episodes and previously acquired knowledge, there exists another system that allows previous experiences to express themselves directly but implicitly, as for example in skill learning, emotional conditioning and perceptual learning. These distinctions will be further discussed and elaborated in subsequent chapters, and will only briefly be reviewed here.

Motor learning is responsible for all the procedural skills that we have acquired throughout life, from knowing how to eat with a fork and knife (or sticks) to the mastery of swimming, bicycling or driving a car, as well as the advanced skills of playing billiards or playing a saxophone. Memory is

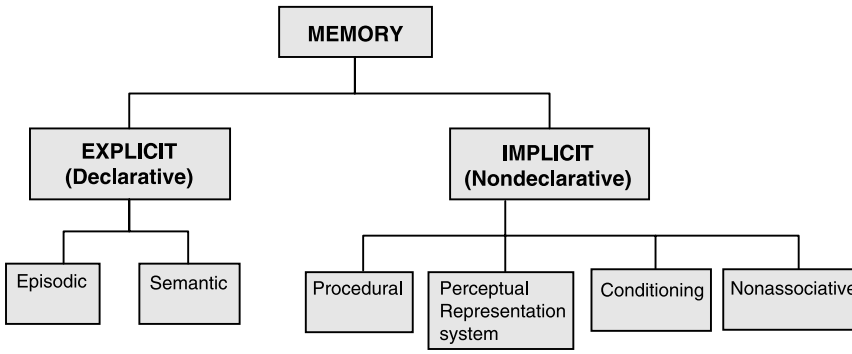

Figure 1.1 A taxonomy of human memory systems.

implicit in the sense that the effects of previous experiences and exercises manifest themselves directly in behaviour; the individual training sessions may be vaguely remembered or may be completely inaccessible to conscious recollection, but the mastery of the skill is there. In a broad sense, motor skills also include what is referred to as procedures – linguistic as well as academic and social skills.

Conditioning represents a basic memory system (Squire & Kandel, 1999) that, in humans, is particularly important in tying emotional reactions to external stimuli or situations. For example, in phobic reactions, anxiety is triggered by the phobic stimuli but the person is typically not aware of the learning episodes in which the connection between the emotion and stimulus was established. Similarly, a piece of music, or a specific odour, may evoke romantic feelings without an accompanying experienced memory episode.

Perceptual learning, or the perceptual representation system, enables us to perceive the world as consisting of meaningful entities, because in order to produce a perceptual experience, on-line sensory signals must join stored representations, and this linking is part of the perceptual process itself. To see is to recognize, or to realize that you do not recognize.

We could go on to list a variety of identified memory types or typical memory tasks. One reason why many memory researchers were led to postulate the existence of separate memory systems is that lesions to the brain may impair some forms of memory while leaving other forms intact; such dissociations have been described for several memory systems.

An important feature of the memory-systems concept is the idea that the various systems store information in different formats, and that the information stored in one format is not directly translatable into others. This implies that the information stored in one system is not immediately accessible to other systems. Assuming that the memory systems operate independently and in parallel, this would imply that most experiences are recorded and stored in parallel in different formats, and can be accessed with the assistance of several

memory systems working in concert (Tulving, 2002). Memory researchers disagree, however, as to whether the distinction between episodic and semantic memory indeed reflects separate systems or only different manifestations of one and the same system. When memory is tested in the laboratory, it may be difficult to distinguish episodic from semantic memories. Most memories will contain aspects of both. For example, when a particular picture is recognized as having been presented earlier, is it because the participant *remembers* it or because the participant *knows* that it was there? In the first case it would be episodic memory, in the second it might be semantic memory that governs the choice – or perhaps it is guessing based on yet another *implicit* memory system? Tulving and Schacter (1990) identified *priming* as a separate memory system in implicit memory. In priming, the person's performance on a specific recognition or production task is facilitated (or inhibited) by the previous presentation of related information.

This idea has also been debated, however. There is little disagreement between memory researchers that human memory covers a vast array of memories of different types, and that some of these can be functionally lost because of failures of systems or processes while others remain intact. There is an ongoing discussion, however, as to whether memory is a set of systems or a set of processes or classes of memory operations (Bowers & Marsolek, 2003; Foster & Jelicic, 1999; Tulving, 2002). The treatment of human memory in everyday contexts in this book is neutral with regard to this debate.

The importance of memory in human life is testified by the widespread public interest in memory-related questions. It is a popular theme in party conversations: Many people wonder about memory either because they notice absentmindedness or forgetfulness in everyday life, or because they have relatives who have become disoriented or have bizarre memory problems. The reliability of memory and eyewitness reports is discussed in the media. Articles on memory-enhancing techniques are frequently published in the press, "therapeutic" groups and techniques for recovering near-birth memories are advertised, and topics such as memory and emotion are among the most popular ones for visits to neuroscience websites (Herculano-Houzel, 2003) – just to mention a few examples. People have various ideas about memory, about how we remember and why we forget, and about ways to improve memory. These ideas are sometimes disclosed in the way we speak about memory – the metaphors of memory. A question of interest is whether the folk psychology of everyday memory constitutes just a set of loose metaphors, or are these metaphors actually based on firm common sense? If the latter is true, then to what extent has modern memory research exchanged old metaphors for new ones, which today are invading everyday memory conceptions? In what follows, we discuss lay beliefs about memory, focusing first on the way people talk about memory, and then looking at the specific ideas people have about memory.

HOW WE TALK ABOUT MEMORY – MEMORY METAPHORS

In attempting to understand memory, scientists as well as laymen are forced to try to describe something that is not directly observable. We are aware of the processes that take place during learning, and of the processes that take place in attempting to search for a piece of information in memory, but we have little access to the processes that mediate between encoding and retrieval. In order to make sense of the phenomena to which we have little access, both laypeople and researchers tend to use metaphors and analogies borrowed from the physical world. The use of metaphors is very widespread in communication: When describing a man's bravery we might say "he is a lion" or if he is coward, "he is a mouse". What is physical and known is used to describe what is abstract or unknown. This use of analogies and metaphors is not only characteristic of everyday communications; memory researchers sometimes also resort to metaphors in communicating their ideas. Furthermore, these metaphors also guide them in formulating their questions and designing their experimental paradigms. In his classic article on reaction time research, Saul Sternberg (1969) described a process termed "memory scanning". In a task used to investigate that process, Sternberg had people study lists of letters or digits and then indicate whether a subsequently presented target letter or digit had been included in the study list. Implicit in the Sternberg paradigm is the notion that a list, represented as a mental image, is processed by something like a beam scanner, a mechanism that searches the image in order to carry out the task of recognition. The scanner metaphor accords with participants' post-experimental reports of what they did they in order to perform the task, and is commonly described by laypeople in terms of the notion of a memory "search". "Wait a moment; I need to search my memory for that name."

Metaphors are quite frequent in everyday descriptions of memory. However, as illustrated by the previous example, memory researchers also use metaphors to guide investigations. The metaphor in the Sternberg case is not just an "as if" conceptualization of a phenomenon. By utilizing the metaphor, Sternberg postulated a mechanism that could either operate the scanner or examine the content of memory, but could not do both at the same time. He further assumed that it takes a fixed amount of time to switch from one operation to the other; each step of encoding and matching takes a certain time for each item in the list. If scanning involves searching the list of items one at a time, the pattern of reaction times would be different to that if all items were scanned simultaneously. Thus, the metaphor, when specified, permits scientists to derive testable hypotheses; the metaphor serves as a working model for scientific tests (Fernandez-Duque & Johnson, 1999).

In many cases, the metaphors used by scientists are simply ways to talk about and think about phenomena at a pre-theoretical stage. Many such metaphors have been proposed to guide our understanding of memory. Thus,

memory has been compared to a wax tablet, an encyclopaedia, a muscle, a telephone switchboard, a computer and a hologram (Roediger, 1980). Theorists have proposed core-context units, cognitive maps, memory tags, kernels and loops (Underwood, 1972). Common to most memory metaphors, in science and in everyday life, is that they are based on the idea of an organized space; a physical store of some sort. This space might have a structure of networks with nodes or paths or hierarchies with localizations and classifications. The nodes or localizations may represent verbal, perceptual, propositional or other entities of memory. These metaphors affect both the scientific investigation of memory and how we talk about and understand memory in everyday life.

One can talk about "storing" memories, "searching" them and "accessing" them. Memories and thoughts can be "organized", memories that have been "lost" can be "looked for" and, if we are lucky, they can be "found". More broadly, ideas in our minds are described as objects in a space, and the mind is a place that keeps "things". We can "keep" ideas "in mind", or ideas might be in the "front" or at the "back" or on "top" of our mind, or in the dark corners or "dim recesses" of the mind. They can be difficult to "grasp" or encounter difficulties "penetrating" into our mind. We even speak of people as of being "broad", "deep" or "open" minded whereas others are "narrow, "shallow" or "closed". Metaphors like these imply that humans think and talk of memory processes in terms of concrete, physical analogues. The Norwegian word for memory, "*hukommelse*", derives from the word "hug", which has as its etymological origin a name for a small bag in which to keep important things when travelling.

The physical store metaphor implies that anything that has entered the store will remain there until it is removed. One might fail to retrieve a piece of information from memory but it is nevertheless available there; an idea reflected, for example, in Tulving and Pearlstone's (1966) distinction between availability and accessibility. The metaphor has inspired speculative theories that memories might disturb us and create psychological problems, without conscious awareness, and it implies that the important areas to look at for explanations of poor memory performance are linked to encoding and retrieval, rather than to the memory store in itself.

A good example of how metaphors might provide us with ideas on how memory works is the muscle metaphor, first suggested by Woodworth (1929). According to this view, memory can be trained and developed in more or less the same way as muscular systems can be trained. Just as muscles have strength, memories can be regarded as varying in strength. Muscles can gain or lose strength. Can memory too? This is still a moot question that nonetheless has instigated much theorizing and empirical research on learning and memory. Everyday memory statements like "my brain works slowly today", "ask me again when I am not so worn out", or "I feel sharp" all suggest an organ metaphor of memory.

Metaphors like these are widespread both in everyday language and in

science. But because metaphors tend to highlight certain aspects of an issue while hiding others, the metaphor chosen will steer research in a certain direction. In the following section we discuss some of the most prominent metaphors in current memory research. Memory metaphors will be encountered in several of the following chapters, and new ones will be introduced (see, for example, Chapter 13).

The theatre metaphor

The theatre metaphor can be traced to David Hume (1739–40/1978): "The mind is a kind of theatre, where several perceptions successively make their appearance; pass, re-pass, glide away, and mingle in an infinite variety of postures and situations. There is properly no simplicity in it at one time, nor identity in different; whatever natural propensity we may have to imagine that simplicity and identity. The comparison of the theatre must not mislead us. They are the successive perceptions only, that constitute the mind, where these scenes are represented, or of the materials, of which it is composed" (p. 253). The metaphor accords with Hume's meta-theoretical empiristic stand, in which the mind is conceived as a stage at which mental processes take place along associative links rather than being guided by an active agent.

In the scientific study of cognition, theatrical analogies have continued to guide research. Mental phenomena have been regarded as representations ("*Vorstellungen*") that are displayed in front of inner perceptions of thoughts, analogous to the way a work of art is staged before an audience. Accordingly, to remember is viewed as a representation of events or knowledge, and conscious awareness resembles a spectator who is only partly aware of what is going on "backstage" or below awareness. The theatre metaphor provides a rich analogy, inviting inferences about the mind, and allusions to the theatre metaphor persist in memory research. A script in the theatre is a recipe of the prescribed actions of actors during the performance. According to Schank and Abelson (1977) scripts are "long-term memory representations of some complex event such as going to a restaurant". The idea is that people record in memory a generalized representation of events they have experienced and these experiences are invoked, or retrieved, when a new event matches an old script. An important feature of a script is that it is a structure that reduces the burden on memory for all details of events. At the same time it represents a framework or context within which new experiences can be understood and a variety of inferences can be drawn to complete the understanding of a new event (Abbot, Black, & Smith, 1985).

In everyday language, the terms schemata and scripts are rarely used. This is not surprising, because schemata and scripts are assumed to function without conscious awareness. We suggest, however, that expressions such as "we are programmed to behave in this way", "it is difficult to stop giving tips after being abroad", or "I have to get back to my routine", point towards a folk

realization of script-like structures. The script notion belongs to a class of models with emphasis on the constructive nature of memory.

The multiple store metaphor

By conceiving memories as being like physical objects and the mind as operating on programs in multiple stores, the multiple store model has guided theoretical research on memory over the last 40 years. Inspired by the rapidly developing computer technology, the emerging information-processing psychology proposed a distinction between a primary short-term store and a secondary long-term store (e.g., Atkinson & Shiffrin, 1968; Waugh & Norman, 1965), in addition, a separate transient sensory store was recognized (Sperling, 1963). The short-term store is assumed to hold information over a short period of time. During this time the information has a certain probability of being transferred into the long-term store. In the earlier models this transfer was linked to the kind of processing that was performed on the information. Maintenance rehearsal was considered to be a holding operation, whereas elaboration rehearsal would increase the probability that information became transferred. The long-term store was thought of as unlimited. Retrieval of information from the long-term to the short-term store was conceived of as a re-presentational process, with long-term stored information temporarily activated in a short-term working memory space.

Although the idea of distinct memory stores has a long history, it received its strongest impetus from the computer metaphor and from the various memory stores that are installed in computers. This has had implications for how researchers conceptualized the kind of units that are stored in memory. Emphasis has been on verbal, word-like material, with units not unlike those found in high-level computer programs, and a number of stores have been suggested (Tulving, 1972). One implication of this conceptualization is that memory traces are viewed as static structures with active processes working on information in the stores. For example, to retrieve is to locate a memory and select the appropriate information. Memories are viewed as complete, with all information in a trace available simultaneously.

The store metaphor has inspired laboratory research to the extent that the Atkinson and Shiffrin model is often called "the modal model" for human memory. Atkinson and Shiffrin outlined the model, allowing for the inclusion of a multitude of stores and substores, with various control processes connected to the stores. The model has been a huge success in accounting for the available empirical findings, but the price has been that the model is difficult to refute. As a metaphor it has served more like a conceptual framework than a strict theory to be tested for its precise propositions.

One of the important features of the store model is that it implies limited capacity. It is impossible to conceive of a physical store that would not be filled up at some point in time. Thus, the metaphor has implications for how we understand the forgetting process. A common misconception is related to

assumptions about short-term storage. In everyday language we sometimes hear statements like "I cannot remember what happened yesterday because my short-term memory is no longer working properly", suggesting that the general public has picked up the idea of distinct memory stores, but not in the same way that memory researchers meant. The departure from scientific conceptions derives, perhaps, from the lack of introspective access to cognitive mechanisms like forgetting over the short term. People tend to understand short-term memory as extending over hours and days, and long-term memory as being measured in months and years. Interestingly, several researchers have recently begun to go along with this folk conception of short-term memory, and debate the usefulness of the modal model.

The multiple store metaphor calls for some mechanism by which information "moves" between stores. In some descriptions, the multiple-store metaphor implies that when information is "transferred" from short-term to long-term memory (through some sort of "stamping"), it no longer exists in short-term memory. This is an example of a situation in which researchers employ a metaphor without committing themselves to all the features of that metaphor. An alternative solution, sometimes proposed, is that of implicating a kind of copy-machine at the interface between stores: A "copy" of the information is transferred from short- to long-term memory or vice versa. But a metaphor may also force researchers to consider aspects of the metaphor that have not been intended. For example, if short-term memory is a gateway to long-term memory, we must change our conception of short-term memory to accommodate the observations that information in long-term memory appears to be represented in a variety of formats, such as acoustic, visual and enactive.

Multiple store models have also been criticized for not capturing important memory phenomena, such as false and incomplete memories. Although these models have inspired ingenious laboratory experiments, researchers concerned with observing memory phenomena in "real life" have questioned the usefulness of storage-inspired research. Neisser (1967), for example, proposed a different metaphor to account for everyday memory.

Memory as archaeology

The store metaphor has not reigned alone. A metaphor covering other aspects of memory was developed by Bartlett (1932), who observed that episodes are remembered in terms of common, culturally shared knowledge. This common knowledge, Bartlett believed, had a structure similar to schemata. The basic assumption of the metaphor is that remembering is a reconstruction of memories from available information rather than a verbatim reproduction of the contents of memory. The assumption is that from the memory of a general theme plus a few memory details we reconstruct the event, much like a story that has been told. "Schema refers to an active organization of past reactions or of past experiences, which must be supposed

to be operating in any well-adapted organic response" (Bartlett, 1932, p. 213).

Neisser subsequently adopted the constructionist view, suggesting that remembering ". . . likens the constructive work of a palaeontologist who uses a small set of bone fragments as well as general knowledge about dinosaurs and other similar animals in order to reconstruct and piece together the skeleton: out of a few bone chips, we remember the dinosaur" (Neisser, 1967, p. 285), and more recently Schacter consider the constructive view of memory to provide a useful framework for conceptualizing a variety of phenomena observed in the study of memory intrusions and memory distortions (Schacter, 1996, 2001; Schacter, Norman, & Koutstaal, 1998).

Archaeology is the study of the cultural past. From pieces and fragments the archaeologist reconstructs old cultural constructions. The past is thus regained (cf. Proust, 1932/1938). In analogy, the study of memory might be conceived as an attempt to reconstruct a person's individual memories, with remembering viewed as a process of reconstruction, like putting together a whole picture based on a few pieces. This process entails "filling in" of the missing parts, a process well known in perceptual processing (Spillmann & De Weerd, 2003; Spillmann, Otte, Hamburger & Magnussen, 2006). The implications of the archaeology metaphor, then, are that memory traces are incomplete as opposed to the "all-in-one" structure of the store model. Remembering is a process where memories are constructed rather than found or selected. To remember is a question of the fit between an event and what is remembered (Koriat & Goldsmith, 1996a).

Memory as perception

A third metaphor proposed as an alternative to the store model is the depth of processing model (Craik & Lockhart, 1972). Within this framework, memory is regarded as a product of perceptual processing. Rather than assuming different stores processing different kinds of information, Craik and Lockhart suggested that it is the level of information processing that characterizes memories. Preliminary, shallow levels deal with sensory and physical properties and pattern recognition, while deep levels of processing deal with meaning and more elaborate processing. Craik and Lockhart argued that this model was a literal interpretation compared to the metaphorical store model. However, the model can be easily understood in terms of metaphors of orientation or metaphors of trace strength. Like items being embedded on a riverbank leaving traces, levels of processing can be seen as more or less "deep" imprints of the items to be remembered. At this point a few comments on the metaphorical aspects of the trace concept are appropriate. Although memory researchers at times refer to "memory traces" as if they should be observable entities, the concept of a memory trace was introduced as a hypothetical construct, as a metaphor of a memory's material substrate. No one has ever observed a memory trace, and perhaps never will,

despite the impressive advances of modern brain imaging, Thus, there is some dissatisfaction with the concept of a "memory trace", particularly when it implies a "full-blown entity" (see below).

The correspondence metaphor

Koriat and Goldsmith (1996b) pointed out that the storehouse metaphor invites an interest in the number of stored items. An effective store is one that can contain many items, that can retain these items for long periods of time, and that allows easy access to the stored items. Memory, then is evaluated in terms of its *quantity* – how much is retained, how much is lost. Quantitative aspects of memory are frequently of great interest in everyday life but often, in forensic contexts, the focus is on accuracy. When people disagree on questions of memory, it is frequently a question of nuances: was her dress green or blue, was the party arranged in the beginning, in the middle or at the end of which month. A high-quality memory is more faithful to the remembered event than an inferior memory is. However, sometimes people remember events that never happened (see Chapter 7). The assessment of memory correspondence should therefore start with the output – what the person reports – rather than with the input – what actually happened. An output-bound assessment reflects the accuracy of what is remembered – how much of what the person reports did in fact occur. Indeed, in many real-life situations, such as in court, there is greater concern with the accuracy of the report than with the amount of information reported.

The value of memory metaphors

There is no way to prove a metaphor wrong or right. Metaphors are conceptual tools that help us to understand phenomena in a more or less appropriate way (see Koriat & Goldsmith, 1996b). They provide conceptual frameworks within which memory phenomena can be analysed and explained. Metaphors highlight some aspects of a phenomenon and hide others. Thus scientific research may be guided by metaphors, but may miss important attributes of a phenomenon. Both the multiple store metaphor and the archaeology metaphor capture important aspects of memory. The store metaphor has guided laboratory research whereas the archaeology metaphor survives in the context of everyday memory. The two types of metaphor reflect fundamentally different ways of thinking about memory. As Koriat and Goldsmith (1996b, pp. 186) argue, "even if agreement could be reached about the memory phenomena that ought to be studied, the experimental procedures, and the appropriate context of enquiry, the two metaphors would still imply different perspectives for looking at and interpreting the data". However, nothing prevents us from being inspired by more than one metaphor; each metaphor has its own advantages and its focus of convenience.

WHAT PEOPLE BELIEVE ABOUT MEMORY

So far we have discussed the metaphors of memory that seem to be used in everyday communication about memory. These metaphors capture some of the beliefs that people hold about the working of memory. We turn next to an examination of some of the specific beliefs that people have about memory. These beliefs concern questions such as whether children's memories are less trustworthy than those of adults, the old-age impairment in memory, and why we forget. Beliefs are important because they govern social behaviour, explicitly or implicitly (Fazio & Olson, 2003; Ferguson & Bargh, 2004), and the ideas people have about memory guide their judgments and evaluations in many circumstances. Memory researchers have studied such questions for more than a century. To what degree have the results of scientific research been incorporated into the psychological folklore? Do people typically nurture ideas about memory that conflict with the current knowledge, or do they have scientifically realistic ideas about memory?

To obtain some tentative answers to these questions, the authors of the present volume carried out a nationwide telephone survey, asking three representative samples of 1000 adult Norwegians a set of general questions about memory (Magnussen et al., 2006). In selecting questions for study, the authors drew on their personal experience as memory researchers regarding the type of questions they had been asked by news media, the popular media and by individuals in informal settings.

The questions that were included in the survey are those that have been addressed in various chapters of this book. For some of the questions, science has a reasonably good answer, for some we have a tentative answer, and for some we still do not have an answer, although the individual researcher may express definite opinions. When people talk about memory, they usually refer to episodic and semantic memory; the recollection of the things they have learned and the experiences they have had. In the survey we avoided complicating the issue by calling people's attention to the various forms of memory that scientific taxonomies define, but accepted the assumption that memory is simply what people believe it is.

Table 1.1 lists some of the questions included in the survey (Magnussen et al., 2006). The first two are questions that memory experts are frequently asked privately and by the public media. First: Do you think it is possible to train memory? Weekly magazines frequently publish articles on memory enhancing techniques – how to improve your memory. Most of these rephrase the various mnemonic techniques, but sometimes the mnemonic techniques are presented as suitable for overall memory improvements. The scientific literature on memory expertise indicates that superior memory of experts in the various fields, such as chess and sports, is limited to domain-relevant information and does not carry over to other fields (Kimball & Holyak, 2000; see also Chapter 9). Thus scientists would tend to answer that memory cannot be trained in this way. However, when we probed this "muscle" concept of

Table 1.1 Some of the questions included in the survey

Question	*Response %*				
	A	*B*	*C*	*D*	*E*
Physical exercise makes the body stronger. Do you think it is possible to train memory in an analogous fashion? (a) Yes (b) No	94	4			
Most people receive large amounts of new information each day. Do you think there is a limit to the amount of information the brain is able to remember? (a) Yes (b) No	69	26			
Why do we forget? (a) Memory fades like tracks in snow (b) Memory capacity is limited and old memories are pushed out (c) New memories block old memories	31	9	38		
When small children tell about events they have experienced, do you think they remember better, as well as, or worse than adults? (a) Better (b) As well as (c) Worse	38	37	18		
Many people tell about memories from early childhood years. How far back in time do you believe people can remember? (a) 1 yr (b) 2 yr (c) 3 yr (d) 4 yr (e) 5 yr >	4	14	29	21	29
It is generally believed that the memory gets worse with age. When do you think the decline starts? (a) < 30 yr (b) 30–50 yr (c) 50–60 yr (d) 60–70 yr (e) > 70 yr	19	35	19	12	3
Sometimes people become witnesses to dramatic events. Do you think the memory for such events is (a) worse, (b) as good as or (c) better compared to the memory for everyday events?	70	12	11		
Sometimes people who have committed murder claim to have no memory for the crime. Do you think such memories can be repressed and (a) that the perpetrators are telling the truth, or (b) do you think they are lying?	39	45			

Notes
The table is based on data reported by Magnussen et al. (2006). Note that the percentages do not add up to 100; the missing value is the "uncertain" category.

memory, the results showed that an overwhelming majority of the participants believed that memory capacity can be trained in this way, and only 2% were sceptical.

Closely linked with the idea of memory exercising is the question of whether long-term memory has a limited storage capacity or whether it is limitless. This question specifically hinted at the storehouse metaphor of long-term memory (Koriat & Goldsmith, 1996b; Koriat, Goldsmith & Pansky, 2000), illustrated by the textbook anecdote of the professor of ornithology who stopped learning the names of his students because each time he learned the name of a student, he forgot the name of a bird. However, memory

science is not aware of any limit to the amount of information the brain is able to store and retrieve; we do not know how many memories each of us have stored. Most classical papers on the memory for large amounts of information suggest that human long-term memory is virtually limitless (Landauer, 1986; Standing, 1973), and the wide distribution of memory-activated neural circuits in the brain (Cabeza & Nyberg, 2000), together with the evidence that the brain is continuously forming new synapses and even growing new neurons (Gould, Reeves, Graziano, & Gross, 1999), suggest a system that might be expanding according to need. Whatever memory researchers believe, the results of the survey show that two thirds of the respondents believed there is a limit to memory, with a substantial minority disagreeing (Table 1.1).

If memory capacity is limited, is this the reason why we forget? We gave a third sample of participants three alternatives, illustrating theoretical explanations of forgetting, that are well known to memory researchers: first, memories fade like ski tracks in snow (in Norway everybody practises winter sports and cross-country skiing); second, memory capacity is limited and old memories are pushed out of the store; and third, memories do not disappear but new memories block the retrieval of old memories. A large minority of the respondents could not decide. The remaining respondents were divided between the fading and interference explanations, with a very small minority believing in the limited storehouse space explanation (Table 1.1). Thus, it appears that even if the majority of respondents believed in a limited storage capacity of memory, this is not believed to be the main cause of forgetting. Perhaps the answer to the capacity question may be based on a more philosophical approach to the question – for example, the brain contains a limited number of neurons – rather than on a belief in what are the limiting factors to one's own memory.

How does memory change across the life span? This is one of the main topics in current memory research, and the basic facts about the development, maintenance and decline of the various memory systems are now fairly well known (see also Chapters 5 and 12). We asked our respondents four questions. First, what do you believe about the memory of small children as compared with the memory of adults? The scientific evidence is quite clear: The memory reports of children at the age of 3–6 years are basically correct if children are questioned properly, but contain fewer details than do the stories of older children and adults (Fivush, 2002; Peterson, 2002; see Chapter 5). On this question, the public does not agree with science. A large majority believed that small children's memory is at least as good as the memory of adults, and close to 40% of the respondents even thought it was better. This is an interesting result, given most parents' experience that small children do not remember much of what has happened in kindergarten, and if asked, the answer is often "we played". Perhaps the belief in children's memory skills derives from our selective memory of the infrequent episodes where the child displays an extraordinary good recollection of a detail of a long-forgotten

event; it is perhaps the surprising memory performance that we remember rather than the daily sketchy stories from the classroom (Magnussen et al., 2006).

How well do adults remember their own early childhood? The concept of childhood amnesia refers to the inability of adults to remember anything from the early years of life, usually before 3 years of age, depending upon their language capabilities at the time (Simcock & Hayne, 2002; see also Chapter 5). Each of us may nonetheless possess a grey zone with memory glimpses and vague images before genuine episodic memories emerge (Peterson, 2002). Rubin (2000) has published a meta-analysis indicating that a very small proportion of memories can be dated back to the second year of life, and that there is a steady growth in the proportion of memories from that time on. This curve is independent of the age of the informant, which indicates that it is not the time factor in storage – the age of the memory – that determines the fate of early memories. If the beliefs in early memories are influenced by the informant's own childhood memories, they should conform to the empirically established findings – which they did. Very few respondents (1%) believed it was possible to have memories from birth on, and only a few more believed that it was possible to have memories from the first year of life. In fact, the general public is more conservative than science, as more than 50% of the participants believed that no memories were available before the age of 4 years. This might be a little surprising, given the frequent reports about age regression in the popular media and the current popularity of various regression exercises offered in courses, seminars and non-professional therapies. Obviously, the overwhelming majority of the readers and listeners remain soundly unconvinced by such claims.

Episodic memory is most vulnerable in older age. This is the target of many jokes among adults when something has slipped from the mind. Obviously, the expected memory decline is an important part of the adult self-concept. We asked 1000 persons to judge their own memory performance during the last 5 years – whether it had become better or worse – and another 1000 participants to tell us at what age they believed memory started to decline. The results showed interesting discrepancies between the rating of their own memory, the general belief in time of memory decline, and the objective finding from large-scale studies on memory changes in the adult lifespan (Hedden & Gabrieli, 2004; Nilsson, 2003; see also Chapter 12). People have an unduly pessimistic view of their own memory. More than 40% of the respondents aged between 18–29 years reported that their memory had declined, a similar proportion of respondents between 30–44 years reported a decline, and this figure rose to 50% for participants aged 45–59 years and to more than 60% for participants above 70 years of age. However, when a similar sample of respondents were asked when they thought age decline stared, only 6% believed it started before 30 years of age, and more than 50% of the participants, independent of their own age, believed it started after 50 years (Table 1.1). The results of empirical research suggest that the general

change in performance on episodic and semantic memory would not be noticeable until after that age. When healthy young to middle-aged people claim to have memory problems, it must be due to misattribution of the normal memory problems all people have, rather than genuine age changes, but probably inspired by the well-known fact that memory declines as a result of old-age degenerative brain diseases, and that memory problems are an early sign of such diseases (Hedden & Gabrieli, 2004; Nilsson, 2003).

On September 10, 2003, the Swedish foreign minister Anna Lindh was stabbed to death in a shopping mall in Stockholm in front of many people. How well will these witnesses remember this tragic and dramatic event later? How well do victims and witnesses to crimes, natural disasters and war remember the events they witnessed? This is a question of the relationship between emotional activation and memory: whether emotional events are remembered better or worse than ordinary events. In the history of science, two positions have been defended by philosophers and psychologists: Emotional memories were strong and vivid, "clinging to the mind" (Augustine, William James) or repressed from conscious recollection (Schopenhauer, Freud), in whole or in part (Porter & Birt, 2001). From a lay point of view, the answer is not obvious. For example, it might be argued that such events are frequently fast moving and that observations are therefore unreliable, or that the drama of the event would lead to emotional activation that might interfere with or block observational capacities and memory encoding. Therefore, the memories of emotional, dramatic events might be dim. Or it might be argued that such memories are so frightening that they are denied access to consciousness. In the terms of psychoanalysis, they become repressed. However, it might also be argued, as many memory researchers do, that emotional activation might act to focus attention and facilitate encoding of attended details, which would lead to enhanced memory for some aspects of the event at the expense of other aspects (Christianson, 1992; Ochsner & Schacter, 2000). This would lead to objectively superior memory for some aspects of the emotional event, and probably a subjectively vivid memory. Both of these aspects of memory might be further reinforced by frequent rehearsal of the event.

The experimental evidence tends to support the latter position. Studies in the flashbulb memory tradition show that memory for dramatic events is as good as, or better than, memory for ordinary events (Christianson & Engelberg, 2003; Talarico & Rubin, 2003), but is subject to similar distortions. Several studies of memory for war experiences, natural disasters and accidents (McNally, 2003) confirm this. The results of the survey show that two thirds of the respondents agreed with scientists who hold emotional memory to be better, whereas only every tenth respondent answered "worse" on the simple question whether dramatic events were remembered better or worse than non-dramatic events. We also asked, of two different samples of 1000 persons each, questions that were directly aimed at probing the idea that frightening events might be repressed. One question stated that people who

have had frightening and dramatic experiences sometimes claim memory loss, and asked the participants to indicate whether they believe that such loss is genuine. The second question specifically mentioned the example of the self-reported amnesic murderer – between 25 and 70% of persons committing violent murders claim to have no memory for the event (Christianson & Merckelbach, 2004; Parkin, 1997) – and asked whether the participants believed that such memory loss was real or faked (Table 1.1). On these specific questions the participants were more divided. A sizeable minority of about 15% in both samples refused to take sides on the issue, and the remaining participants were split. A closer analysis of the data revealed an interesting pattern, namely that the belief in genuine memory loss increased with the number of years of formal education. On the more general question of amnesia for dramatic events, about 30% of the respondents with elementary school education believed in the memory loss explanation compared to 46% of the respondents with a college or university degree. On the question of the amnesic murderer, only 20% of the low-education participants believed they spoke the truth, whereas 45% of respondents with a university degree expressed the belief that the amnesia was genuine (Magnussen et al., 2006).

The idea that traumatic memories are blocked from consciousness can be traced to the psychoanalytic concept of repression, originally formulated to explain the blocking of painful childhood memories from conscious recollection. However, in the psychological folklore this notion has been expanded and applied to the apparent forgetting of adult traumatic experiences such as having committed violent crimes. Psychoanalytically inspired thinking has been absorbed by society, especially by intellectuals, but detached from its theoretical basis and diluted. In Norwegian daily language, the concept of repression has become almost synonymous with forgetting but with special reference to unpleasant memories, such as remembering an appointment with the dentist. So the idea that extremely unpleasant memories can be completely blocked is readily available. The finding that the proportion of participants accepting the idea of repression increased with years of formal education is an indication that the belief derives from intellectual theory rather than from folk psychology. However, the ideas of folk psychology are consistent with science. The concept of repression has been difficult to support empirically (see, for example, Schacter, 2001; Tulving & Craik, 2000), as it does not stand the test of relevant real-life studies of traumatized individuals (Goodman et al. 2003 McNally, 2003). Indeed, trauma-induced psychogenic amnesia is extremely rare, if it exists at all (Christianson & Merckelbach, 2004; Kihlstrom & Schacter, 2000). Rather, studies of war veterans, some of whom may themselves have committed gruesome acts, and of victims to such acts, point in the opposite direction: These memories persist all too well (McNally, 2003).

The wisdom of everyday psychology

In general, the results of the present survey indicate that beliefs about memory among non-scientists in a Western European country are in good agreement in many respects with the findings of normal memory science, but in other respects the beliefs of the public deviate from current scientific knowledge, sometimes in ways that have implications for the interpretation of daily events. The reason for the shared opinions might be found, at least partly, to reflect shared memory metaphors. Where disagreements show up, scientists may have developed, or be on their way to developing, new or revised metaphors (see Chapter 13 for an example). These metaphors need not be more precise; they may leave space for different interpretations and beliefs, as we saw, for example, in connection with the memory training question in our survey.

In this chapter we have argued that memory science is heavily influenced by metaphorical thinking. Everyday memory conceptions are similarly saturated by metaphors. These metaphors help guide our thinking about memory. Although there are certain differences between the metaphors that are common in everyday conversations and those that are implicit in the scientific literature, both types of metaphors reflect accumulated knowledge about memory. What is clear is that each metaphor captures only some aspect of the phenomena of memory, neglecting others. Because metaphors are vehicles of thought that help us think about the phenomena, their worth depends entirely on their utility. There is no objection to entertaining a variety of metaphors in order to capture the richness of memory phenomena. In the spirit of Koriat and Goldsmith's (1996b) plea for "metaphorical pluarism", this book attempts to combine metaphors from both the scientific study of memory and everyday conceptions.

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Edited by

SVEIN MAGNUSSEN

and TORE HELSTRUP

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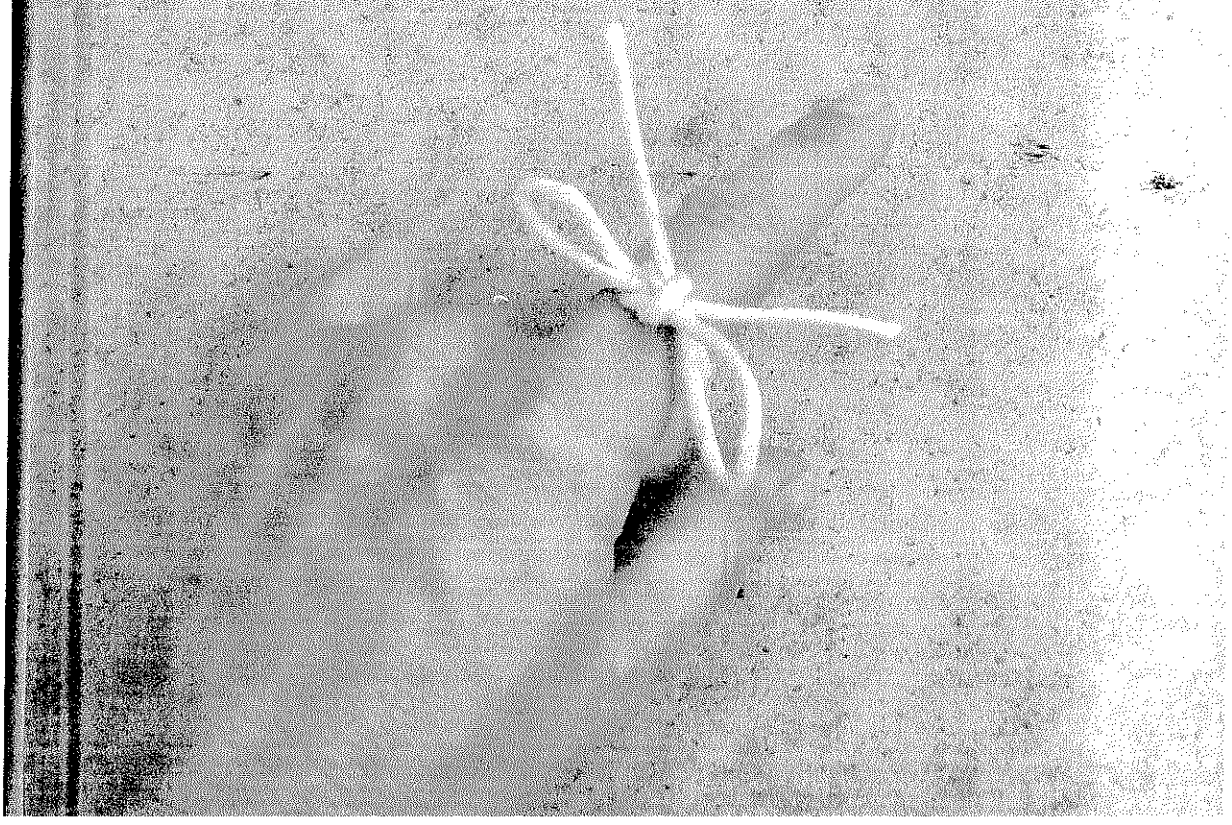

First published 2007 by Psychology Press
27 Church Road, Hove, East Sussex, BN3 2FA

Simultaneously published in the USA and Canada
by Psychology Press
270 Madison Avenue, New York, NY 10016

Psychology Press is an imprint of the Taylor & Francis Group, an informa business

Typeset in Times by RefineCatch Limited, Bungay, Suffolk
Printed and bound in Great Britain by
MPG Books Ltd, Bodmin, Cornwall
Cover design by Lisa Dynan

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data
Everyday memory / edited by Svein Magnussen and Tore Helstrup.
p. cm.
ISBN 1-84169-579-3 (hardback)
1. Memory. I. Magnussen, Svein. II. Helstrup, Tore.
BF371.E838 2007
153.1'2-dc22

2006017755

ISBN 978-1-84169-579-2

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Psychology Press