Event Cueing, Event Clusters, and the Temporal Distribution of Autobiographical Memories

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SUMMARY

This article provides an overview of a series of *event-cueing* experiments conducted to investigate how autobiographical memory is organized at the event level. In these experiments, participants first generate a set of personal events (*cueing events*) and then respond to each by retrieving a second event memory (the *cued event*). Subsequently, relations between cued and cueing events are coded, and all events are dated and rated for importance. This approach has produced two general findings. First, we have found that event memories are often embedded in narrative-like *event clusters*. Second, across experiments, we have observed large, systematic differences in the temporal distribution of the event pairs. In this article, we review evidence concerning the organizational importance of event clusters. We then examine the temporal distributions obtained from three representative experiments and account for the marked differences in these distributions by considering how task demands, memory structures, and response strategies affect retrieval from autobiographical memory. © 1998 John Wiley & Sons, Ltd.

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Narratives (Bruner, 1991; Nelson, 1993a), self-narratives (Fitzgerald, 1988; Robinson and Taylor, in press), personal narratives (Fivush, 1991), personal stories (Schank and Abelson, 1995), personal histories (Robinson, 1992), general events (Conway, 1996), extended events (Burt *et al*., 1995), and larger episodes (Reisser, 1983) are among the terms used refer to a certain type of autobiographical memory structure. As these names imply, such structures are story-like, organizing memories of individual events in a way that maintains their causal, temporal, and thematic relations. And, as their number implies, there is a widespread and long-standing belief that event memories are typically embedded in such structures.

Much evidence indicates that people do have access to memory structures that organize information about interesting or important event sequences, and that some specific event memories are subsumed by these larger structures (e.g., Anderson and Conway, 1993; Bruner and Feldman, 1996; Robinson, 1992; Robinson and Taylor, in press; Schank and Abelson, 1995; Thompson *et al*., 1993). However, prior research has provided little support for stronger claims concerning the frequency or organizational importance of narrative-like structures in autobiographical memory

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(Conway, 1996). This is a problem because approaches to autobiographical memory will differ depending on whether these narrative-like structures are the exception or the rule. If such structures are common, it suggests that clustering is a by-product of the processes engaged when people plan, execute, and evaluate meaningful actions and implies that these processes and their memorial consequences need to be better understood. In contrast, it could be that narrative-like structures are rare and that they only form around important or interesting events. This pattern would be consistent with the idea that events must be narrated if they are to be well remembered (Barclay, 1996; Fivush, 1991; Nelson, 1993b) and would imply that the study of autobiographical memory and the study of narrative processes are inseparable.

In this article, we sketch a research programme initially undertaken to determine whether event memories are often embedded in *event clusters*, where an event cluster is defined as a memory structure that organizes information about a set of causally and thematically related events. In order to address this issue, a method called *event cueing* was devised and refined (see also Brown, 1990, Experiment 3; Fitzgerald, 1980). The participant first generates a set of personal events. Then he or she responds to each of these *cueing events* by retrieving a second personal event (the *cued event*). In the next section, we describe this method and its variants in some detail and consider its advantages relative to other methods used to investigate autobiographical memory. Also, we briefly review evidence obtained using this method that supports the view that event clusters are common and hence unlikely to be the product of special narrative processes.

Following this overview, we focus on the temporal distributions of the cueing and cued events. Over the course of several studies, we have observed that these distributions differ greatly from one condition to the next. We summarize these differences and propose a theory to account for them. Briefly, this theory holds that people have access to memories of recent, mundane events and older, more important events; that event memories are frequently, but not always, embedded in event clusters; and that task demands and the nature of the cueing event jointly affect the probability that a recent event will be retrieved.

EVENT CUEING

The method and its variants

The typical event-cueing study carried out in our laboratory has consisted of five tasks: an event-generation task, an event-cueing task, a relation-coding task, a dating task, and an importance-rating task. During each task, participants, who have all been university students, were prompted by messages or cues presented on a computer-controlled video display and responded by typing their answers at the computer's keyboard.

The main purpose of the event-generation task (Task 1) was to obtain a sample of event memories that can be used as event cues during the second task. To date, several different versions of the event-generation and event-cueing tasks have been investigated. Two methods have been used to elicit cueing events during the generation task. Both approaches are well known in the autobiographical memory literature. In one, participants first go through a brief life-review period, and then generate and briefly describe a set of memories that correspond to significant personal events (Fitzgerald, 1988; Fromholt and Larsen, 1991). In the second, people perform a cued-retrieval task: on each trial a word cue is presented and the participant is required to respond by rapidly recalling and briefly describing the memory of a personal event (Crovitz and Schiffman, 1974; Robinson, 1976; Rubin, 1982).

In addition to manipulating the nature of the generation task, we have also manipulated task requirements in the word-cue task. In some experiments, participants were told to respond only when they have succeeded in retrieving an event memory that was in some way related to the current word cue; in others, they were told to respond with the first memory that comes to mind, regardless of whether the word cue and the retrieved event were related. Because the cue word restricts the set of acceptable memories in the first case but not the second, we term the two conditions as *restricted* and *unrestricted*, respectively.

Across experiments, restricted and unrestricted retrieval versions of the event-cueing task were employed. As mentioned above, the event memories generated during Task 1 were presented to participants as event cues during Task 2. In restricted conditions, participants were instructed to respond with the first event memory that came to mind that was related in some way to the cueing event. In unrestricted conditions, participants were merely asked to respond to each event cue with the first event memory (other than the cueing event or previously recalled events) that came to mind.

Despite differences in the way that cueing events were generated and the presence or absence of retrieval restrictions, all conditions produced event pairs composed of a cueing event and the cued event. The remaining tasks, which differed little from one experiment to the next, yielded information about the events that comprised these pairs. On each trial during Task 3, the relation-coding task, an event pair and menu were presented together on the computer display. The menu listed the following questions on separate lines: Did Event A (the cueing event) and Event B (the cued event) involve the same person or persons? Did Event A and Event B involve the same activity? Did Event A and Event B occur at the same location? Did one of the events cause the other? Is one of the events part of the other? Are both of these events part of a single broader event? Are Event A and Event B related in some other way? Participants were required to respond to each question by typing **Y**(es) or **N**(o) in an associated response field.

During Task 4 and Task 5, all cueing and cued events were presented one at a time in random order, with the constraint that when one member of a pair appeared during the first half of the task, the other appeared during the second. During Task 4, participants estimated, to the day, when each of the recalled events occurred, and during Task 5, they rated the personal importance of each event on a 1 (not at all important) to 5 (very important) scale.

Rationale and predictions

Event cueing is used to investigate how autobiographical memory is structured at the event level. This approach assumes that event memories are systematically associated with one another and that people typically recall an associated event memory when responding to an event cue. These assumptions imply that the relations that hold between cued and cueing events correspond to the type of associations that bind event memories and that the frequency of these relations reflects their organizational importance (Brown, 1990). For example, if autobiographical memory is typically organized around event categories as Schank and his colleagues once proposed (Kolodner, 1983; Reisser *et al*., 1985; Schank, 1982), then cued and cueing events should refer to the same type of activity (e.g., the memory of dinner at one Chinese restaurant might elicit the memory of dinner at another Chinese restaurant) but may have little else in common. In contrast, if event memories are typically embedded in narrative-like event clusters, cueing events should frequently elicit cued events from the same cluster, and the responses produced during the relation-coding task (Task 3) should reflect this fact. Specifically, participants should often indicate that paired events are causally related, that one event is nested in another, or that both events are part of a more general story.

Advantages of event cueing

Prior researchers have used word- and phrase-cue tasks to study the temporal distribution of autobiographical memories and their hierarchical organization (e.g., Conway and Bekerian, 1987; Reisser *et al*., 1985; Rubin, 1982; Rubin *et al*., 1986). Others have attempted to understand how event memories are related to one another by examining how people narrate important or distinctive event sequences (e.g., Bruner and Feldman, 1996; Hirst and Manier, 1996; Robinson and Taylor, in press). Event cueing complements these methods, allowing researchers to identify the associations that link event memories and to determine the relative importance of different types of interevent associations. Neither the conventional cueing tasks nor narration tasks can accomplish these goals. Standard cueing tasks have provided information about the relative cueing efficiency of different concepts and have contributed to our understanding of how information is retrieved from autobiographical memory and how semantic concepts and generic self-knowledge are related to event memories (Brown, 1993). However, because standard word- and phrase-cues do not refer to personal events, they cannot be used to study how event memories are related to one another. To do this, it is necessary to use event memories as probes and to obtain event memories as responses; this, of course, is the core of the event-cueing method.

Narration tasks have provided empirical support for the position that some event memories are part of story-like structures. However, as these tasks sample only select portions of autobiographical memory, it is unclear whether the narrative-like structures they reveal are common. Moreover, because participants in these experiments are explicitly instructed to tell stories from their lives, it is possible that reported narratives are reconstructed from a fragmentary trace of the event sequence or are composed from general knowledge in accordance with some set of social and linguistic conventions.

Event cueing studies can be conducted in ways that avoid both problems. The sampling problem can be addressed by cueing participants with a wide range of event memories. These sets can be obtained by having participants perform a standard word-cueing task; the event descriptions generated during this task can then be used as cues during the event cueing task. Task demand issues can be dealt with by giving participants neutral retrieval instructions; typically, we ask participants to retrieve a related memory, but leave the nature of the relation between the cueing event and the target event unspecified.

Event cueing and event clusters

Our research indicates that event memories regardless of age or importance are often embedded in event clusters. Support for this claim comes from an event-cueing experiment that used two methods to elicit event cues (Brown and Schopflocher, in press). Participants in one group, the *important-event* group, were instructed to recall 14 important personal events during the first phase of the experiment. Those in the other group, the *word-cued* group, were presented with 14 cue words and were instructed to respond to each with the memory of a related personal event.[1] Event descriptions generated during the first phase of the experiment served as event cues during the second. During this phase, both groups received restricted-retrieval instructions. In other words, all participants were asked to respond to each cueing event with the first related event memory that came to mind. The event cueing task was followed by the relation-coding, event-dating, and importance-rating tasks.

We considered events in a pair to be drawn from the same cluster when the participant indicated during Task 3 that the pair members were causally related, that one member was nested within the other, or that both members were part of the same broader story. In this experiment, event cues often elicited cueing events from the same event clusters, though participants in the important-event group produced a higher percentage of clustered pairs (i.e., pairs where the participant indicated that both cued and cueing event belong to the same cluster; 82%) than those in the word-cued group (72%), and important cueing events were more likely to elicit cluster mates than unimportant ones. Across 5 levels of rated importance, and collapsing over groups, the percentage of clustered pairs increased monotonically from 66% to 81%. The prevalence of clustering, regardless of the importance of the cueing event, is consistent with the view that these clusters play a prominent role in organizing event memories and suggests that their formation is a common consequence of the planning, execution, and evaluation of goal-directed action sequences (Brown and Schopflocher, in press). Also, if one assumes that important events (or event sequences) are more likely than unimportant ones to be narrated or rehearsed (Brown and Kulik, 1977; Burt *et al.*, 1995; Conway *et al.*, 1994), then the observed relation between importance and clustering suggests that narration or some other form of rehearsal serves to strengthen associations that link clustered event memories.

In addition to demonstrating that event clusters are common, this experiment provided evidence that memories organized by these clusters, like episodes in a story, are often causally related, temporally proximate and similar in content. Specifically, we found that 67% of the clustered event pairs were causally related, that clustered events often occurred close together in time (the median difference between the age of the cueing and cued events was 2 days for clustered pairs and 317 days for nonclustered pairs), and that clustered pairs were more likely than nonclustered pairs to refer to the same people (51% versus 43%), take place at the same location (51% versus 31%), and involve the same activity (38% versus 31%). Finally, it should be noted that participants retrieved a cued event faster when the cueing and cued event were part of the same cluster (median Reaction Time [RT] = 6.7 s) than when they were not (median RT = 8.3 s) indicating that less search or reconstruction was required in the former case than in the latter.

[1]The generation task was manipulated to ensure that participants would be exposed to a wide range of cueing events.

TEMPORAL DISTRIBUTIONS

It is common for participants who take part in cueing experiments to provide date estimates for the events they have recalled. These estimates are then used to determine the temporal distribution of the retrieved events. Typically, these temporal distributions resemble negatively accelerated retention functions, and therefore are assumed to be the product of a decay process (Rubin, 1982). In this section, we report large between-experiment differences in the temporal distributions of cueing events, cued events, and event pairs. We also attempt to account for these differences, which are too complex to be explained by a simple decay model, by considering how task demands, memory structures, and response strategies affect retrieval from autobiographical memory.

Temporal distribution of cueing and cued events

The event-cueing paradigm produces two sorts of information about the temporal aspects of autobiographical memories. First, the distribution of cueing and cued events can be considered separately. Second, it is possible to examine the temporal distribution of the event pairs. The single-event distributions constructed separately for cueing events (the left column of panels) and cued events (the right column) are plotted in Figure 1, for three representative experiments. These experiments differed in the way that event cues were generated; word cues were used to elicit cueing events in Experiments A and B, but not in Experiment C. In this last experiment, participants recalled and described important life events. In addition, participants in Experiments B and C received restricted-retrieval instructions, and those who took part in Experiment A received unrestricted instructions. These differences and other details are summarized in Table 1.

Not surprisingly, the single-event distributions portrayed in Figure 1 closely resemble those reported elsewhere in the literature. In general, participants retrieved a high percentage of very recent events and few older events when responding to word cues or cueing events elicited by word cues (Figure 1, top and middle rows; Rubin, 1982). In contrast, important cueing events and event memories cued by these events were less likely to be very recent, and more likely to come from an earlier period in the participant's life (Figure 1, bottom row; Fitzgerald, 1988; Fromholt and Larsen, 1991). Consistent with these observations, standard power functions (memories per hour $= \alpha t^{-\beta}$, Rubin, 1982) differed greatly across experiments, with Experiments A and B yielding relatively large exponents (for Experiment A, $\beta = -0.92$, for both cued and cueing events; for Experiment B, $\beta = -0.77$ for cueing events, and -0.79 for cued events), and Experiment C relatively small ones ($\beta = -0.58$ for cueing events, and -0.61 for cued events).

To explain the between-experiment differences in the shape of the cueing-event distributions (Figure 1, left column), we assumed two distinct forms of autobiographical memory. One type of memory is highly accessible, but readily forgotten. Memories of this sort typically refer to very recent, mundane activities like the preparation of last night's dinner, this morning's commute, or this afternoon's conversation with a friend. The second type of autobiographical memory is less accessible, but more permanent. These memories typically refer to important, distinctive, and/or emotional personal events, e.g. losing a family member, being injured, winning an

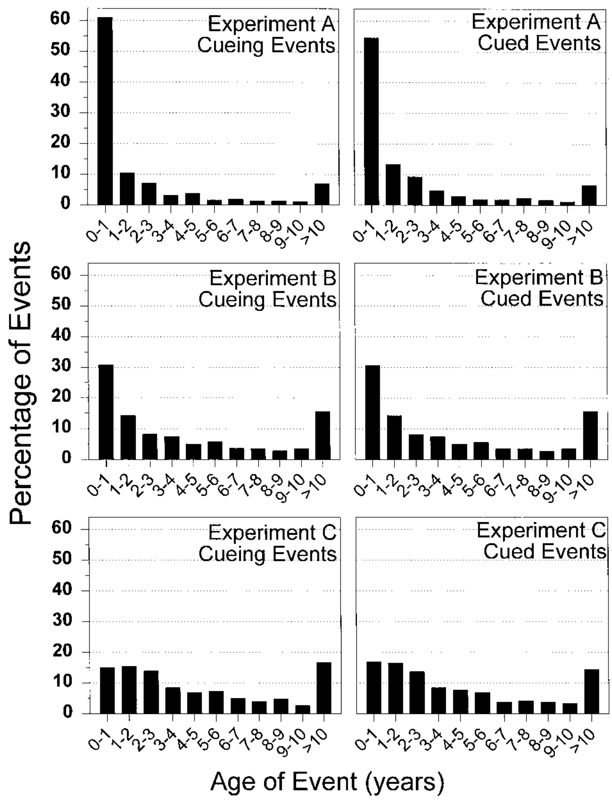

Figure 1. Temporal distributions of cueing events (left column) and cued events (right column) for Experiment A (top row), Experiment B (middle row), and Experiment C (bottom row)

award, being offered a job. It is likely that only a few recent memories are transformed into very-long-term memories and that the transition is related to the level of affect associated with the event, the distinctiveness of the event, its causal centrality within an event sequence, and the frequency with which it is discussed (Thompson *et al.*, 1996; Wagenaar, 1986).

Under unrestricted retrieval instructions, it is only necessary that the retrieved memory refers to a personal event. As a result, participants are free to respond with very recent event memories or older ones. It is possible that some unrestricted-memory participants simply ignore experimenter-provided retrieval cues and focus on very recent memories because they are easy to recall and that others retrieve very recent events when their initial attempts to recall cue-related memories fail. If people adopt these strategies following unrestricted-retrieval instructions, it would explain why so many very recent events were recalled in Experiment A.

In contrast to Experiment A, participants in Experiment C, who were instructed to describe significant events from their own lives, recalled relatively few recent events. This is not surprising – it is obvious that important events are spread across the life span. As a result, participants who recall such events should ignore very recent event memories and respond with older ones. In Experiment B, participants responded to word cues with related memories and produced fewer very recent memories than

Table 1. Between-experiments differences, and percentage of on- and off-diagonal event pairs in Experiments A, B, and C

Exp	Cue generation	Retrieval instructions		Participants	Event pairs	Percentage of event pairs			
		Task 1	Task 2			Diagonal	Scatter	recent/old	old/recent
A	word-cued	Unrestricted	Unrestricted	63	943	38	27	22	14
B	word-cued	Restricted	Restricted	102	938	56	32	4	7
C	imp. event	Restricted	Restricted	102	1048	73	25	1	1

Experiment A participants and more than Experiment C participants. This suggests that cue words are sometimes related to both very recent event memories and older ones, and that the former will often come to mind when this is the case.

In brief, across conditions, we have observed large explicable differences in the temporal distribution of cueing events. Interestingly, the temporal distributions of cued events mirror these differences, with participants in Experiment A displaying the strongest tendency to respond with recent event memories and those in Experiment C the weakest (Figure 1, right column). One possible explanation for this within-experiment similarity is that participants responded to the cueing event by recalling a cued event of the same age. This implies that the estimated ages of the cueing events should be closely related to the estimated ages of the event memories that they cue. The relevant data are equivocal; rank order correlations between the estimated ages of the cueing and cued events, computed over all event pairs, were 0.67, 0.83, and 0.87, for Experiments A, B, and C, respectively; and the median absolute difference in the estimated age of paired events was 76 days in Experiment A, 13 days in Experiment B, and 4 days in Experiment C. Although these correlations and medians are suggestive, it is also true that large differences in the estimated ages of cueing and cued events did occur and that factors manipulated across experiments did affect the probability that cueing events elicited same-age cued events. Thus, it would be wrong to conclude that the single event distributions resembled one another within experiments because cueing events always elicited cued events of the same age.

Temporal distribution of event pairs

In the last section, we considered the temporal distribution of cued and cueing events separately and dismissed the hypothesis that people inevitably respond to a cueing event with another event memory of the same age. In this section, we take a different tack and adopt the event pair, rather than the single event, as the unit of analysis. The relevant data from Experiments A, B, and C are plotted in Figure 2. In these plots, each point represents a single event pair, with the location of a point determined by the estimated age of its cueing event (its x-coordinate) and the estimated age of its cued event (its y-coordinate).

Figure 2 makes it clear that the three experiments yielded quite different patterns. We quantified these differences by dividing the plots into four mutually exclusive regions and computing the percentage of event pairs falling into each. The *recent/old* region ('a recent event cueing an older event') lies along the y-axis. Points were assigned to this region when the participant indicated that the cueing event had happened within the last month (i.e., the estimated age of the cueing event was 31 days or less) and that the cued event was at least 10% older than the cueing event. The *old/recent* region ('an older event cueing a recent event') lies along the x-axis. Points were assigned to this region when the cued event happened within the past month and the cueing event was at least 10% older than the cued event. We assigned points to the *diagonal* when the estimated age of the cued event was $\pm 10\%$ the estimated age of the cueing event. The percentage of events on the diagonal provides an index of the likelihood that a cueing event would elicit a cued event of about the same age. Finally, points were assigned to the *scatter* when they fell outside the other three regions. When an event pair is in the scatter, neither the cued nor cueing event were recent, and one event was somewhat older than the other.

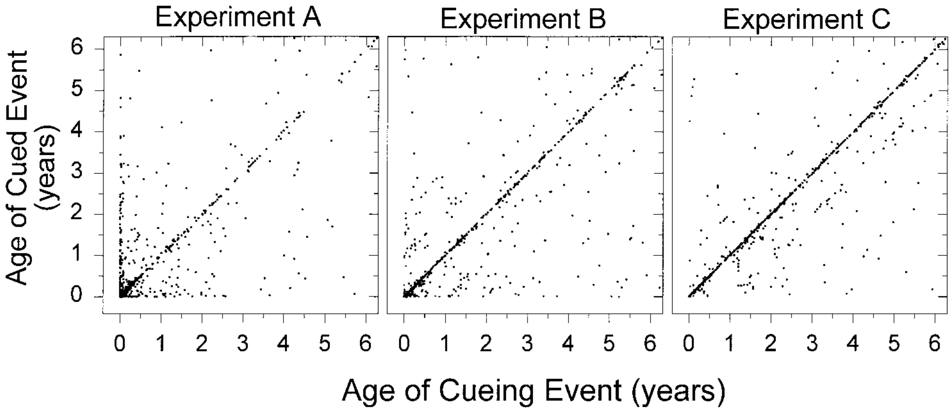

Figure 2. Temporal distribution of event pairs in Experiment A (left panel), Experiment B (middle panel), and Experiment C (right panel), excluding pairs composed of at least one very old (greater than 6 years) memory

Table 1 presents the percentage of points assigned to each region, for each experiment. As Figure 2 suggests, event pairs were distributed very differently across the three experiments. The contrast between Experiments A and C is particularly striking. In Experiment A, 36% of the points were assigned to either the recent/old or old/recent regions and 38% to the diagonal; comparable numbers for Experiment C were 2% and 73%. The results from Experiment B fell between the two, with 11% of the event pairs assigned to an axis region and 56% to the diagonal.

Accounting for the temporal distribution of event pairs

Three factors can account for the marked differences in the temporal distribution of event pairs in Figure 2: (a) the temporal distribution of the cueing events, (b) the restrictions placed on the retrieval task, and (c) the probability that events in the cueing set are embedded in event clusters. The first of these requires little discussion; the temporal distribution of the cueing events is important because it places an upper bound on the number of recent/old event pairs that can be produced in a given condition. Obviously, when very recent cueing events are uncommon (e.g., Experiment C), recent/old event pairs will also be uncommon. Thus, other things being equal, factors that reduce the percentage of very recent cueing events (e.g., important-event cues, restricted-retrieval instructions) should also reduce the percentage of recent/old event pairs.

To understand the way task demands and memory structure affect the distribution of event pairs, it is necessary to consider how people respond to event cues and how event memories are organized. As a starting point, we assume that participants in these experiments report the first event memory they retrieve that fulfils current task requirements. We also assume that recent, mundane events are readily available; that event memories, particularly older, more important ones, are often embedded in event clusters; and that events organized by these clusters, like episodes in a story, are often temporally proximate (Brown and Schopflocher, in press). Finally, we assume that accessing one member of a cluster facilitates the retrieval of others.

Given these assumptions, it is possible to identify three ways a person might respond to an event cue. These methods differ from one another in the effort required to retrieve an event memory, the probability that the cued and cueing events will be related, and the type of temporal relation likely to exist between memories in the event pairs. One way to approach an event cueing task is to focus on very recent events. In general, this strategy should require little effort as very recent events are easy to access. However, because the accessibility of recent events is independent of the content of the current cueing event, this strategy provides no assurance that the retrieved event and the cueing event will be related. Thus, a recent-event strategy is likely to be useful only when participants are given unrestricted retrieval instructions. Consistent with this point, old/recent event pairs were much more common in Experiment A than Experiments B and C (Figure 2 and Table 1).

A second strategy would be to recall an event memory that is directly related to the target event. Like the recent-event strategy, this strategy should produce event memories with relatively little effort. In addition, because cued events are often related to cueing events, this approach can be used when participants are given restricted retrieval instructions as well as when they are not.

As noted above, event memories are often embedded in event clusters, and these clusters often subsume events that happen at about the same time. Thus, when participants recall an event memory that is directly related to the cueing event they will often recall a cluster mate; and when they recall a cluster mate, they will often recall an event of about the same age as the cueing event. This implies that a large percentage of event pairs should fall along the diagonal, and that the prevalence of on-diagonal event pairs will be influenced by the nature of the retrieval task and by the nature of the cueing events. Other things being equal, restricted retrieval instructions should produce a higher percentage of on-diagonal pairs than unrestricted instructions because the former fosters the use of a related-event strategy while limiting the applicability of a recent-event strategy (cf. Experiments A and B, see Figure 2 and Table 1). Likewise, important-event cues should yield a higher percentage of on-diagonal pairs than word-cued cueing events (cf. Experiments B and C, see Figure 2 and Table 1). This is because the former are more likely to be embedded in event clusters than the latter (Brown and Schopflocher, in press).

A third way to approach the event cueing task would be to decompose the cueing event into elements (e.g., its participants, location, activity, props, etc.) and to use one or more of these elements as a retrieval cue. Because this decomposition strategy can produce cued and cueing events that are not part of the same event cluster, there is no reason to expect that the events in such a pair would have happened at about the same time. Thus, the use of this strategy should decrease the percentage of event pairs falling on the diagonal and increase the percentage of off-diagonal pairs.

In principle, the decomposition strategy entails more effort than the recent-event or related-event strategies. As a result, this strategy should be relatively common only when participants are given restricted retrieval instructions and are presented with event cues that refer to isolated memories (i.e., memories that are not embedded in event clusters). Previous research has shown that event cues generated in response to word cues are less likely to be part of a cluster than those obtained when participants are asked to recall significant life events (Brown and Schopflocher, in press). This correctly implies that Experiment B (restricted memory instructions, word-cued cueing events) should yield more off-diagonal event pairs than

Experiment C (restricted memory instructions, important-event event cues; Table 1 and Figure 2).

To summarize, large between-experiment differences in the temporal distribution of event pairs appear to reflect the temporal distribution of cueing events, the nature of the retrieval task, and the way that event memories are organized in autobiographical memory. In particular, it seems (a) that the temporal distribution of the cueing events places an upper bound on the percentage of event pairs falling within the recent/old region, (b) that restricted retrieval instructions decrease the percentage of event pairs in the old/recent region, and (c) that factors that increase the percentage of isolated events among the event cues increase the percentage of off-diagonal pairs. More generally, these claims imply that event-pair distributions do not provide a direct reflection of the availability of event memories across the lifespan. Rather, it appears that these distributions are shaped by a variety of interrelated processing and memorial factors. Although similar points were made above in the context of single-event distributions (Figure 1), it was the complex pattern of differences displayed by the event-pair distributions (Figure 2) that obliged us to adopt this complex perspective on cued-memory performance.

CONCLUSION

The event-cueing method was initially devised as a way of studying the organization of autobiographical memories at the event level. To date, experiments using this method have demonstrated that event memories are often embedded in event clusters, and they have produced large systematic differences in the temporal distribution of event pairs. To account for these differences, it has been necessary to adopt an enriched perspective on the cueing task. This perspective assumes that people maintain a pool of recent, mundane events and a pool of older, more important events, and it treats the cueing task as a competition between these two types of events, where the retrieval of an event from one pool or the other is determined by existing associations between cues and event memories, and by current task demands.

Our interpretation of the temporal distributions observed in cueing studies is a marked departure from others that assume that these distributions provide a simple, direct reflection of the availability of personal memories across the life-span. In contrast, our general conclusion concerning the existence and ubiquity of event clusters is consistent with the current consensus on the matter. For example, Bruner has asserted that 'we organize our memory of human happenings mainly in the form of narratives' (1991, p. 4), and many others appear to agree with Robinson's contention that narrative-like structures 'are a primary form of organization in autobiographical memory' (1992, p. 233; see also Barsalou, 1988; Brown, 1990; Conway, 1996; Fivush, 1991; Linton, 1986; Nelson, 1993a,b; Schank and Abelson, 1995). Thus, one contribution of the present research is that it has provided a new methodology for assessing the validity of such claims. In the process, this work has raised a number of issues concerning event clusters that have yet to be investigated. We conclude by considering one of these.

As noted above, we have found that cueing events generally elicit cued events from the same event cluster, and that this is true regardless of the age or importance of the cueing event. These findings suggest that event memories are typically embedded in event clusters, but do not explain why clusters are as common as they are. Our approach to this question begins with the recognition that noteworthy events, even minor ones, do not occur in isolation. Rather, we assume that such events are often caused by prior events and/or spawn subsequent ones, that people perceive causally-related events as episodes in the same meaningful sequence, and that events from a given sequence are likely to share 'story' elements (e.g., participants, locations), and often occur close together in time. We assume further that each experienced event creates a memory trace and that these traces may come to be associated with one another.

We have also implicated (a) simple association, (b) planning, evaluation, and causal reasoning, and (c) narrative processes in the creation, maintenance, and modification of event clusters (Brown and Schopflocher, in press). Briefly, basic memory processes, which create associations on the basis of similarity and contiguity, should promote clustering because episodes that comprise a meaningful event sequence tend to be similar in content and temporally proximate. Planning, evaluation, and causal reasoning, processes which play a central role in intelligent, goal-directed behavior, should also promote clustering. This is because these mental activities require people to understand present and future events in the context of earlier ones. As a result, these processes are likely to facilitate the creation of links between related events even when they are separated in time and interspersed among events from other sequences. Finally, the tendency for people to recount interesting and significant event sequences (i.e., to tell one another stories about their own lives) is likely to affect clustering in two ways. First, the compositional processes required to create a readily understood narrative from a complex set of real-world events should strengthen some pre-existing interevent associations and may give rise to new ones. Second, like spaced rehearsal, the telling or retelling of a personal narrative should impede forgetting.

In summary, the results from a series of event-cueing experiments have allowed us to demonstrate that event clusters play an important role in organizing autobiographical memory, and we have speculated about the environmental factors and cognitive mechanisms that cause people to create and maintain these memory structures. The obvious next step is to investigate these factors and mechanisms in greater detail.

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REFERENCES

Anderson, S. J. and Conway, M. A. (1993). Investigating the structure of specific autobiographical memories. *Journal of Experimental Psychology: Learning Memory, & Cognition*, **19**, 1–19.

Barclay, C. R. (1996). Autobiographical remembering: Narrative constraints on objectified selves. In D. C. Rubin (Ed.), *Remembering our past* (pp. 94–125). New York: Cambridge University Press.

Barsalou, L. W. (1988). The content and organization of autobiographical memories. In U. Neisser and E. Winograd (Eds.), *Remembering reconsidered: Ecological and traditional approaches to memory* (pp. 193–243). New York: Cambridge University Press.
Brown, N. R. (1990). Organization of public events in long-term memory. *Journal of Experimental Psychology: General,* **119**, 297–314.
Brown, N. R. (1993). Response times, retrieval strategies, and the investigation of autobiographical memory. In T. K. Srull and R. S. Wyer (Eds.), *Mental representation of trait and autobiographical knowledge of the self: Advances in social cognition, Vol. V* (pp. 61–68). Hillsdale, NJ: Erlbaum.
Brown, N. R. and Schopflocher, D. (in press). Event clusters: An organization of personal events in long-term memory. *Psychological Science*.
Brown, R. and Kulik, J. (1977). Flashbulb memories. *Cognition*, **5**, 73–99.
Bruner, J. (1991). The narrative construction of reality. *Critical Inquiry*, Autumn, 1–21.
Bruner, J. and Feldman, C. F. (1996). Group narrative as a cultural context of autobiography. In D. C. Rubin (Ed.), *Remembering our past* (pp. 291–317). New York: Cambridge University Press.
Burt, C. D. R., Mitchell, D. A., Raggatt, P. T. F., Jones, C. A. and Cowan, T. M. (1995). A snapshot of autobiographical memory retrieval characteristics. *Applied Cognitive Psychology*, **9**, 61–74.
Conway, M. A. (1996). Autobiographical knowledge and autobiographical memories. In D. C. Rubin (Ed.), *Remembering our past* (pp. 67–93). Cambridge: Cambridge University Press.
Conway, M. A., Anderson, S. J., Larsen, S. F., Donnelly, C. M., McDaniel, M. A., McClelland, A. G. R., Rawles, R. E. and Logie, R. H. (1994). The formation of flashbulb memories. *Memory & Cognition*, **22**, 326–343.
Conway, M. A. and Bekerian, D. A. (1987). Organization in autobiographical memory. *Memory & Cognition*, **15**, 119–132.
Crovitz, H. F. and Schiffman, H. (1974). Frequency of episodic memories as a function of their age. *Bulletin of the Psychonomic Society*, **4**, 517–518.
Fitzgerald, J. M. (1980). Sampling autobiographical memory reports in adolescents. *Developmental Psychology*, **16**, 675–676.
Fitzgerald, J. M. (1988). Vivid memories and the reminiscence phenomenon: The role of a self narrative. *Human Development,* **31**, 261–273.
Fivush, R. (1991). The social construction of personal narratives. *Merrill-Palmer Quarterly*, **37**, 59–82.
Fromholt, P. and Larsen, S. F. (1991). Autobiographical memory in normal aging and primary degenerative dementia (dementia of Alzheimer type). *Journal of Gerontology Psychological News*, **46**, 85–91.
Hirst, W. and Manier, D. (1996). Remembering as communication: A family recounts its past. In D. C. Rubin (Ed.), *Remembering our past* (pp. 271–290). New York: Cambridge University Press.
Kolodner, J. L. (1983). Maintaining organization in a dynamic long-term memory. *Cognitive Science*, **7**, 243–280.
Linton, M. (1986). Ways of searching the contents of memory. In D. C. Rubin (Ed.), *Autobiographical memory* (pp. 50–67). New York: Cambridge University Press.
Nelson, K. (1993a). Events, narratives, memory: What develops? In C. A. Nelson (Ed.), *The Minnesota symposia on child psychology: Vol. 26. Memory and affect in development* (pp. 1–23). Hillsdale, NJ: Erlbaum.
Nelson, K. (1993b). The psychological and social origins of autobiographical memory. *Psychological Science*, **3**, 7–14.
Reisser, B. J. (1983). Contexts and indices in autobiographical memory. Doctoral dissertation (Tech. Rep. No. 24). New Haven: Cognitive Science Program, Yale University.
Reisser, B. J., Black, J. B. and Abelson, R. P. (1985). Knowledge structures in the organization and retrieval of autobiographical memories. *Cognitive Psychology*, **17**, 89–137.
Robinson, J. A. (1976). Sampling autobiographical memory. *Cognitive Psychology*, **8**, 578–595.

Robinson, J. A. (1992). First experience memories: Context and functions in personal histories. In M. A. Conway, D. C. Rubin, H. Spinnler and W. A. Wagenaar (Eds.), *Theoretical perspective on autobiographical memory* (pp. 223–239). Dordrecht, The Netherlands: Kluwer.

Robinson, J. A. and Taylor, L. R. (in press). Autobiographical memory and self-narratives: A tale of two stories. In *The Proceedings of the SARMAC Conference*. Hillsdale, NJ: Erlbaum.

Rubin, D. C. (1982). On the retention function for autobiographical memory. *Journal of Verbal Learning and Verbal Behavior*, **21**, 21–38.

Rubin, D. C., Wetzler, S. E. and Nebes, R. D. (1986). Autobiographical memory across the life-span. In D. C. Rubin (Ed.), *Autobiographical memory* (pp. 202–221). New York: Cambridge University Press.

Schank, R. C. (1982). *Dynamic memory*. New York: Cambridge University Press.

Schank, R. C. and Abelson, R. P. (1995). Knowledge and memory: The real story. In R. S. Wyer (Ed.), *Advances in social cognition, Vol. VII* (pp. 1–85). Hillsdale, NJ: Erlbaum.

Thompson, C. P., Skowronski, J. J. and Betz, A. L. (1993). The use of partial information in dating personal events. *Memory & Cognition*, **21**, 352–360.

Thompson, C. P., Skowronski, J. J., Larsen, S. F. and Betz, A. L. (1996). *Autobiographical memory: Remembering what and remembering when*. Mahwah, NJ: Erlbaum.

Wagenaar, W. A. (1986). My memory: A study of autobiographical memory over six years. *Cognitive Psychology*, **18**, 225–252.

