

CHAPTER FOUR

The Structure of Autobiographical Memory

Martin A. Conway

Department of Psychology, Lancaster University, UK

David C. Rubin

Department of Psychology, Duke University, USA

INTRODUCTION

Autobiographical memory is memory for the events of one's life. Autobiographical memory is attractive to memory researchers because it constitutes a major crossroads in human cognition where considerations relating to the self, emotion, goals, and personal meanings, all intersect. Another, more tangible, pragmatic, and equally attractive attribute of autobiographical memory is that recent research has demonstrated that effective investigations of this type of memory can be undertaken using current research methods—for a sample of current methods and theoretical thinking, see the papers collected in Rubin (1986), Conway, Rubin, Spinnler, and Wagenaar, (1992), and for an overview of the area, see Conway (1990a). In this chapter we will review some of these recent investigations and consider the implications for autobiographical memory. At the same time we will also indicate how current research bears upon the larger issue of the role of autobiographical memories in human cognition more generally.

The chapter is loosely divided into four sections. In the first section we review research that has focused on the nature and structure of autobiographical knowledge. Towards the close of this section we also consider how retrieval processes operate on the autobiographical knowledge base and what role the self might play in retrieval. The second section provides a detailed review of autobiographical memory

retrieval across the lifespan, in which we consider the contribution of recent investigations to an evolving explanation for the pattern of lifespan memory retrieval. In the third section we provide an overview of some of the major findings to emerge from investigations of the breakdown of autobiographical memory in neuropsychological and psychopathological disorders. Finally, we summarise the central findings in the study of autobiographical memory and consider areas in which future developments are likely to occur.

STRUCTURE OF THE AUTOBIOGRAPHICAL KNOWLEDGE BASE

A striking feature of autobiographical memory that has emerged from a number of independently conducted research programmes is that autobiographical memory is highly structured and that within this structure there is no specific type of knowledge which can be easily singled out as being *a memory*. Rather, memories are compilations, constructions, or compositions of knowledge. Researchers have identified three levels of structure that appear to contribute to the construction of memories and we shall refer to these as *lifetime periods*, *general events*, and *event specific knowledge* and collectively as the *autobiographical knowledge base*.¹

The term "lifetime periods" was used by Conway and Bekerian (1987) to refer to extended periods in a person's autobiography such as *when I lived with "X"*, *when I worked at "Y"*, *when I was at secondary school*, and so forth. Conway and Bekerian (1987) found that lifetime periods were far more effective cues to memory retrieval than a range of other types of cues and that lifetime periods constituted effective primes for memory retrieval. Lifetime periods, however, have been independently identified, discussed, and variously labelled by other researchers: Linton (1986) in her diary study of her own memory identified what she called *extenditures*; Barsalou (1988) in content analyses of freely recalled autobiographical knowledge observed what he termed *extended-event time lines*; and Schooler and Herrmann (1992), who refer to lifetime periods as *periods*, found that they were effective in the production of generalised autobiographical knowledge and that independent judges could accurately identify this level of structure in recall protocols. These independently conducted research programmes converge on the view that lifetime periods represent an abstract or general level of autobiographical knowledge that primarily contains *thematic knowledge* relating to specific time periods (cf. Conway, 1992).

A lifetime period may also contain general knowledge of significant others associated with the time period (Conway, 1992), moods (Linton,

1986), goals (Barsalou, 1988), and may represent major thematic divisions of a person's life (e.g. into husband, father, psychologist, football player, etc.). Relating to this latter point Conway and Bekerian (1987) found that lifetime periods often overlapped in terms of the chronological period to which they referred so that, for example, *when I lived with "X"* might refer to the same time period or might overlap with *when I worked at "Y"* but the two lifetime periods represent different constellations of themes, others, emotions, and goals and index different portions of the autobiographical knowledge base (see also, Brown, Shevell, & Rips, 1986 for a compelling demonstration of how different lifetime periods that cover *exactly* the same time period provide differential access to the autobiographical knowledge base).

In contrast to lifetime periods, general events constitute a more specific level of autobiographical knowledge. General events take the form of summaries of repeated events such as *evening hikes to meadows* (Barsalou, 1988) and extended events such as *holiday in Italy* (Conway & Bekerian, 1987). General events, like lifetime periods, have been independently investigated by Conway and Bekerian (1987) who use the term general events, Barsalou (1988) who refers to the class as *summarised events*, Linton (1986) who refers to them as *episodes and events*, and Schooler and Herrmann who refer to general events as *episodes*. It should also be noted that this level of structure has been independently identified and investigated by J.M.G. Williams and his colleagues in studies of memory retrieval in clinically depressed patients (e.g. Williams & Broadbent, 1986; Williams & Dritschel, 1988, 1992; Williams & Scott, 1988), and this work is considered in detail in a later section.

Although a number of researchers have all identified the general event level of autobiographical knowledge there have been surprisingly few investigations directly concerned with the nature of general events. However, in a series of studies Reiser and his colleagues (Reiser, Black, & Abelson, 1985; Reiser, Black, & Kalamarides, 1986) explored the contextual nature of general events. The main finding from these studies was that general events may be organised around contextualising actions that provide access to other less contextually distinct general event-knowledge. For example, Reiser et al. (1985) found that memory retrieval to compound cues naming contextualised actions (e.g. *going to the cinema*) and general actions (e.g. *finding a seat*), was faster when the cues were presented in the order contextual action then general action, than in the reverse of this order.

Recently, Anderson and Conway (in press) reported a series of studies that attempted to examine the role of distinctive knowledge and temporal knowledge in general event organisation. These authors

contrasted a range of different recall conditions in which subjects were asked to output knowledge from remembered events according to various recall schedules such as free recall, forward recall (from first to last action sequence in the event), backward recall (from last to first detail), centrality recall (from most to least central detail), and "interest" recall (from the details that a friend would find most interesting to the details that the friend would find least interesting). The main finding was that the free recall and forward recall conditions provided fastest access to general event knowledge with a slight but reliable advantage of free recall over forward recall. Further investigations of the order of details in free recall found that details were not output in *strict* chronological order, but rather that the first few memory details to be listed were often associated with the most distinctive detail in the memory, and that subsequent details were output in a loose chronological order. In other cued retrieval time studies Anderson and Conway found that distinctive details provided fastest access to knowledge contained in general events. These findings suggest that general events are organised in terms of contextualising distinctive details that distinguish one general event from another, and which also represent the theme or themes of a general event. However, this thematic organisation is also supplemented by temporal organisation, and the order in which action sequences occurred is, at least partly, preserved in general events.

Related findings have recently been described by Robinson (1992) in a fascinating study of "first experiences memories" (FEMs). In this study Robinson examined memories for extended first time experiences such as *learning to drive* and *first romantic relationship*. As far as organisation of general events is concerned his main findings were that FEMs are like mini-histories, which represent records of goal attainment and the emergence of personally relevant themes relating to goal-attainment. It was found that FEMs were structured around general events for initiating events, "benchmark" general events directly associated with the goals of the FEM, and general events for culminating events representing the outcomes of the goal-attainment process of the FEM and the significance of these outcomes for the self. Thus, FEMs like the general events studied by Anderson and Conway (in press) are organised by both themes and chronology.

One final point about general events relates to their ubiquity in autobiographical recall. For example in the work of Schank (1982; 1986) general events are the level of autobiographical knowledge at which subjects are "reminded" of other thematically related general events and such reminders may play a central role in certain types of problem solving (see, for example, the papers collected in Kolodner & Riesbeck,

1986). Moreover, general events make up by far the most frequent type of autobiographical knowledge present in relatively unconstrained retrieval tasks (cf. Williams & Hollan, 1981). Conway (1992) proposed that general events may represent a *basic level* (see Rosch, 1978) in autobiographical knowledge. That is the preferred level of knowledge retrieval and a level at which autobiographical knowledge is maximised in terms of event specificity—general event knowledge is neither too abstract or general, as is lifetime period knowledge, nor is it too specific and overly detailed as is event specific knowledge (to be considered next). Thus, autobiographical knowledge at the level of general events may be maximally informative for many tasks in which autobiographical knowledge features. This is not to deny, however, that knowledge of specific events may predominate in certain contexts. For instance, in informal discourse people do not relate general events to one another. Instead, everyday conversations typically feature highly specific event knowledge. Our claim is that such specific knowledge is constructed into a “memory” in the context of associated lifetime period and general event knowledge, and we will return to this point later.

The third layer of autobiographical knowledge—event specific knowledge—is far more detailed than knowledge at the lifetime period and general event levels. Event specific knowledge tends to take the form of images, feelings, and highly specific details indicating the retention of sensory details of objects and actions in a general event. A good example of event specific knowledge can be found in the work of B.H. Ross (1984), who investigated transfer of learning in the acquisition of word processing skills. In Ross's study, subjects in an initial training session practised elementary word processing skills such as deleting a word using a particular sequence of key-strokes. In subsequent acquisition sessions subjects might, for example, be required to delete a different word using the same sequence of key-strokes. Ross found that in the early phases of training subjects were frequently reminded of words that they had previously edited. These reminders occurred when a similar editing operation was performed, e.g. deletion, and subjects would spontaneously recall the *exact* word that had been previously edited and often commented that the current word should be edited in the same way as the word from the earlier training session.

In a large scale study in which subjects recorded ongoing events in their daily lives in response to a randomly timed signal, Brewer (1988) found that recall of sensory details was closely associated with accurate recall. In this study subjects also judged how well their recall approximated to the actual sensory experience of the event, and in the case of highly accurate recall, sensory re-experience (especially for the

visual and auditory modalities) was judged to approximate closely to the actual experience. In a related study, Johnson, Foley, Suengas, and Raye (1988) found that subjects' ratings for a range of characteristics of an event that they had actually experienced versus an event that they had only thought about were distinguished by the greater extent of perceptual knowledge pertaining to the experienced as opposed to the imagined event.

Finally, Anderson and Conway (in prep.) investigated the amount, organisation, and nature of knowledge subjects were able to retrieve for each of the details listed in a general event. For example, one subject recalled the action sequences from his memory of a trip to another town to play in an important college football (soccer) game. Subsequent recall of the details associated with the action sequence found that details were only retrieved to a few of the action sequences, and typically (but not always) these were the distinctive actions of the event. This pattern was present for all of our subjects and, interestingly, details were not usually listed in any identifiable chronological order, but rather appeared to be "read off" knowledge fragments containing specific sensory-perceptual information. Indeed, the majority of our subjects claimed to recall one or more images when listing details of action sequences from general events and, possibly, such images might be taken as further evidence for the analogical nature of event specific knowledge.

Further evidence for event specific knowledge is reviewed by Conway (1992), who argues that such knowledge might be thought of as summary records of on-line processing structured around the contents of on-going phenomenal experience. This author speculates that discrete records are created each time the contents of on-going phenomenal experience change, and that records are preserved in memory if they are indexed by a general event, as will be described later. Other evidence for the retention of event specific knowledge sensory-perceptual details is directly discussed in the present volume in the chapters by Barsalou and Crowder. Barsalou in particular argues for a compositional view of concepts in which concepts are composed on-line from underlying schematic records of perceptual processing.

In this section we have outlined some of the evidence in support of the structure of the autobiographical memory knowledge base. The evidence suggests that there may be three layers of knowledge: lifetime periods represent knowledge about thematically distinct periods in a person's life and these periods typically span periods of years and decades; general events also represent thematic knowledge but this is localised to events with short time spans (such as first time experiences, and other extended and repeated events) and general events refer to time periods measured in days, weeks, and months; finally, event-

specific knowledge represents sensory-perceptual knowledge spanning periods of seconds, minutes, or hours, (cf. Neisser, 1986, for a highly related account of autobiographical knowledge).

Researchers have proposed (Barsalou, 1988; Conway & Bekerian, 1987; Conway, 1992) that each layer of autobiographical knowledge provides indices to other layers, so that knowledge in a particular lifetime period, e.g. *when I lived in city "X"*, provides indices to associated general events, e.g. *meeting friends at location "Y"*, which in turn contain, in the action sequences comprising the general event, indices to event specific knowledge. Across these layers of knowledge hierarchical knowledge structures can be constructed (Conway & Bekerian, 1987, refer to these as *Autobiographical Memory Organisations Packets* or A-MOPs, after Schank, 1982, and Kolodner, 1983) either on-line in the context of some processing task or, in certain cases, hierarchical knowledge structures may pre-exist in memory. Barsalou (1988) suggested that such hierarchical knowledge structures might take the form of hierarchical *partonomies* in which event specific knowledge is part of a general event, which in turn is part of a lifetime period, the most inclusive level in the hierarchy. Conway (1992) argues that thematic and temporal relatedness provide the main ways in which different levels of autobiographical knowledge become integrated into partonomic hierarchical knowledge structures.

This view of the structure of autobiographical memory has two main advantages. First of all the traditional notion of a discrete memory for an "event" or "episode" is preserved, in that existing hierarchies may retain, for example, frequently used indices and so allow a rememberer to "retrieve" a memory *as though* it were a discrete, differentiated, unitary representation. Secondly, and by way of contrast, the compositional nature of autobiographical knowledge also facilitates the construction of memories in which "forgotten" knowledge may once again be recalled, new interpretations can be placed on established memories, and the type of knowledge actually retrieved can be tailored to the needs of a particular task (as in "reminders"). Thus, the structural view of autobiographical memory (Conway, 1992) can accommodate both stability and flexibility in memory retrieval.²

CONSTRUCTING AUTOBIOGRAPHICAL MEMORIES

How is the autobiographical knowledge base sampled? One model, proposed by D.M. Williams and Hollan (1981), suggests that autobiographical memory is mediated by a process of *cyclic retrieval*. Cyclic retrieval features three identifiable phases: in the first phase a

memory description is developed from cues available in the specification of the retrieval task; in the second phase the memory description is used to search memory; and in the third phase outputs from the search phase are evaluated and a decision is made whether to terminate the search or to cycle through a further phase of retrieval. Subsequent retrievals follow on the elaboration of a new memory description based upon the outcome of the previous cycle.

Conway (1992) proposed that cyclic retrieval was mediated by the central executive component of working memory (Baddeley, 1986; Baddeley, this volume; Norman & Shallice, 1980; Shallice, 1988). The central executive component of working memory is thought to contain mechanisms that, among other things, regulate the access and output of knowledge from long-term memory. However, the central executive may also contain other components that facilitate the construction of temporary knowledge structures to be used in a processing task, such as memory descriptions (Norman & Bobrow, 1979). In particular the central executive may contain a *model* of the cognitive system (Johnson-Laird, 1983). Such a model, apart from containing metamemory knowledge and other high level knowledge concerning long-term memory, may also encompass a current model of the *self*. In this case the self is conceived of as some currently active set of goals, plans, knowledge, preferred ways of processing (Neisser, 1989), and perhaps a set of currently relevant possible selves (Markus & Nurius, 1986). According to this view, then, the current configuration of the self enters directly into the process of memory construction by influencing cyclic retrieval at the phases of memory description generation and evaluation of outputs from memory. In short, the current configuration of the self directly contributes to the building of a model of the retrieval task.

We do not suggest that *all* memory retrieval is initiated by a top-down memory search in which the parameters of the retrieval model are set by the current configuration of the self. It has often been observed that memories may "spontaneously" come to mind perhaps in response to a cue in the environment (see Salaman, 1970, for many illustrative examples), or in response to a cue word presented in the laboratory (see later section), or in response to the structure of a particular problem (Schank, 1982, 1986), or during the course of cognitive tasks that do not specifically require memory retrieval (Conway, 1990b, c; B.H. Ross, 1984). We do, however, suggest that if long-term memory output is monitored and regulated by a central executive, then the self may play a direct role in mediating experiences such as "spontaneous" rememberings and reminders. For instance, perhaps such reminders occur far more frequently than currently believed but are suppressed from attention and consciousness by the mediating effects of the central

executive on output from long-term memory. Conversely, the model of a task created by the central executive may be such that when highly associated autobiographical knowledge is activated and this activation reaches some criterion level in relation to the task-model, then a memory may be fully constructed and come into consciousness “spontaneously”.

According to these views, then, when a task requires memory retrieval the autobiographical memory knowledge base is sampled by the process of cyclic retrieval. In many cases a search may be initiated once a potentially productive lifetime period or set of lifetime periods has been identified. Consider, for example, a retrieval task in which a subject is asked to recall a memory to the cue word *cinema*. Assume that the subject is not a regular cinema attender and that the memory description phase elaborates the cue into *when did I go to the cinema a lot?* and that the current version of the self is able to provide the answer *when I was a student*. Thus, the parameter of the first search phase is set to *when I was a student*. This memory description can then be used to contact lifetime periods relating to the target time period and knowledge within these lifetime periods can be used to index associated general events, which in turn provide cues that index event specific knowledge. Perhaps, the initial cycle is set to terminate once general events have been accessed and a further phase of retrieval is initiated following an evaluation of the retrieved general event details (cf. the recall protocols in Williams & Hollan, 1981). The whole cycle is then terminated once appropriate lifetime period, general event, and event specific knowledge are represented in a temporary structure in working memory: a memory has been retrieved (see Conway, 1992, for a more detailed account of this process of cyclic retrieval, and Barsalou, 1988, and Kahneman & Miller, 1986, for related discussions.)

As mentioned earlier it seems that the autobiographical knowledge base is exquisitely sensitive to cues and it is, perhaps, not unreasonable to suppose that stable patterns of activation are constantly forming and dissipating within the knowledge base (Barsalou, 1988) while conscious recollection of memories is regulated by monitoring functions of a central processing resource such as the central executive of working memory. The labile nature of autobiographical knowledge to cues may facilitate very rapid memory retrieval, although it should be noted that consciously directed effortful retrieval typically takes anywhere between two and five seconds, on average, for a majority of subjects (see Conway, 1990a)—further suggesting the operation of a complex retrieval and evaluation process. Moreover, within-subject variation in memory retrieval time can be considerable and is especially marked when a difficult retrieval task is employed, further suggesting elaborate, effortful construction for some memories, compared to fast, effortless,

possibly automatic construction for other memories in the same subject. These variations may reflect the fact that the construction of some memories requires extended memory search and evaluation, whereas pre-existing indices in the autobiographical knowledge facilitate the rapid construction of others. Finally we note that a number of researchers have elegantly demonstrated the influence of the self on autobiographical remembering—Barclay and DeCooke (1988), Barclay and Subramaniam (1987), Barclay and Wellman (1986), Ross (1989), Ross and Conway (1986). Our claim is that in memory construction this influence operates primarily in the formation of a memory description and in the evaluation of outputs from memory.

THEMES

Autobiographical memory, then, involves issues relating to the self, personally relevant goals, and, ultimately, personal meanings. In our account of the autobiographical knowledge base and the process of memory construction some of these issues were discussed. However, a central feature of autobiographical knowledge is its thematic nature and themes in autobiographical memory are, inevitably, personal themes (Conway, 1990a, 1992). Although themes have been identified in much of the research reviewed in earlier sections, the nature and quality of themes in autobiographical memory remain to be investigated. Yet in other areas and research traditions, not usually considered the province of the cognitive memory researcher, themes and their role in autobiographical memory have received considerable attention.

Autobiographical knowledge and personal meanings have been most directly linked and most extensively studied in various psychoanalytical schools and the connection between memories, meanings, and themes is made most strongly in the work of Freud. Freud's thinking about memory generally and autobiographical memory in particular is spread throughout his extensive writings, although the paper *Remembering, repeating, and working-through* (1914) contains many of his main thoughts on memory (for an excellent recent review, which covers both Freudian and later psychoanalytic theories of memory, see B.M. Ross, 1991). Obviously we cannot attempt here to discuss even a small number of the memory mechanisms and processes that Freud introduced; however, the basic aim of Freudian therapy was to bring to consciousness memories of events and fantasies from childhood, which because of their affective qualities were not directly accessible to consciousness (see Nelson, this volume, for a cognitive account of "childhood amnesia"). Such memories were thought to be "screened" by other non-threatening memories and part of the psychoanalytic process

involved identifying screen memories and “piercing” the screen to gain access to the traumatic memories at the centre of a patient’s psychopathology. Now whether one agrees with Freudian theory or not, the point we wish to draw from Freud’s work and the many case studies he describes is that they clearly illustrate the formation of themes that link together whole sets of memories, sometimes across the lifespan. In Freud’s patients, the themes that join memories of other events are often affect laden and represent ways in which individuals protect themselves from (repress) memories of traumatic events.

The notion of themes in psychoanalysis was further developed by Kris (1956/1975), who in a series of case studies identified what he called the *personal myth*. Kris found that certain patients when routinely probed about their pasts were able to respond with detailed, fluent, and highly consistent autobiographies embracing all their past history. Now this is somewhat unusual because most people do not usually have ready access to a well worked out autobiography in which themes of different lifetime periods are highly consistent with one another and smoothly extend across the lifespan. During the process of analysis Kris determined that these personal myth autobiographies were in fact being employed as part of the process of repression to keep from consciousness other traumatic autobiographical knowledge. For example, in one of his cases he eventually discovered that the myth, which included the patient leaving home when 16 years old, was in fact incorrect and the patient had actually left home when 18 years of age. The missing two years, it later transpired, referred to a period in which a sequence of events had repeated (repressed) traumatic events from earlier in childhood and the myth, by editing out the memories of the repeated events, was able to maintain the repression.

Kris proposed that personal myths constitute a central part of the self but that in the nonpathological individual the myths are constantly changed and updated. However, there may be periods when changes to the personal myth are particularly marked, extensive, and far reaching. Indeed, Erikson (1978), in his account of ego identity, described just such a period of change, which he referred to as the *identity crisis of late adolescence*. During this period the self is in flux and the period ends with the emergence of a stable self concept. It seems that this period also entails the generation of new themes that link together autobiographical knowledge, the stabilisation of already existing themes, and the discarding of themes no longer relevant to the emerging self. As Kris (1956/1975) comments, this is the period when the person answers the question “how did it all come about?”. We also note that a similar period of revision of personal myth has often been reported as occurring later in life when individuals are in their 70s and the elderly frequently

describe having passed through periods of reminiscence in which they reviewed and "made sense of their past" (Butler, 1963; Coleman, 1986; see also Salaman, 1970).

The psychoanalytic tradition, then, constitutes a rich source of theory and data that bears upon the concept of "themes". Indeed we have covered only a very small sample of the relevant work, and other approaches drawn from different psychoanalytic schools have not been considered (see, for example, Barclay & Smith's, 1992, use of object-relations theory in building a model of "personal culture"). Other, non-psychoanalytic, approaches have also explicitly examined the role of themes in personal history. Most notably the humanistic psychologists Csikszentmihalyi and Beattie (1979) investigated what they termed *life themes*. Life themes arise in response to existential problems facing an individual during childhood—for example, grinding poverty. In their study Csikszentmihalyi and Beattie (1979) traced the development of life themes and identified individuals who in response to similar problems developed different life themes, e.g. *always have sufficient money* versus *understand the causes of poverty*. Life themes reflect conceptualisation of stressful existential problems and, also, the individual's solution to such problems, i.e. *get a steady job* versus *fight social inequality*. From our perspective the interesting finding of Csikszentmihalyi and Beattie (1979) was that all the individuals they interviewed spontaneously recalled many events directly related to their own life theme including many vivid memories of childhood experiences that had been central in the development of the theme.

Screen memories, personal myths, and life themes are, perhaps, mainly present in individuals who have experienced traumatic and stressful childhood events. Nevertheless they demonstrate the integrative role of themes in autobiographical knowledge. It may be that something akin to personal myth acts to unify different lifetime periods in nonpathological autobiographies and perhaps each lifetime period presents its own existential problems that give rise to the development of themes specific to that period. More generally the emergence of a stable self concept should have a marked influence on autobiographical remembering and, as we shall see in the next section, this influence may be most evident in the recall of events across the lifespan.

DISTRIBUTION OF AUTOBIOGRAPHICAL MEMORIES OVER THE LIFESPAN

The research reviewed thus far has focused on the nature and structure of the autobiographical knowledge base with a particular emphasis on autobiographical knowledge associated with identifiable time periods.

However, another approach to autobiographical memory rather than focusing on separate time periods from individual autobiographies examines the distribution of memories recalled across the whole lifespan. Many studies have now examined the pattern of lifespan recall, and the data arising from these studies are among the most fascinating in cognitive psychology because they are among the most regular and because they relate directly to so many theoretical issues.

Figure 4.1 presents 1373 memories of 70 adults sorted into the decades in which the individuals reported the remembered event to have occurred. The subjects, who were about 70 years old, were tested in three different laboratories under slightly different conditions (Fitzgerald & Lawrence, 1984; Franklin & Holding, 1977; Rubin, Wetzler, & Nebes, 1986). In all cases, however, they were asked to provide the autobiographical memory cued by each of between 20 and 50 words. On completing this they were asked to date each memory. Roughly half the memories produced by these subjects are not included in Fig. 4.1. These memories occurred within the most recent year of life and including them in the plot would have meant that the vertical axis would have to be expanded making the rest of the curve less visible. Similar curves were plotted for 40, 50, and 60 year olds based on data from the same three (Zola-Morgan, Cohen, & Squire, 1983) and one additional (Rubin et al., 1986) laboratory.

The curve is clearly non-monotonic. Before concentrating on the reminiscence bump that peaks in adolescence, the two extreme portions of the plot are examined. At the far left of the curve, are events that were dated as occurring in the first decade of life. If these events and others like them are examined in detail, then the phenomenon of *childhood amnesia* is seen. People recall little from the first five years or so of their life (Nelson, this volume; Wetzler & Sweeney, 1986) and none from before birth. In fitting curves to the distribution of memories like those given in Fig. 4.1 for subjects of different ages, a component is needed that has a value of zero at birth. It is possible when dealing with subjects of one age to use a term based on retention interval that will go to zero at birth, but when dealing with groups of subjects of many different ages this term has to change with age. Therefore, a childhood amnesia component is needed that is measured in time since birth, not retention interval.

At the far right of the curve, the first few points could follow a monotonic forgetting curve like those found in the laboratory. If this part of the curve is expanded a host of data sets show that events reported as coming from the most recent 20 years of one's life follow a power function forgetting curve that works well for laboratory situations (Anderson & Schooler, 1991; Rubin, 1982; in prep.; Rubin et al., 1986; Wixten & Ebbesen, 1991).

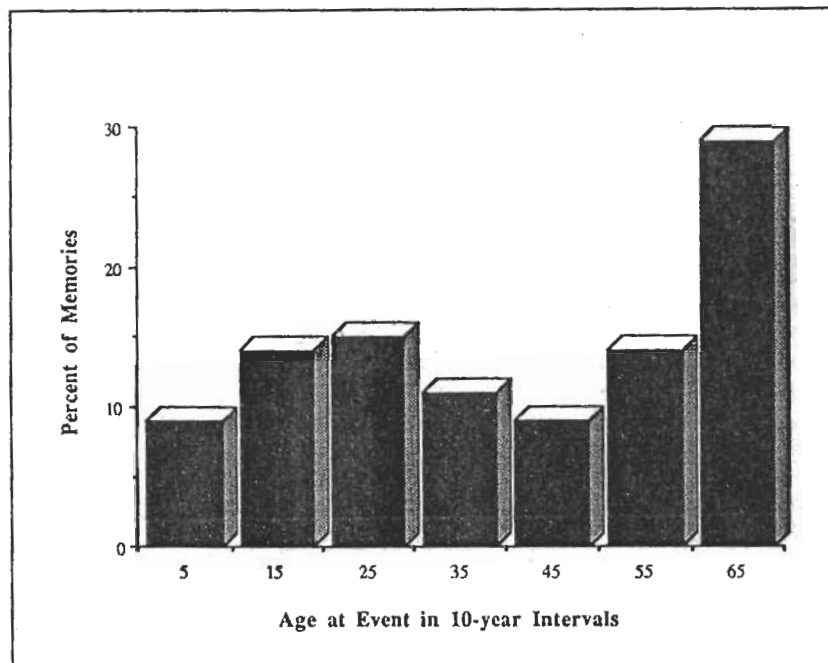


FIG. 4.1. Distribution of autobiographical memories over the lifespan, adapted from Rubin et al. (1986). Only memories older than one year are included in this histogram. For this and all the figures that follow, the vertical axis is normalized by using percent of memories. For this and all the figures that follow, the left side of the horizontal axis displays the oldest memories or events (i.e. those nearest to the subjects' birth) and the right side displays the subjects' most recent memories or events.

Now let us return to the reminiscence bump. Although this increased recall of events from adolescence has been a common report of older adults, it has only recently existed as a quantitative finding, first noted by Franklin and Holding (1977) and studied in more detail by Rubin et al. (1986). It is a robust finding in that it appeared in data from four laboratories, but more data and with it better interpretations now exist than in the Rubin et al. (1986) analysis.

Hyland and Ackerman (1988) reported a replication of these findings. Individuals ranging from 17 to 73 years old were cued with object nouns, activity verbs, and feeling terms from Robinson (1976). Subjects over 60 showed a clear reminiscence effect, which peaked in their teens and early twenties. Subjects in their fifties showed a possible reminiscence effect, whereas those in their forties had a nearly equal number of

memories from their teens, twenties, and thirties, with 80% of their reports falling in the most recent decade of life.

Rubin (1989) also offers a replication. He presented curves for two individual 70-year-old subjects who had been cued with 921 words over the course of several sessions, with dating afterwards, at the end of each session. Both subjects showed the reminiscence effect, but their plots show great individual differences. One subject had a peak in the decade between 11 and 20 years old, which contained over 200 memories, more memories than any other decade. The other subject had a peak in the decade between 21 and 30 years old, which contained less than 50 memories. In contrast, the most recent decade contained approximately 85% of the memories. Reminiscence was a real phenomenon in both cases, but for the first subject memories from the early years of life were better recalled, whereas the opposite was true of the other subject.

The most impressive and counter-intuitive finding comes from Fromholt and Larsen's recent studies (1991, 1992). Instead of cueing each memory with a single word as in the studies just reviewed, subjects were asked to spend 15 minutes recalling events that had been important in their lives. A more directly comparable instruction would have been to ask for events without specifying that they be important, but there are studies that used the cue word technique that also ask for important or vivid memories, so there are grounds for comparison. For instance, Rubin (1982) asked undergraduates for 50 memories from their life without giving any cues, but they were much younger and the request was for individual events rather than an extended recall. Thus, Fromholt and Larsen is the first such test of the reminiscence effect and demonstrates that its existence does not depend on the cueing technique or any details of its procedure (Rabbitt & Winthorpe, 1988).

Besides testing 30 normally functioning volunteers between the ages of 71 and 89, an age and education matched group of 30 Alzheimer's patients was tested. The control subjects recalled an average of 18 memories and the Alzheimer's patients an average of eight memories. The distributions of memories across the lifespan are presented in Fig. 4.2, using decade divisions on the horizontal axis and the same percent-of-memories vertical axis as were used in Fig. 4.1. Although the Alzheimer's patients recalled many fewer memories, the percent-of-memories measure ensures that the area under both curves is the same 100%, allowing the relative age of memories from the two groups to be easily compared.

The reminiscence effect occurs at the same place and shape as it does in Fig. 4.1 and in the other two studies just reviewed. The changes in procedure have increased the reminiscence component at the expense of memories from the most recent decade of life. In Fig. 4.2, all the data

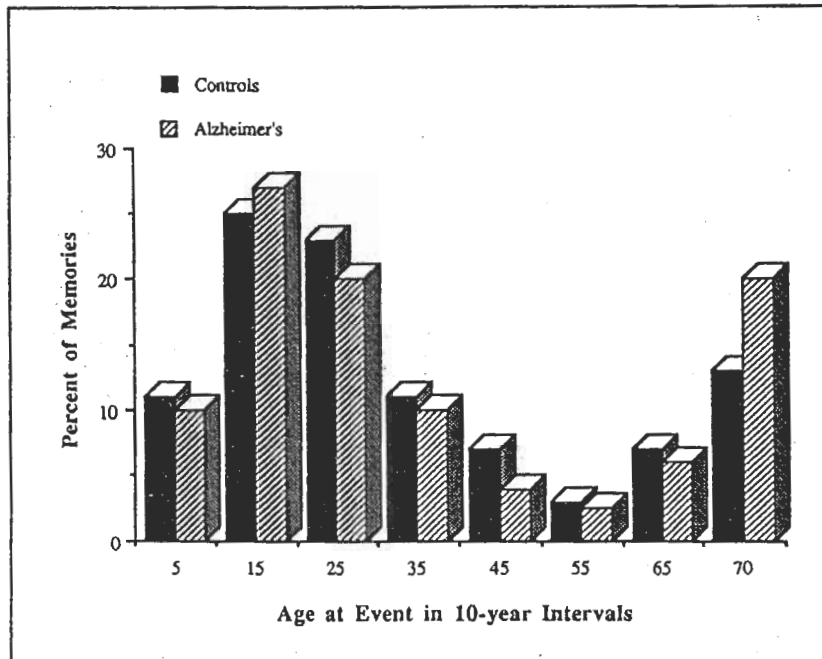


FIG. 4.2. Distribution of autobiographical memories over the lifespan, adapted from Fromholt & Larsen (1991, 1992).

are presented, but in Fig. 4.1, approximately half the memories are in the most recent years of life and thus are not shown on the plot, so this change is larger than is shown. From the work to be reviewed next, it appears that both the request for important memories and the change from word cues to the free narrative method contributed to this difference. More remarkable is that, although the Alzheimer's patients recalled far fewer memories, when the percentage of memories per decade is plotted they do not differ from their controls, except in the most recent decade. Thus counter to what might be expected from folklore or memory loss in other forms of amnesia (Butters & Cermak, 1986), there is no differential loss of recent memories noted in this study.

How are we to interpret the findings of the non-Alzheimer's patients? Fitzgerald (1988) compared the results of two studies he had performed. Both studies asked individuals with an average age of almost 70 to record autobiographical memories. In one study, the standard word-cue technique was used with 40 words; in the other, the subjects were asked for three vivid memories. Figure 4.3 shows the different distributions

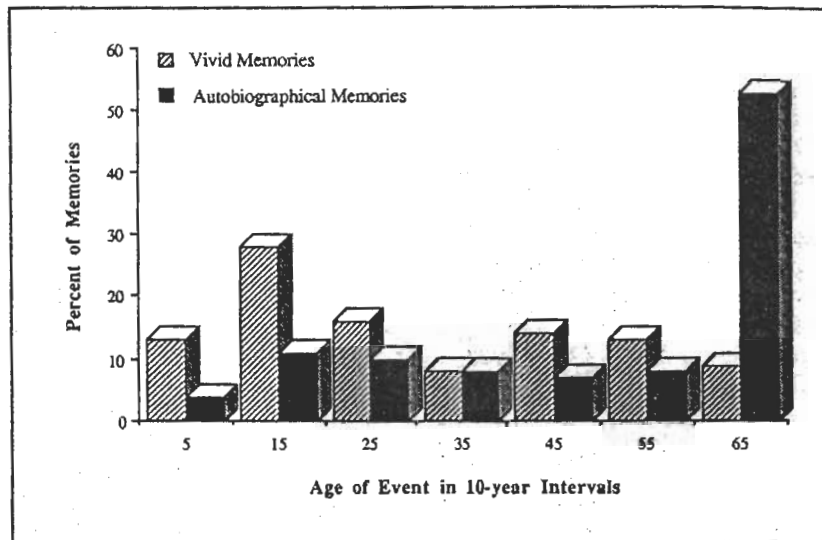


FIG. 4.3. Distribution of vivid autobiographical memories over the lifespan, adapted from Fitzgerald (1988).

that resulted. The plot of memories cued by words looks much like those from the similar procedures that produced Fig. 4.1. The plot of vivid memories looks more like the “important” memories of Fig. 4.2, which were also cued by a general request rather than individual words. Here both sets of subjects were drawn from the same general population by the same researcher.

Fitzgerald argues that the reminiscence bump in the word-cue method may be due in large part to the availability of vivid memories in the same period. He then considers why the vivid memories exist in greater frequency during that period. He dismisses the least interesting alternative, that this is just when important life events such as a first job or a marriage occur, because such life events make up only 14% of the memories in the reminiscence bump (cf. Fromholt & Larsen, 1991). Likewise he finds little support for a special period of cognitive abilities during adolescence and early adulthood that could account for stronger encoding. That is, although there are normal cognitive functions, such as rehearsal and imagery, that could account for why particular memories are given, there is no reason to expect that these mechanisms are especially effective in the period of the reminiscence bump. Rather he concentrates on what he terms “noncognitive interpretations”. Fitzgerald notes that psychologists have focused on traits and

characteristics to define personality and identity. An alternative approach concentrates on individuals' life narratives (Gergen & Gergen, 1983). The vivid memories given are part of this narrative and their increased frequency is at a time when identity is being formed. Neisser (1988) adds the caution that not all vivid memories need be of this kind, which does not weaken Fitzgerald's basic hypothesis.

Two studies of vivid memories with older adults provide general support for Fitzgerald's views. Benson et al. (1992) report on studies in which ten vivid memories were requested from Japanese and rural midwestern American subjects. Both groups showed a reminiscence peak: the Japanese in the 21–30 year old decade of their lives, the Americans in the 11–20 decade. Cohen and Faulkner (1988) requested six vivid memories from adults ranging from 20 to 87. Unlike the other studies, subjects in the 40–59 and in the 60–87 age ranges recalled most memories from when they were 0–10 years old, with a fairly steady linear decline in the percentage of memories with each successive decade. That is, if they had shown the common decrease in the first decade, the results would be like those of the other studies requesting vivid memories, but with a more accented reminiscence effect. Cohen and Faulkner explain this in terms of search strategy. Just over 60% of their subjects listed their earliest memory first and almost 40% of their subjects listed at least three of their six memories in chronological order. That is, many of their subjects started at the beginning of their life, apparently using the time line as a retrieval cue.³ Independent of the discrepant point from the first decade of life, these results show a substantial retrieval from the early part of the subjects' lives.

In support of Fitzgerald's dismissal of life events as causing the reminiscence bump, Cohen and Faulkner note that the eight life events that were judged as the most important in a typical person's life accounted for just about half the memories given. These memories did not peak at the reminiscence bump, but were evenly distributed across all but the 0–10 and 71–80 decades of life, which had lower percentages.

Studies by Schuman and Scott (1989) and Schuman and Rieger (1992) further clarify the interpretation of the reminiscence bump. In 1985, a probability sample of 1410 Americans over 18 were asked to list one or two especially important "national or world events or changes" from the last 50 years. Thus, as sociologists interested in the concept of generation, they asked for public rather than personal events. The five panels of Fig. 4.4 each present the data from one of the most often listed events. The percentage of the total responses to that category is plotted against the age of the person reporting that event at the time the event occurred. The ages are approximate because people are grouped into 5-year periods and because most of the events had long durations from

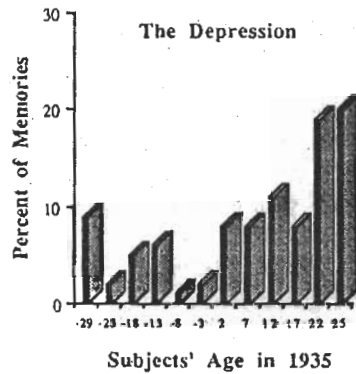
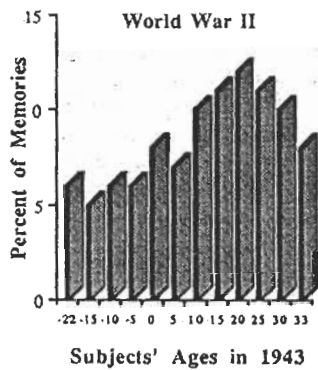
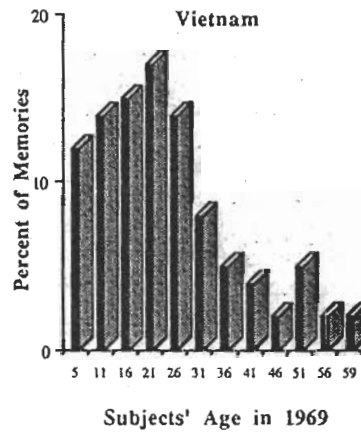
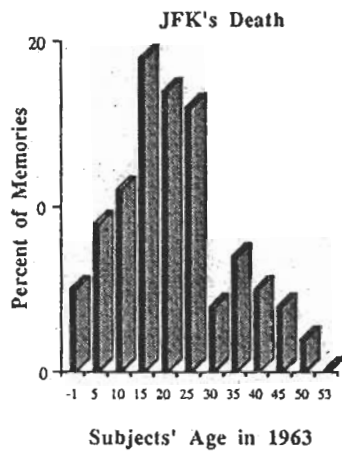
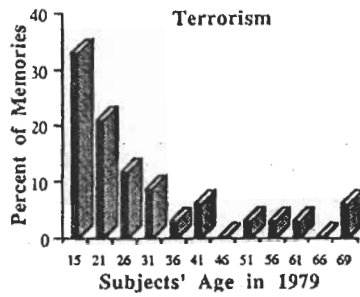


FIG. 4.4. Distribution of five important public events, adapted from Schuman & Rieger (1992).

which the midpoint was used (for other distributions, see Schuman & Scott, 1989). Negative ages simply mean the person reporting the event was not born at the time the event occurred. For all five events the peak time of reporting occurred when the people were in their teens or twenties, that is, when the reminiscence bump occurs in autobiographical memory. Any of the respondents could have responded with any of the five events listed. The empirical observation is that people tend to report as important events and changes that happened in their late teens or early twenties.

It seems reasonable to seek a common explanation for both phenomena, but first some added empirical support is offered. In the Benson et al. study the Japanese had vivid memories from a period later than the Americans. Part of this effect was attributed to the respect shown to age in Japan, but part was due to vivid memories relating to World War II and its aftermath. Fromholt and Larsen, in addition to the data reported in Fig. 4.2, also asked their Danish subjects to recount important public events that occurred in their lifetime, much as in Schuman et al.'s studies. The control subjects listed two to three events, whereas the Alzheimer's patients listed only one on average. Nonetheless, when the data are normalised by plotting the percentage of memories falling in each decade, as is done in Fig. 4.5, the two groups are remarkably similar. Most memories were of World War II, as might be expected from Schuman et al.'s data with subjects of this age range. The curve is sharper here than for the American data, but Denmark was occupied by Germany during the war, making the event even more salient. The only clear difference between Fromholt and Larsen's two samples is that the Alzheimer's subjects had fewer reports from the most recent decade.

Schuman et al.'s interpretation of their finding is basically equivalent to Fitzgerald's except that one's political, social, or generational identity is being formed. The reason that it occurs at this period is not drawn from noncognitive theories of human emotional or personality development in the way Fitzgerald's theory is. Rather it is cognitive. Before the age of young adulthood, people first lack the cognitive abilities to learn about complex events but, even once they have these, in our culture they lack much awareness of the world beyond the family. The frequently reported events of adolescence and early adulthood are the first political events encountered and understood as political events. One might suspect, then, that the Depression for a family without an income, or World War II when a family member is involved, might be reported earlier than events that do not impinge on family life, but this need not be the case. Autobiographical memories might come from such occurrences, but not reports of important world or national events.

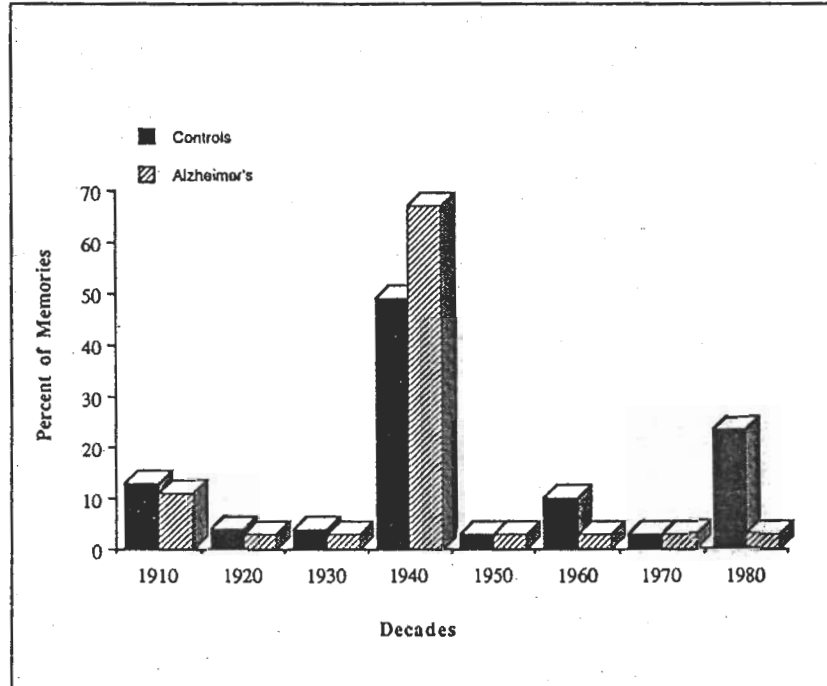


FIG. 4.5. Distribution of important public events, adapted from Fromholt & Larsen (1992).

The idea that first occurrences of events are better remembered and serve as models for later occurrences is not new (Robinson, 1992). Support comes from the Cohen and Faulkner study reported earlier. It found that 20% of the vivid memories reported were of "first times" and that an additional 73% were of "unique one-off events", leaving only 7% for generic events and last times.

An interesting offshoot of this parallel between reminiscence for public events and autobiographical memories is that in questionnaires of public memories there may be an increased accuracy in answering questions from when subjects were adolescents or young adults. Thus, an increase in accuracy for questions about World War II may not be because they were *easier* for a wide sample of people, but rather because the event being asked about occurred in a *critical* period.

The observation remains that in the period from about 15 to 25 years of age, people who are over 40 years old recall more autobiographical memories than would be expected from a monotonically decreasing

retention function and in the same period they also list important public events with greater frequency than events from other periods. Thus, both kinds of memories are more available (Rubin, 1983). Rubin et al. (1986) favoured an increase in the sampling of memories at retrieval from the critical period as the person aged to account for the increase in autobiographical memories. This speculation may still be of value, but two new possibilities need to be added to account for the added data and theory.

First, there could be differential encoding of events from this period for what Fitzgerald terms noncognitive reasons or for more cognitive first time reasons. That is, the basic cognitive processes of rehearsal, and various forms of organisation need not reach a peak in the age period 15–25 years. Rather they could be used more in that period because personal or political identity is being formed or because the first time experiences require more effort at understanding. Thus rehearsal and spaced practice could work the same, but there could be more rehearsal in this period. This alternative explanation would stress differences in encoding as opposed to differences with retrieval that occur with ageing.

The second possibility is based on the public event data. The restriction that people must be over 40 to show the reminiscence bump did not hold for the public event data collected by Schuman and his colleagues. The over-40 restriction might still be correct for autobiographical memory, but another interpretation needs to be considered. The reminiscence bump might be there for both public and autobiographical memories for all age groups, but we may not be able to see it until the decrease in memories from the thirties and forties occurs. That is, the bump is of theoretical interest, but a dip is needed to find it empirically. A study of vivid memories using the paradigm of Fitzgerald or of Fromholt and Larsen that tested 30 year olds as well as older subjects would be able to see if the reminiscence bump is always there, at least for vivid memories. In these paradigms there is not a large number of memories from recent times that would mask the decrease of memories in the 25–30 year old range, if such a decrease were present. Studies that ask 35 year olds for autobiographical memories younger than 30 would not work because such restrictions can induce U-shaped functions at any period (Rabbitt & Winthorpe, 1988).

On a more integrative level, there exists a simple, replicable, widespread, quantitative phenomenon. Sufficient data now exist to show that it cannot be viewed as an experimental artifact or a curiosity without clinical or sociological importance. Initial speculation and theory from within cognitive psychology still apply, but more general principles of individual and group behaviour may be needed for a full understanding. For instance, we have already suggested that a critical

period of change occurring in late adolescence—the period corresponding to the reminiscence bump—may conclude in the formation of a stable self concept and herald the emergence of personal themes that will preoccupy the individual in the future.⁴ Assuming that the enduring themes that emerge at this time continue to influence the current configuration of the self in later periods of life (well into old age), then the reminiscence bump can be explained by a match between encoding and retrieval environments. That is to say that the reminiscence bump might be conceptualised as an encoding specificity phenomenon (Tulving & Thomson, 1973) in which enduring themes of the self facilitate access to events originally encoded when those themes were first generated—in late adolescence. Similarly, the powerful recency effects so frequently observed in lifespan retrieval may be mediated by the themes of the current configuration of the self. Thus, the reminiscence bump reflects the stable and enduring portion of the self extending back to a critical period of self formation, and recency reflects the influence of the current self extending into the immediate past. Access to events not directly related to enduring or current themes will, generally, be more effortful and, perhaps, less successful, hence the dips in the lifespan retrieval curve. Finally, the period of childhood amnesia may arise because the themes of the child do not endure and are not represented in any way in the (nonpathological) adult self (but see Nelson, this volume, for an encoding rather than retrieval account of childhood amnesia). Our view, then, is that we can begin to understand lifespan memory retrieval by bringing together cognitive accounts of memory and noncognitive accounts of the development of self.

BREAKDOWNS OF AUTOBIOGRAPHICAL REMEMBERING

One of the most encouraging developments in autobiographical memory research is the converging evidence emerging from studies of autobiographical remembering in neuropsychological and psychopathological disorders. As we saw in the last section, Alzheimer's patients show the "reminiscence" bump characteristic of lifespan recall and were in most respects similar to their controls. In contrast, most amnesic patients are markedly impaired in remembering recent events. This pattern of retention is also very often, but not always, present in certain groups of brain-damaged amnesic patients (Albert, Butters, & Brandt, 1981; Albert, Butters, & Levin, 1979; Butters & Cermak, 1986; Cohen & Squire, 1980; Kopelman, 1985, 1989, 1991, 1992; Zola-Morgan et al., 1983). The remote memory impairment of alcoholic Korsakoff

patients has often been found to take the form of a retrograde amnesia extending back from the time of the onset of the amnesia to the period of early adulthood or late adolescence. Memories of events from below the age of about 20 years are, however, intact and available to Korsakoff and other amnesic patients (see especially MacKinnon & Squire, 1989, and Squire, Haist, & Shimamura, 1989, for striking demonstrations of this). Following our earlier reasoning we suggest that retention of memories from this earlier, formative, period may perhaps reflect the involvement of stable and enduring aspects of the self, which can still be utilised by the neurologically impaired patient in constructing memories.

Currently a richer set of data is emerging from single case studies of amnesic patients, usually encephalitis patients, and findings from these studies bear directly on our early views concerning the autobiographical knowledge base and construction of memories (see Conway, *in press*, for a detailed review of the relevant single case studies). For example, Cermak and O'Connor (1983) studied an encephalitis patient who although densely amnesic appeared to have an intact long-term autobiographical memory. Subsequent investigations revealed that this patient did not "remember" events but rather had a limited stock of "stories" of personal experiences, which he often related. He did, however, have access to general thematic knowledge of the events of his life and appeared to be able to access lifetime period and some general event knowledge. Similar cases, varying in severity, have been reported by Tulving, Schacter, McLachlan, and Moscovitch (1988), Stuss and Guzzman (1988), and Van der Linden, de Partz, Schils, and Seron (1992). All these patients showed at least some preservation of lifetime period and, occasionally, general event knowledge but were unable to construct specific and detailed memories. It seems possible that in these sorts of patients the neurological damage has led to an inability to process event specific knowledge.

Korsakoff and encephalitis patients often have specific neurological damage in the limbic-diencephalic neurological circuits known to be implicated in memory. However, another group of patients also show impairments of autobiographical memory and these patients have neurological damage in the frontal lobes (Baddeley & Wilson, 1986; Shallice, 1988; Stuss & Benson, 1984). Frontal lobe amnesias appear to be directly associated with impairments to the ability to construct autobiographical memories and, ultimately, to the disruption of cyclic retrieval. For example, the series of patients examined by Baddeley and Wilson (1986) showed two particularly interesting deficits. Some of their patients were unable to construct detailed memories although these patients could, nonetheless, recall specific events. The problem appeared

to be that these patients could not fully incorporate event specific knowledge into their memories although they could incorporate a few specific details. Baddeley and Wilson refer to this as a *clouding* of autobiographical memory and, perhaps, this arises when a patient can access appropriate knowledge in the autobiographical knowledge base but is unable to fully integrate accessed knowledge in a temporary knowledge structure in working memory. In contrast, frontal lobe patients who *confabulate* often produced highly detailed "memories", sometimes at length, which later turned out to be fantasies. In this case it may be that there is a failure at, or disruption of, the evaluation phase of cyclic retrieval, and outputs from long-term memory cannot be accurately assessed for task relevance, so all, or most, are accepted. Clouding, then, may reflect a disruption of integration, and confabulation a disruption of evaluation. It is worth noting that some Korsakoff patients with frontal lobe pathology also occasionally confabulate and it may be that memory impairment in these cases extends both to access and evaluation of autobiographical knowledge.

Interestingly, similar impairments of autobiographical remembering have been identified in psychopathological patients who have no history of neurological injury. J.M.G. Williams and his colleagues (Williams & Broadbent, 1986; Williams & Dritschel, 1988, 1992; Williams & Scott, 1988) have documented a phenomenon similar to "clouding" in clinically depressed patients. Depressed patients also often fail to retrieve specific and detailed memories and instead respond with overgeneral memories. For example, a patient asked to recall a detailed and specific memory to a cue such as *errand* might respond with the lifetime period *when I was at school* but be unable to elaborate the lifetime period into a specific memory. In fact, clinically depressed patients' overgeneral memories nearly all comprise what Williams calls *categoric* memories. Categoric memories, as the name suggests, refers to a category of highly similar events, often repeated events, such as *the times I have fallen downstairs* (Williams & Dritschel, 1992) and contrast with *extended* memories, which are comprised of lifetime periods and general events. Thus, the autobiographical recall of depressed patients does not exactly parallel the recall of frontal lobe patients who show access to specific memories but whose memories are "clouded" (lack detail). Nevertheless, clinically depressed patients may suffer from an impairment of the search phase of retrieval. On a positive note, this may serve an adaptive function in that patients do not then recall potentially traumatic memories of negative events and so exacerbate their mood state. However, Williams and his colleagues also argue that the autobiographical memory impairment may be one of the factors that prevent the patient from breaking the cycle of depression.

Finally, some very recent studies have examined autobiographical remembering in schizophrenia. Tamlyn et al. (submitted) studied a large and symptomatically diverse group of schizophrenics and followed five of these patients in case studies. The case study data revealed that schizophrenic autobiographical remembering was generally depressed compared to the performance of matched controls but like the Korsakoff patients described earlier the schizophrenics' memory for remote events appeared to be preserved relative to memory for recent events. Moreover, some of these patients showed delusional memories and one patient's data was so contaminated with delusional memories it could not be scored. In a recent pilot study, Coleman and Conway (1991) contrasted depressed and schizophrenic autobiographical memory recall to cue words. In this study the acute schizophrenics often fluently recalled extensive tracts of autobiographical knowledge but this was disconnected and did not approximate to discrete memories. Coleman and Conway concluded that, in their sample at least, schizophrenics were unable to control and integrate the flow of output from long-term memory, whereas, in contrast, depressed patients were unable to maintain a sustained memory search.

CONCLUSIONS: THE MICRO- AND MACRO-STRUCTURE OF AUTOBIOGRAPHICAL MEMORY

In our review of autobiographical memory research we have focused on two broad strands of findings and theory that bear, respectively, on the micro- and macro-structure of autobiographical memory. Several investigations into the micro-structure of autobiographical knowledge have identified at least three levels of knowledge: lifetime periods, general events, and event specific knowledge. Knowledge structures within these layers of knowledge are held together by cues that reflect personal themes and temporal knowledge. Themes and chronology can be used to create new knowledge structures or serve to bind together relatively permanent structures. The autobiographical knowledge base is sampled by a complex retrieval process and it is proposed that "memories" are temporary structures constructed and briefly retained in working memory.

The macro-structure of autobiographical memory has emerged from the now numerous investigations of autobiographical remembering across the lifespan. The remarkably consistent finding from this set of investigations is that the distribution of memories across the lifespan of people over the age of about 40 years contains three identifiable components: one component from the ages of zero to about five years represents a period of childhood amnesia; a second component from the period of about ten years

to the early twenties is known as the *reminiscence bump* and is characterised by an increase in memory accessibility; finally, the third component stretches back from the current age of the subject to the start of the reminiscence bump and is characterised by a marked decline in older memories. Recent research has indicated that the reminiscence bump may be identifiable in subjects below the age of 40 years and much attention has focused on accounting for the reminiscence bump. The more mechanistic explanations for the reminiscence bump, such as rehearsal, preferential encoding of events, and encoding specificity type effects in retrieval, have been supplemented by recent studies, which suggest why such mechanisms so powerfully affect the pattern of lifespan autobiographical remembering. The reminiscence bump most likely reflects a critical period in the development of the individual; the emergence of a stable and enduring self concept.

By far the majority of autobiographical memory research has been conducted in the last 12 years and, in our opinion, the advances made in understanding this aspect of remembering have been impressive. However, in many respects this body of work might be thought of as a prelude to more substantial and sustained research efforts to follow. The findings reviewed earlier essentially lay a part, probably a small part, of the groundwork on which subsequent research might build. So the question arises, "where next?"

In terms of what we have dubbed the "micro-structure" of autobiographical knowledge there seem obvious targets for future research. For instance, general event knowledge is little understood and, undoubtedly, much remains to be discovered of the nature, structure, and content of general events; the work of Robinson (1992) and Anderson and Conway (in press) makes initial steps in this direction. At a more general level, the role and nature of themes and temporal information in the structuration of autobiographical knowledge are important issues awaiting investigation. Similarly, event specific knowledge has yet to be seriously explored although there are, perhaps, possibilities here to interface autobiographical memory research with research into the procedural and perceptual basis of memory (see Barsalou, Crowder, Schacter, this volume).

The construction of autobiographical memories and the nature of retrieval processes that sample the autobiographical knowledge base also await investigation and it is curious that the increasingly influential work of Williams and Hollan (1981) has not been followed-up in subsequent studies. A source of rich data that bears upon these issues is currently emerging from neuropsychological and psychopathological reports of the breakdown of autobiographical remembering, and autobiographical memory theorists would benefit from an awareness of

this literature. However, it may be that construction and retrieval processes are amenable to laboratory based investigations. If, as we have proposed, knowledge access and memory construction are mediated by mechanisms of the central executive of working memory, then an obvious development would be to use the methods of the working memory researcher to explore construction and retrieval. Thus, retrieving memories while performing secondary tasks designed to draw selectively upon the processing capacities of the central executive might reveal part of the nature of construction and retrieval. Moreover, by taking this approach it should be possible to forge an important link between consciousness, autobiographical memory, and working memory (see Baddeley, this volume).

Research into the pattern of lifespan memory retrieval is clearly converging on a generally agreed account of why and how phenomena such as the reminiscence bump arise. However, there remain many other issues that have yet to be investigated. For instance, cross-cultural differences in the pattern of lifespan retrieval, although established, have yet to receive serious investigation. Similarly, the generational differences reported by Schuman and his colleagues are particularly intriguing and suggest fascinating cross-generation differences in autobiographical memory. More generally, although the reminiscence bump has received a great deal of attention, empirical exploration of the two other components of the lifespan retrieval curve has hardly begun. Thus, although much has been written on childhood amnesia, the actual number of investigations of this phenomenon are rather few in number (see Conway, 1990a; Wetzler & Sweeney, 1986; Nelson, this volume) and little is known about patterns of retention that may or may not be present in this period. Similarly, the recency component of lifespan remembering has yet to be extensively investigated (see Rubin & Baddeley, 1989 for a recent review) although an intriguing finding by Linton (1986) suggests that chronologically based searches of memory may only be effective for the most recent two years of a person's autobiography and after this period theme based searches become more effective—suggesting, perhaps, another interesting connection between themes, self, and lifespan recall.

It is undoubtedly the case that the study of autobiographical memory has only just begun. However, recent findings demonstrate that this area is empirically tractable and that regular and manipulable phenomena exist. In order to understand these phenomena the researcher is often compelled to draw upon both memory theory and theory from other areas of psychology not traditionally associated with the study of human memory. In our view such a synthesis will ultimately be of benefit to the study of human memory generally.

NOTES

1. Note that we are *not* implying that the autobiographical knowledge base is some form of separate memory "system" (cf. Tulving, 1972, 1983). Indeed it is an open question whether or not autobiographical knowledge is part of some larger knowledge base. In this chapter we simply use the term "autobiographical knowledge base" to refer collectively to the three levels of structure: lifetime periods, general events, and event specific knowledge.
2. The proposed model provides a good description of the data and serves to summarise the working assumptions of much current research. Like all such models care must be taken not to reify the components of the model into things to be localised in the mind or brain on the basis of functional, behavioural analysis (Rubin, 1988). Within the general framework we have outlined, structured knowledge base and constructions of "memories" in working memory, many different types of models of autobiographical memory can be implemented. In short, the current experimental data are not sufficiently specific to impose strong constraints on detailed models within our general framework (cf. Watkins, 1990). However, findings from the study of impairments of autobiographical memory (reviewed later in the chapter and see Conway, in press) and particularly from studies of organic amnesia are beginning to contribute evidence that may, eventually, provide the type of constraints needed to support a detailed model of autobiographical memory. For example, to date no cases of organic amnesia have been reported in which patients can access event specific details but are unable to access general event and lifetime period knowledge. Similarly, loss of lifetime period knowledge with retention of general events does not appear to occur in organic amnesia. Such findings support our proposal that autobiographical knowledge may be organised hierarchically. Thus, as further data emerge, detailed conjectures about the organisation of autobiographical memory will become subject to stronger constraints. Of course, as these new data are reported the model we have proposed may require revision or even outright rejection.
3. Fromholt and Larsen's subjects acted similarly, with control subjects recalling four times as many pairs of events in forwards than backwards chronological order and the Alzheimer's subjects two times as many. Fitzgerald's and Benson et al.'s subjects may have acted similarly, but we have no data on this.
4. We are not suggesting that the self does not change after late adolescence or that immutable themes are created at this time. Nor are we assuming a "core" self or denying the possibility of different, even contradictory, "selves" existing simultaneously within the same individual. Our suggestion is altogether more modest and simple: it is that personally important themes emerge in late adolescence and these are of central importance to the configuration of the self later in adulthood. Some of these themes may survive into old age, as Schuman and Scott's (1989) and Schuman and Riger's (1992) work on political aspects of the self indicates, but many will not. To the extent that the themes to emerge from the period of late adolescence persist, even in radically changed form, into later life, then these themes may provide a basis for phenomena such as the reminiscence bump.

ACKNOWLEDGEMENT

David Rubin thanks the Netherlands Institute for Advanced Study in the Humanities and Social Sciences for support during the writing of this chapter.

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Theories of Memory

edited by

Alan F. Collins,
Susan E. Gathercole,
Martin A. Conway, and
Peter E. Morris
*Memory Research Unit, Lancaster
University, UK*

 LAWRENCE ERLBAUM ASSOCIATES, PUBLISHERS 
Hove (UK) Hillsdale (USA)

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Lawrence Erlbaum Associates Ltd., Publishers
27 Palmeira Mansions
Church Road
Hove
East Sussex, BN3 2FA
UK

British Library Cataloguing in Publication Data
Theories of Memory
I. Collins, Alan F.
153.1

ISBN 0-86377-290-0

Cover design by Joyce Chester
Printed and bound in Great Britain by BPC Wheatons Ltd., Exeter