The Role of Spreading Activation in the Retrieval of Autobiographical Memories

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Abstract

The current study examined the role of spreading activation in autobiographical memory. We employed the Galton-Crovitz cueing technique to assess retrieval times for self-referent information. In Experiment 1, 19 undergraduates retrieved 2 personal memories to 48 target words. It was found that spreading activation occurred in autobiographical memory. It was also found that retrieving autobiographical facts took significantly longer than retrieving autobiographical events. The evidence from Experiment 1 would also indicate that 1) autobiographical facts and autobiographical events are stored in the same memory system 2) availability operates in autobiographical memory. To further test this interpretation, in Experiment 2, 22 undergraduates were presented with target items and asked to recall either as many facts or events as possible in a limited time interval. It was found that while it seems that availability operates differently for facts and events, it does not appear to be a function of category size.

Keywords: Autobiographical Memory, Spreading Activation, Availability, Lag, Category Size, Galton-Crovitz Cueing Technique

1. The Role of Spreading Activation in Autobiographical Memory

The assumption that autobiographical memory is highly organized is no longer debated (Anderson & Conway, 1993; Conway & Pleydell-Pearce, 2000). Two major views are that autobiographical memory may be organized thematically (Anderson & Conway, 1993; Conway, 1992) or categorically (Robinson 1976; Robinson & Swanson, 1990). Theorists have noted that these theories do not necessarily contradict each other. As Conway (1992) pointed out, personal memories may have a complex hierarchical structure that incorporates components of each theory at different levels of the system.

1.1 The Thematic Organization of Autobiographical Memory

The thematic organization model of autobiographical memory suggests that memories are organized in terms of personal themes (Anderson & Conway, 1993; Conway, 1992; Sakaki, 2007). Event-specific knowledge is stored in an autonomous memory store that can be indexed by hierarchically organized thematic knowledge. Event-specific knowledge and personal themes combine in a dynamic fashion to create a personal memory. For example, a person might recall the time he/she took his/her cat to the veterinarian. This event-specific knowledge might be indexed by the personal theme "being a pet owner". Thus, a personal memory is not the strict recollection of event knowledge, but the combination of that knowledge with personal themes that help piece together the memory and give it meaning.

Event knowledge and personal themes are combined through a process of cyclic (or generative) retrieval based directly on Williams and Hollan's (1981) model of autobiographical memory retrieval. In the first phase of this process, a cognitive model is activated on the basis of retrieval cues and task demands. In the second phase, elaboration occurs within this model by searching for information that is relevant to the activated model. Conway (1992) assumes that this process proceeds by spreading activation. Personal information can be thought of as being contained in a semantic network with themes serving as the connections. When a theme is activated, all memories connected by that theme are also activated.

In the third phrase, the memory is evaluated in light of the original cognitive model and task demands. If the memory fails to meet the criteria of either the model or the task demands, then phase two is re-initiated. The third phase acts to verify the information not (necessarily) in terms of veridicality, but in terms of match to the cognitive model. Successive retrievals are undertaken as the memory is constructed. A memory is output from this system when a suitable match is found. Although this model does argue that personal memories are indexed by thematic knowledge, it should be emphasized that this model is much more of a procedural model than it is a structural model. Conway (1992) emphasizes the role of active construction in the memory retrieval process much more than the actual organization of the memories. The thematic model argues that the key to memory organization is not the structure of the memory store, but the way in which the memory store is constructed by the individual.

1.2 The Categorical Organization of Autobiographical Memory

Unlike the thematic model of autobiographical memory, the categorical model does not make the assumption that memories are actively constructed by the rememberer. The central goal of this model is to describe a structural model of the organization of personal memories. The model proposes that personal memories are indexed by general category names. The category name serves as the associative links between the disparate pieces of information. Themes do not necessarily help to actively construct the memories, only connect them. Robinson (1976) investigated this model by gathering memory retrieval times to single word cues. These cues were divided into three broad categories: objects, activities, and emotions. One of the findings Robinson noted was that the retrieval times were significantly shorter for object and activity words than for emotion words. If autobiographical memories are indexed by categories, then the number of events associated with a cue word would directly affect retrieval times. As the number of personal experiences associated with a category increases, the associative strength between the category and each individual experience would decrease. Thus, the long retrieval times for words involving feelings may be a function of category size (Landauer & Freedman, 1968; Robinson & Swanson, 1990).One of the implications of this model is that autobiographical memory retrieval may be influenced by category size. Category size plays an important role in the spreading activation model (Anderson, 1983; Collins & Loftus, 1975). This model suggests that once a category is activated in a network, it makes memories related to the category more accessible. The spreading activation model also proposes that as more nodes in a network are activated, the more likely the activation will diffuse. This diffuse activation would lead to stronger activation of members of a small category and hence to faster retrieval times. While this model is useful in explaining personal memory retrieval, it should be pointed out that it is possible to generate experiments which appear to contradict the model. As was noted by Reiser, Black, and Abelson (1985), very specific cues, such as "went to the cinema and did not find a seat", produced long retrieval times.

One of the more intuitive arguments for the categorical approach to autobiographical memory is that short phrases or single words often act as powerful memory cues in everyday contexts. For instance, the phrase "high school days" conjures up many memories that are readily available. Certain categories, such as the example given, may represent more realistic categories by which people think about their lives. More simply, the cue "high school days" will more readily group event memories than would the cue "table". Categories such as "high school days" may be thought of as representing life themes (Anderson & Conway, 1993; Conway, 1992). As noted above, the thematic model emphasizes the process of generative retrieval through which memories are actively constructed. The categorical model concentrates on how memories may be organized and makes little effort to explain the retrieval process outside of structure. Conway (1992) suggests that these models may complement each other such that the categorical model describes how the base memory system is organized and that the thematic model describes how the memory is retrieved in a coherent fashion.

1.3 Spreading Activation in Autobiographical Memory

One commonality shared by the categorical and thematic models is the reference to spreading activation (i.e., when one memory structure is activated, this activation extends to related memories). In the thematic model, spreading activation is assumed to occur during the second phase of the retrieval process. While the thematic model of autobiographical memory makes the assumption of spreading activation, research assuming the categorical model offers some empirical support for the process. Robinson (1976) manipulated category type and found that emotion word cues led to significantly longer retrieval times than object or activity cue words. He interpreted these results as evidence for spreading activation in autobiographical memory. Robinson inferred that emotion words had larger category sizes than other types of words, thus leading to weaker activation and longer retrieval times.

Although spreading activation is employed in different ways in the two models, its primary function for both models is that it serves as a means to quickly access information about related memories. Facilitating the retrieval of personal memories would therefore serve as evidence that a mechanism similar to spreading activation operates in autobiographical memory (e.g., Mace, 2010). The most common method used to facilitate semantic memory retrieval is priming. For example, by presenting the word "doctor" as a prime, the retrieval of related (target) items such as "nurse" or "hospital" should be facilitated. The amount of facilitation depends upon at least two factors. The first factor is the strength of the association between the prime and the target items. The greater the relation between the two items, the greater the facilitation. The second factor is the number of intervening trials between the prime and the target. This manipulation is also referred to as lag (i.e., the greater the number of intervening trials, the greater the lag). The general finding is that the greatest amount of facilitation occurs if the target is presented immediately after the prime (no intervening trials). This facilitation diminishes as the number of intervening trials increases (see Loftus & Loftus, 1974; McNamara, 1992; Woltz, 2010).

The lag manipulation offers a straightforward test of the hypothesis concerning spreading activation in autobiographical memory. One could ask participants to recall 2 different personal memories for a cue word and retrieval times could be taken for each retrieval. The retrievals for the cue word were either consecutive (no lag) or interrupted by a certain number of memory retrievals unrelated to the cue word (lag). If spreading activation is present, the greatest amount of facilitation should occur when no intervening trials were placed between two related personal memory retrievals. As the number of intervening trials between the memory retrievals increased, the facilitation should diminish. While the lag manipulation addresses the issue of spreading activation in autobiographical memory, it may be that the effects of lag differ for dissimilar memory structures within autobiographical memory. For instance, one might posit that the effects of lag are limited to semantic information and would not influence the retrieval of event information. In order to investigate this possibility, we looked to Brewer's (1986) distinction between autobiographical facts and personal memories. The former represents what is essentially self-related semantic information while the latter refers to event specific information. These differences allow us to test the generalizability of the lag manipulation within autobiographical memory. If the effects of lag differ for personal memories and autobiographical facts, then the hypotheses about spreading activation in personal memory will have to be qualified.

We also chose to investigate this distinction between personal facts and personal events more closely. One supposition that has been made is that semantic and episodic memories are contained in separate systems (Tulving, 1983). A way to investigate the validity of this supposition is to examine the effects of retrieving one memory type on the retrieval of a different memory type. This manipulation, also referred to as a sequence manipulation, has two conditions: same sequence and different sequence. In the same sequence condition, participants are asked for the same memory type on the second memory retrieval as they recalled on the first retrieval for a cue word (e.g., two facts concerning the target "dog"). In the different sequence condition, participants are asked for a different memory type on the second memory retrieval as they recalled on the first retrieval for a cue word (e.g., a fact and an event concerning "dog").

If facts and events are stored in separate systems, the retrieval of one memory type should not affect the retrieval of the second memory type. Conversely, if both facts and events are stored in a (single) common system, then we should see some effects of facilitation as the result of a previous retrieval for a given target word. That is, retrieving information about a target item should affect the subsequent retrieval of additional information about the target regardless of the type of information retrieved. Evidence for spreading activation in autobiographical memory would serve two purposes. First, it would demonstrate the generalizability of the theory to other memory systems. Second, it would affirm the view that autobiographical memory is amenable to the same manipulations and mechanisms as other memory systems. To further investigate the role of spreading activation in autobiographical memory, a sampling method must first be determined. Two considerations were made in this decision. First, we wanted to make the procedure as natural as possible (e.g., recalling personal information). Second, we wanted a procedure that could collect a large number of data points from a single participant in a short span of time. Some studies of personal memory (e.g., Walker, Skowronski, & Thompson, 2003) that are rich in data can often be immensely time consuming.

1.4 Sampling Autobiographical Memory: The Galton-Crovitz Cueing Technique

Galton (1879) proposed an open-ended word technique for studying human memory. This technique involved reading a word to a participant and then recording whatever ideas the word elicited from the participant.

This technique has been modified by Crovitz and Schiffman (1974) for the study of autobiographical memory. The crucial modification was to ask the participant to "think of a specific memory for each word."

The Galton-Crovitz cueing technique has become a highly useful method for studying personal memories (e.g., Arbuthnott & Brown, 2009; Janssen, Chessa, & Murre, 2005). The approach allows the experimenter to have control over memory cues, thus enabling the experimenter to view the effects of semantic category type (Robinson, 1976), category size (Reiser et al, 1985), and personal vs. non-personal cues (Conway, 1987). This method also allowed for different dependent variables to be used in analyzing personal memories including the collection of reaction times (Conway, 1987; Robinson, 1976) and memory details (Anderson & Conway, 1993). While the technique has many potential advantages, it also has its share of problems (Brewer, 1986). For example, many studies have shown that memories for even highly salient events such as the Space Shuttle Challenger explosion or the 911 Terrorist Attacks are often simply wrong (Gibbons, Vogl, Kiefer, Thompson, & Walker, 2008; Talarico & Rubin, 2007). These findings raise legitimate concerns about the veridicality of personal memories. Such procedures have been shown to yield reasonably accurate memories (Brewer, 1994). The Galton-Crovitz cueing technique allows the experimenter to employ manipulations in autobiographical memory that are normally reserved for tasks of semantic memory. An experimenter can examine the effects of repeated memory probes on the same cue word, or the effects of recalling different types of memories about a cue word versus recalling similar types of memories about a cue word.

2. Experiment 1

The first goal of the present experiment was to determine whether facilitation occurs in autobiographical memory when using the Galton-Crovitz cueing technique under varying lag. These data should reflect the general finding in the priming literature: The greater the lag, the less facilitation. This outcome would serve as empirical support for the assumption that spreading activation occurs in autobiographical memory.

The second goal of this experiment was to test the generalizability of spreading activation within different domains of autobiographical memory. If the lag manipulation differentially influences the retrieval of autobiographical facts and events, this finding would suggest that the applicability of spreading activation to autobiographical memory would have to be qualified.

The third goal of this experiment was to examine more closely the distinction between autobiographical facts and autobiographical events. This differentiation made by Brewer (1986) is similar to the episodic/semantic distinction proposed by Tulving (1983). A personal event is a detailed memory for an event that can be placed at a particular location and time. A personal fact refers to more abstract information which cannot be placed in time or space. It has been suggested that these memory types are represented in different memory systems. By using the sequence manipulation (same/different), we can assess the influence of one memory type retrieval on the retrieval of the other memory type. If facts and events are stored separately, retrieval times for facts and events should be different depending on whether they are in the same/different condition. Conversely, if facts and events are stored in one system, retrieval times should be comparable in the same/different conditions for both facts and events.

2.1 Method

2.1.1 Participants. Nineteen undergraduates from a large Midwestern university introductory psychology classes participated in this experiment to fulfill a course requirement. The participants were Caucasians between the ages of 18 and 25.

2.1.2 General design. The experiment utilized a 2 X 2 X 2 within-subjects design. The first factor was memory type. That is, we asked the participant to recall either an autobiographical fact or an autobiographical event.

The second factor was whether the second presentation of the target word cued the same memory type or a different memory type. In other words, in the same sequence condition, participants retrieved two memories of the same type for the same target word (2 facts or 2 events). In the different sequence condition, participants retrieved two memories of different types for the same target word (1 fact, 1 event).

The third factor was the presence or absence of intervening words between presentations of the same target word. There were either no intervening words (no lag) or four intervening words (lag). We chose a lag of four intervening words because this interval usually eliminates facilitation in semantic memory (see McNamara, 1992).

2.1.3 Procedure. We employed the Galton-Crovitz cueing technique to assess retrieval times for self-referent information. Each participant was tested individually. Each participant retrieved 2 personal memories to 48 target words/concrete nouns. These words were randomly chosen from a word pool of high frequency nouns. These items were mixed with 20 non-repeated target words/concrete nouns. Before the test, participants were given the opportunity to practice the memory task with five words not included in the test list.

The experimenter began timing the memory retrieval immediately after orally presenting the memory type (fact/event) and the target word (e.g., the researcher might say "fact" and then "dog"). The experimenter stopped timing when the participant indicated that a memory had been retrieved. At that point, the retrieval time was recorded. The memory recalled by the participant was described to the experimenter in order to verify that the correct memory type had been remembered.

2.2 Results

2.2.1 Data analysis. In analyzing the retrieval time data, we used a within-subjects analysis of variance (ANOVA). Each of the three variables had two levels (fact vs. event, no lag vs lag, and same memory type vs. different memory type). When main effects were qualified by interactions, we report only the interactions. Tukey's HSD was used as a post-test for all interactions. Invalid responses or incidents of "no memory" were coded as missing data. Missing data were replaced with the participant's mean retrieval time for that condition and accounted for less than two percent of the data. The extreme 1% of retrieval times, consisting of those times below 1 s and above 19 s were treated as missing data and also replaced with the participant's mean time for that condition (Ratcliff, 1993).

2.2.2 Retrieving facts and events. Retrieving the second autobiographical fact took reliably longer than retrieving the first fact, while retrieving the second autobiographical event did not take reliably longer than the retrieving the first, $F(1, 18) = 6.01$, $MSE = .33$, $p < .01$, see Figure 1A. These data suggest that recalling successive autobiographical events is easier than recalling successive autobiographical facts. For half the targets participants were asked to retrieve a different memory type on the second retrieval. Retrieving a second memory of the same type took significantly longer than the first retrieval whereas retrieving a second memory of a different type did not, $F(1, 18) = 18.61$, $MSE = 1.10$, $p < .001$, see Figure 1B.

2.2.3 Effects of lag. The lag manipulation was the presence or absence of intervening words between presentations of the same target item. The introduction of the lag significantly increased the retrieval time of the second memory compared to the no lag condition, $F(1, 18) = 6.53$, $MSE = .80$, $p < .01$, see Figure 1C.

2.3 Discussion

2.3.1 Spreading activation in autobiographical memory. Most importantly, the results of Experiment 1 can be used to support the theory of spreading activation (Anderson, 1983; Collins & Loftus, 1975; Mace, 2010) in autobiographical memory. Figure 1C clearly shows that introducing a lag increases the time for the second memory retrieval. We infer that the memory structure is active in the no lag condition and is less active in the lag condition. Evidence of spreading activation has typically been shown in the form of facilitation (i.e., decreased response time). While the second memory retrieval in the present study was never faster than the first memory retrieval, the lag manipulation showed relative facilitation in the second memory retrieval. The memory structure was activated in the no lag condition, and the activation waned with the introduction of intervening trials. Hence these data show relative facilitation between the lag and no lag condition. Given that personal memory retrievals are mediated by availability, relative facilitation is strong evidence for spreading activation.

2.3.2 Facts and events. One of the most powerful effects noted in this experiment was the difference in retrieval times for personal facts and personal events. Events always took longer to retrieve than facts.

2.3.2.1 ***Explanations for differences in retrieval times.*** The difference in retrieval times can be explained in terms of category size. That is, events may index more memories than do facts which would lead to longer retrieval times for events due to diffuse activation. A second, and even more parsimonious explanation, is that events inherently contain more information than facts and thus take longer to retrieve and organize. This possibility is explored in Experiment 2. While we cannot choose among these alternative explanations on the basis of this experiment, the results did show that people had more difficulty retrieving a second fact or second event than retrieving a second memory of a different type. This finding can be framed in terms of memory availability. A reasonable explanation is that people's memories are structured in such a way that once a person's most available memory has been retrieved, a more elaborate search is required to recall a second, and less available, memory.

For example, a person's most available "vacation" memory may be the trip they took to Disney World. After retrieving that particular memory rather quickly a second "vacation" memory may not be quite as available.

2.3.2.2 ***Same or different storage systems?*** Facts and events may be stored within a single memory system or within two disparate systems. According to a two-storage system view, facilitative effects should be more readily seen within a memory system than across memory systems. Framed in terms of the present experiment, a two-store view would predict that the facilitative effects of priming should be noted for the same sequence condition and not the different sequence condition.

The activation of memories in one memory system would not be expected to activate memories in the other system. Conversely, a single-store system would predict that the effects of lag would be the same for both the same and different sequence conditions. The activation of memories in a single store would activate other memories in the same storage system. The effects of lag were the same for both the same and different sequence conditions. Retrieval times in the no lag condition were always faster than in the lag condition and that difference did not change reliably over the same and different sequence conditions. The failure to find a reliable sequence by lag interaction suggests that facts and events are stored in the same memory system. Moreover, the relative facilitation of the lag manipulation was seen for both facts and events across the same sequence and different sequence conditions. If two separate memory systems were involved in retrieving facts and events, one would expect the effects to be DIFFERENT for the sequence conditions. The failure to find a difference suggests that the personal facts and events operate within the same storage system.

The results of Experiment 1 are somewhat contradictory. The results showed that relative facilitation can be achieved using the lag manipulation. Recalling personal facts can facilitate the recall of personal events and vice versa. This finding was used to make the argument that facts and events are represented in the same memory system. However, it is also true that facts are recalled significantly faster than events. Further, subsequent retrievals of facts took relatively longer than subsequent retrievals of events. These findings suggest that facts and events could represent qualitatively different systems. Subsequent memory retrievals always took longer than initial retrievals. This finding was explained in terms of memory availability. If availability operates differently for facts than for events, this could be used as an argument that a distinction should be made between these memory types. It is possible that memory availability and category size may be inexorably confounded (i.e., the larger the category size, the *less* available any one memory is). A more realistic appraisal is that memory availability is influenced by a host of factors including category size, strength of associations, and retrieval verification.

Robinson (1976) found that autobiographical memories recalled by participants for emotions took significantly longer to retrieve than memories for actions or objects. He explained these effects in terms of category size: Emotions indexed more memories than objects or actions, making any single memory more difficult to retrieve. Extending this argument to Experiment 1, it seems reasonable to posit that events, which had relatively long retrieval times, index more memories than do facts. Thus, a participant making an estimate as to how many personal facts or personal events he/she has related to a given target word, the participant should give higher estimates for events than for facts. Such a finding would suggest that availability operates differently for facts and events. If facts and events index a similar number of memories, then category size cannot be used to explain the retrieval time difference between facts and events.

3. Experiment 2

The results of Experiment 1 suggested that availability operates in autobiographical memory. To further test this interpretation, we presented a target item and asked participants to recall either as many facts or as many events as possible in a limited time interval. If availability indeed operates in personal memory, we should expect a greater number of memories to be recalled toward the beginning of the interval than toward the end of the interval. This experiment also gave us the opportunity to investigate the category size of personal facts and personal events. Experiment 1 indicated that recalling a second fact was relatively more difficult than recalling a second event. This would suggest that events form a larger category than do facts. If the category size of facts is smaller than the category size of events, then as the time interval increases, participants should recall *fewer* facts than events.

3.1 Method

3.1.1 Participants. Twenty-two undergraduates from a large Midwestern university introductory psychology classes participated in this experiment to fulfill a course requirement. The participants were Caucasians between the ages of 18 and 25.

3.1.2 General design. This experiment employed a 2 (fact or event) X 3 (1st, 2nd, and 3rd interval) within-subjects design. The first factor was memory type. Participants were asked to recall autobiographical facts or autobiographical events to target words. The second factor was time interval. Participants were given a total of 45 s to recall as many personal memories as they could. The 45 s interval was divided into three 15 s intervals.

3.1.3 Procedure. Participants were tested in groups of 3 to 5. Participants were asked to retrieve as many memories as possible to target words, all nouns. The 40 target words were randomly divided into 5 lists of 8 target words each (no list effects were noted). Target words were presented in written form, one target per page. Participants were given an oral instruction of "fact" or "event" for each target.

This instruction served as the cue to begin recalling the appropriate memories for that target. The recall period was divided into three 15 s intervals. For each memory recalled, participants were asked to write down a word or two to represent the recalled memory. After each 45 s recall period, participants were given 3 min to write descriptions of the memories.

3.2 Results and Discussion

In analyzing the data, we used a within-subjects analysis of variance (ANOVA). Memory type had two levels (fact, event) and interval had three levels (1st, 2nd, 3rd). As can be seen in Figure 2, participants retrieved significantly fewer memories as the interval increased, $F(2, 21) = 59.93$, $MSE = 4.22$, $p < .001$. There was no overall difference between facts and events. However, there was a significant interaction between memory type and interval, $F(2, 21) = 4.09$, $MSE = 1.90$, $p < .05$. Post-tests found reliable differences in the number of facts and events recalled at the first and second intervals. Slightly more facts than events were recalled in the first interval. This result was reversed in the second interval, where more events were recalled than facts. There was no statistical difference in the number of facts and events recalled in the third interval. Recalling successive facts is more difficult than recalling successive events despite the initial advantage facts have over events.

While availability operates differently for facts and events, it does not appear to be a function of category size. The findings of Experiment 2 reject the hypothesis that facts index fewer memories than events. If facts and events have similar category size, why are facts retrieved more quickly than events? This difference could be explained by the fact that event descriptions are typically longer than fact descriptions. To investigate this possibility, we examined the written recall collected in Experiment 2. If events contain more information than facts, one would expect that descriptions for events to be longer than descriptions for facts. A word count was performed on each memory excluding prepositions and conjunctions. Compound words or contractible words were counted as 1 word. These were entered into a one-way analysis of variance (ANOVA) with two levels: Fact and event. Significantly more words were used to describe events ($M = 38.1$) than facts ($M = 22.5$), $F(1, 21) = 26.67$, $MSE = 1.55$, $p < .01$.

4. General Discussion

The lag manipulation in Experiment 1 showed evidence of spreading activation in terms of relative facilitation. While spreading activation has typically been shown in terms of absolute facilitation (Collins & Loftus, 1975), the effects of the lag manipulations were consistent with the effects usually noted with this procedure: The shorter the lag, the greater the facilitation (McNamara, 1992). This finding has two implications. First, these data support the role of spreading activation in the structure autobiographical memory. Second, these data show that autobiographical memory is amenable to the same manipulations as semantic memory. While Experiment 1 showed evidence of facilitation, this facilitation was *relative*. Subsequent memory retrievals almost always took longer than initial memory retrievals indicating that the second memory was less available. This finding was replicated in Experiment 2 in that fewer memories were recalled over subsequent intervals. Availability did interact with memory type in both experiments. These experiments showed that subsequent facts were less available than subsequent events. These findings cannot be explained in terms of category size, since

Experiment 2 found no overall difference in the number of facts and events recalled.

Experiment 1 offered conflicting data on the nature of how facts and events are represented in memory. The finding that events take longer to retrieve than facts is an argument that is commonly used to support the distinction between episodic and semantic memory (Tulving, 1983). Experiment 1 replicated this finding. However, the question remained as to whether this difference represented a qualitative difference in memory types or merely a quantitative disparity.

An analysis of memory descriptors suggests the latter explanation. In sum, events contain more information than facts and therefore take longer to retrieve.More importantly, Experiment 1 showed that the effects of relative facilitation in the no lag condition were consistent in both the same memory type sequence and different memory type sequence conditions (see Figure 1C). Such facilitation would not be expected if event information and fact information were stored in separate systems. This finding is consistent with a single storage system view of memory that is accessed via spreading activation. These results suggest that related memory structures are more readily accessed in the no lag condition. This effect was observed regardless of whether people were asked to remain in the same memory domain (recall 2 facts) or recall different memory types (recall 1 fact and 1 event). In Experiment 1, the second memory recall always took longer than the first. Experiment 2 replicated this finding by showing that fewer memories were recalled across increasing intervals. Even when the memory structures are activated, they are still more difficult to retrieve.Since these experiments show that fact and events are stored in the same memory system, survey research could benefit from sampling from both memory types.

Rather than simply asking for event-specific information, as is usually the case in studies of flashbulb memory for example, a balanced survey would probe related knowledge structures for event-independent information. The suggestion that information should be recalled from many vantage points (in this case, facts and events) is in agreement with techniques such as the cognitive interview (Memon, Meissner, & Fraser, 2010). Further, since repeated memory probes of the same type seem to impede recall, these data suggest that alternating between fact and event probes would yield the best results.

5. Summary

Three main points can be taken from this study. First, evidence of spreading activation can be found in autobiographical memory using the lag procedure. Second, the effects of spreading activation must be tempered by the constraints placed on personal memory retrieval by memory availability. Third, this study found no empirical support for maintaining a distinction between facts and events in autobiographical memory.

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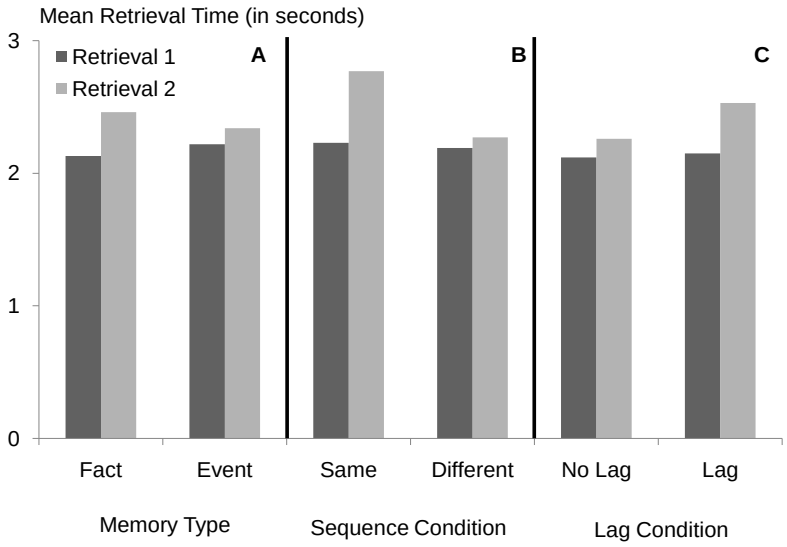

Figure 1. The mean retrieval times for the first and second retrieval attempts for the facts and events (Panel A), the same and different memory types (Panel B), and the no lag and lag conditions (Panel C).

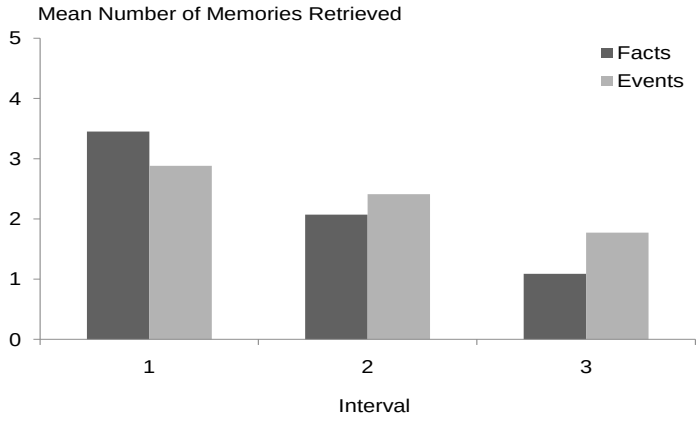

Figure 2. The mean number of memories retrieved in the three intervals for facts and events.