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On the Prevalence of Directly Retrieved Autobiographical Memories

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In this study, we used process measures to understand how people recall autobiographical memories in response to different word cues. In Experiment 1, participants provided verbal protocols when cued by object and emotion words. Participants also reported whether memories had come directly to mind. The self-reports and independent ratings of the verbal protocols indicated that directly recalled memories are much faster and more frequent than generated memories and are more prevalent when cued by objects than emotions. Experiment 2 replicated these results without protocols to eliminate any demand characteristics or output interference associated with the protocol method. In Experiment 3, we obtained converging results using a different method for assessing retrieval strategies by asking participants to assess the amount of information required to retrieve memories. The greater proportion of fast direct retrievals when memories are cued by objects accounts for reaction time differences between object and emotion cues, and not the commonly accepted explanation based on ease of retrieval. We argue for a dual-strategies approach that disputes generation as the canonical form of autobiographical memory retrieval and discuss the implication of these findings for the representation of personal events in autobiographical memory.

Keywords: autobiographical memory, direct retrieval, generative retrieval, memory organization, memory cueing

How do people recall autobiographical memories? The literature provides two answers to this question—answers that correspond to two different research approaches. Psychologists who study involuntary memories tend to focus on *directly retrieved* memories (Berntsen, 1996, 1998; Berntsen & Hall, 2004; Berntsen & Rubin, 2002; Mace, 2004, 2005; Schlagman & Kvavilashvili, 2008). Work on this topic has shown that cues provided by internal and external contexts sometimes combine to trigger an automatic and effortless retrieval of specific autobiographical- events memories. In contrast, researchers who use the Crovitz cue-word method (Crovitz & Schiffman, 1974) and its variants assume that direct retrieval is uncommon (Haque & Conway, 2001). Instead, they stress the importance of either *generation* or *event (re)construction*, and they tend to characterize memory retrieval as a deliberate, effortful, and time-consuming activity (Belli, 1998; Botzung, Denkova, Ciuciu, Scheiber, & Manning, 2008; Burgess & Shallice, 1996; Conway, 1990, 2005; Conway & Loveday, 2010; Conway & Pleydell-Pearce, 2000; Conway, Singer, & Tagini, 2004; Haque & Conway, 2001; Hyman & Loftus, 1998; Norman & Bobrow, 1979; Reiser, Black, & Abelson, 1985; Reiser, Black, & Kalamarides, 1986; J. M. G. Williams et al., 2006; M. D. Williams & Hollan, 1981).

Despite a widespread tendency to equate retrieval processes with retrieval intentions, it has been noted that direct retrieval can occur when participants recall personal memories in response to word cues (e.g., Barsalou, 1988; Berntsen & Rubin, 2004; Brown, 1993; Conway, 1990; Haque & Conway, 2001). Thus, we took the existence of these two retrieval types, direct and generative,[1] as the starting point for our study and designed it to assess the prevalence and impact of direct retrieval when people are required to recall autobiographical memories in response to experimenter-provided cues. Understanding the prevalence of directly retrieved autobiographical memories is important, in part, because it could affect how response times (RTs) are interpreted and, in part, because it could change our understanding of the way personal events are represented in memory. We discuss the RT implications in the next section as a way of explaining the motivation for the three experiments that follow. We leave the representational implications of direct retrieval until the General Discussion.

RT Differences in Cued Retrieval Studies

The autobiographical memory literature includes a number of cued-retrieval studies (Anderson & Conway, 1994; Berntsen & Rubin, 2002; Brown, 2005; Brown & Schopflocher, 1998a, 1998b; Conway, 1990; Conway & Bekerian, 1987; Fitzgerald, 1980;

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[1] As noted previously, *generation* and *(re)construction* refer to different nonretrieval processes. In this article, we rely on the terms *generation* and *generative* when discussing indirect retrieval. This convention has been adopted in part to simplify the exposition and in part because our data suggest that indirect retrieval is more likely to involve cue generation than memory (re)construction. We return to this point in the General Discussion.

Fitzgerald & Shifley-Grove, 1999; Larsen & Plunkett, 1987; Robinson, 1976; Rubin, 1982, 2000; Rubin & Berntsen, 2003; Rubin & Schulkind, 1997a, 1997b; Schlagman, Kliegel, Schulz, & Kvavilashvili, 2009; Schlagman & Kvavilashvili, 2008; Wagenaar, 1986). In many of these, researchers have manipulated the nature of the cues presented to their participants and then measured the time required for participants to retrieve cue-related personal memories. For example, the literature includes several experiments comparing memories cued by object terms (e.g., *book*) with those cued by emotion terms (e.g., *happy*; Conway & Bekerian, 1987; Fitzgerald, 1980; Larsen & Plunkett, 1987; Robinson, 1976). In each case, memories were retrieved more quickly in response to the former than the latter. There are also experiments demonstrating that retrieval is faster when memories are cued by personal periods (e.g., first week of primary school) compared with day-to-day activities (e.g., going to the cinema; Conway & Bekerian, 1987) and faster when cued by day-to-day activities than by general action cues (e.g., finding a seat; Reiser et al., 1985).

As noted earlier, it is typically assumed that people rely on a generative retrieval strategy when confronted with word cues or phrase-length cues. The issue of prevalence is important here because researchers frequently use retrieval times to select between competing representational schemes. For example, Conway and Bekerian (1987) used RTs to argue that personal memories are subsumed by information for lifetime periods rather than by generic event categories. Similarly, Conway and Bekerian (1987) and Larsen and Plunkett (1987) concluded that memories are unlikely to be structured around emotional information because it takes longer to retrieve personal memories when cued by emotion terms than by object terms. The currently accepted explanation for these differences is that generation is easiest when cues readily access cue-related memories through strong associative links compared with cues, such as emotional states, that must be reformulated or embellished before these links can be accessed. This *ease-of-retrieval* account takes for granted that generating memories in response to emotion cues is more difficult and time consuming than generating memories to object cues.

Although it is has become conventional to interpret retrieval times as an index of the effort required to generate a set of effective retrieval cues, there is another way of approaching the same data. This alternative, which we call the *dual-strategies* approach, accepts that generation processes are sometimes required to retrieve autobiographical memories. However, it also recognizes that autobiographical memories can be directly retrieved and that direct retrieval could be much more frequent than previously suggested. It also takes seriously the possibility that this can happen when people recall personal memories in response to experimenter-provided retrieval cues.

According to this view, average RTs are a frequency-weighted blend of two types of responses: fast responses that occur when a memory is directly recalled, and slow responses that occur when generation is required. In this case, overall RTs would depend on the number of direct retrievals within a given set of data. Conversely, averaging over retrieval types, by assuming that memories are always generated, would result in unrepresentative RT values that reflect neither one retrieval strategy nor the other. Furthermore, the dual-strategies position introduces the possibility that RTs associated with different cueing conditions reflect meaningful differences in the frequency of different retrievals processes—and not, as is commonly assumed, differences in the ease of retrieval for a single process.

The prospect that participants use more than one retrieval type complicates the interpretation of RT differences obtained in cued-retrieval studies (Brown, 1993; Lee & Brown, 2004; Siegler, 1987, 1988). It could be that the standard interpretation is correct and that RT differences occur because generation really is more difficult under some conditions than others (e.g., generating memories for emotion terms takes more time than generating memories for object terms). However, for this to hold true, it would also have to be true that (a) generation is equally common in both conditions and that (b) direct retrieval, when it does occur, is no faster in one condition than another.

Of course, if the dual-strategies position is correct, this is only one of several possibilities. For example, it could be that the proportion of (fast) direct responses and (slow) generative responses differs across conditions. Or it could be that generation speed (or direct-retrieval speed) as well as the strategy mix differs between cueing conditions. The only way to select between these possibilities is to determine, for each condition of interest, the prevalence of directly retrieved and generated memories and to assess the retrieval time associated with each strategy across the different cueing conditions.

In brief, there are several reasons for wanting to determine whether direct retrieval is common when people recall personal memories in response to experimenter-provided cues. The present study was undertaken so that we could make this determination. Specifically, we have conducted three experiments. In each, we collected RTs and obtained information about the prevalence of direct retrieval from participants as they recalled autobiographical memories in response to object and emotion terms. In Experiment 1, retrieval strategy was assessed in two ways; participants provided concurrent verbal protocols, and they indicated which retrieval strategy they used by making a selection from a menu. In Experiment 2, we relied on the strategy menus alone. Because self-reported retrieval strategies might be judged by how long it takes to recall memories rather than the actual retrieval process, we introduced a time-independent measure of retrieval type in Experiment 3. These different process measures enabled us to assess the frequency and retrieval times of directly retrieved memories in tasks using the Crovtiz word-cue technique. Taken together, these experiments allowed us to consider the validity of the dual-strategies approach and to determine if the cue-type effect observed in prior studies (Conway & Bekerian, 1987; Fitzgerald, 1980; Larsen & Plunkett, 1987; Robinson, 1976) was caused by differences in strategy mix, differences in ease of generative retrieval, or both.

Experiment 1

Experiment 1 was undertaken with four aims in mind. The first was to gauge the frequency of direct retrieval in a word-cue task; the second was to learn whether people can reliably report information about retrieval strategies; the third was to determine if there is any relationship between cue type and the frequency of direct retrieval; and the fourth was to examine the possibility that differences in RTs associated with cue types are linked to differences in the prevalence of direct versus generative retrieval.

To achieve these aims, we collected three measures; retrieval times, concurrent verbal protocols, and postretrieval strategy reports. On each trial, the participant was presented with a cue word, which was either an object term (e.g., *bag*) or an emotion term (e.g., *happy*) and was required to think aloud (i.e., to provide a concurrent verbal protocol) as they attempted to recall a related autobiographical memory. RT was measured from the onset of the cue word until the participant signaled that he or she had a suitable memory in mind. A strategy report was obtained by asking the participant whether or not the memory had come "immediately to mind."

If participants can accurately determine when memories are directly retrieved (and assuming that word cues sometimes enable direct retrieval), this method should yield two distinct patterns of performance. When an event is retrieved directly from memory, the verbal material in the concurrent protocol should be sparse (or nonexistent), RT should be fast, and the participant should affirm that the recalled memory had come immediately to mind. The opposite should be true for generation; protocols should be verbally elaborate, RT should be slow, and the answer to the retrieval question should be "no."

If generation dominates retrieval as is commonly assumed, then an analysis of strategy usage should indicate that participants used a generative strategy on almost all trials. And if this experiment replicates the standard cue-type effect, then participants should respond more slowly when they generate memories in response to emotion terms than when they generate memories to object terms. In contrast, the dual-strategies position predicts that direct retrieval is at least fairly common and that participants make use of both direct and generative retrieval. As noted previously, this position is capable of accounting for the cue-type effect in several different ways (i.e., direct retrieval more common when the cues are objects; generation slower when the cues are emotion terms; and so on). At the outset of this study, there was no reason to prefer one of these possibilities over any other. Instead, we designed this experiment so that we could make an empirically based selection between the various possibilities.

Method

Participants. Forty University of Alberta undergraduates received course credit for participating (25 females, median age = 20; 15 males, median age = 21). Participants were tested individually in a procedure that took approximately 25 min.

Procedure. Memories were elicited using word cues. Participants were presented with 10 object terms (*automobile*, *book*, *pill*, *bag*, *dog*, *river*, *bread*, *pencil*, *chair*, and *radio*) and 10 emotion terms (*shy*, *surprised*, *bored*, *sad*, *afraid*, *frustrated*, *happy, amused*, *daring*, and *satisfied*). Note that half of the emotion terms were positively valenced and the other half negatively valenced; they were selected from terms that had been used successfully in prior autobiographical memory studies (e.g., Conway & Bekerian, 1987; Robinson, 1976). The cues *automobile* and *shy* were always presented first and second, respectively, and served as practice trials. The remaining cues were presented in random order. On each trial, participants were instructed to recall an autobiographical memory for an event that took place at a specific time and location. Participants were asked to report memories for events directly related to the cue word that did not extend over more than 1 day. They were also instructed to report events that were at least 1 week old in order to avoid the direct retrieval of very recent events. Finally, they were asked to recall only singular events, not repeated activities that could be confused with one another (e.g., going to band practice).

Definitions of direct and generative retrieval strategies were explained in detail at the outset. Participants were told that sometimes memories can be recalled with little or no effort, and may come to mind automatically, and that at other times memories have to be actively searched for in order to be retrieved. It was explained that memories might be immediately triggered by the cue word, but sometimes the participant would have to make a conscious effort by searching memory and using other information in order to recall a suitable memory.

Participants initiated each trial by pressing the backspace key on a computer keyboard, causing a "READY" signal to appear on screen. After 2 s, a cue word was presented, and the RT timer started. While recalling an appropriate memory participants were instructed to think aloud by verbalizing all of their thoughts as they were thinking them. A digital audio recorder was used to record all vocalizations during this phase. As soon as an appropriate memory came to mind participants were instructed to press the spacebar. This stopped the RT timer, erased the cue word from the screen, and presented a response strategy question, "Did this memory come immediately to mind?" Participants pressed either the *Y* key to indicate that the memory had been retrieved suddenly and without apparent effort, implying direct retrieval, or the *N* key to indicate that memory retrieval was effortful and required them to actively search, implying generation. Answering the strategy question caused an input field to appear on screen. Participants then typed a brief description of the memory (~16 words). Pressing the *Enter* key caused the computer to record their responses and to end the current trial. If no appropriate memory came to mind within 90 s of the word cue being presented the computer terminated the trial automatically, and the participant was requested to initiate a new trial when he or she was ready.

Results

We begin by reporting RTs first as a function of cue type to determine whether the expected RT difference between object and emotion cues was obtained. We also report RTs by retrieval strategy to compare the retrieval speeds of direct versus generative retrieval. Next, we examined the overall frequency of direct and generative retrievals. If the currently accepted prevalence of direct retrieval is accurate, then this figure is predicted to be less than 10%. We then breakdown the frequency of direct and generative retrieval as a function of cue type to determine if a dual-strategies perspective can account for the any RT difference between the cues. The dual-strategies account predicts that the direct retrieval will be much faster than generative retrieval and more prevalent when memories cued by objects than when memories are cued by emotions. Alternatively, the ease-of-retrieval account would predict that generative retrieval should, on average, take longer when memories are cued by emotions than objects. In the final section, we provide supporting evidence by comparing the content of the verbal protocols with the participants' self-reported retrieval strategies.

Removal of the two practice trials resulted in potentially 720 trials. However, 16 trials failed to elicit memories within the 90-s time limit. To eliminate extreme outliers, we also removed RT values more than 2.5 standard deviations above or below the mean, leaving a total of 688 analyzable trials. For the purposes of graphing, we report median RTs and have used Bonett and Price's (2002) centrality estimator to calculate 95% confidence intervals around the medians.[2] To draw statistical inferences from the data, we log transformed RT values to deal with positively skewed distributions. We then fitted linear mixed-effects models (LME) using cue type and retrieval strategy as fixed factors, and participants and cue words as random factors. Because inferences based on *t* or *F* distributions (and their associated degrees of freedom) do not apply to LME models, only the relevant beta weights and probability values will be reported throughout this article. Our *p* values were bootstrapped using Markov chain Monte Carlo (MCMC) simulations ($n = 10{,}000$). All main effects and two-way interactions were examined with a stepwise variable elimination method. Taking this approach allowed the variation in random effects to be disambiguated from variation in our fixed effects, meaning that cue words that elicit more direct retrieval than cues and participants who are more likely to directly retrieve memories than other participants have been controlled. Using LME model fitting also permitted us to make legitimate comparisons across the all three experiments.

Cue types and retrieval strategy RT. As predicted from prior studies, memories cued by object terms were recalled 2.8 s faster than those cued by emotion terms (Figure 1). The result of the LME analysis indicated a unique effect of cue type on RT ($b = 0.18$, $p < .01$). A difference as large as 2.8 s was sufficient to permit a strategies-based decomposition of the difference in RTs between cue types and to perform a test of the different explanations for this effect.

Analysis of the strategy reports showed that direct retrieval was more than three times faster than generative retrieval ($b = 1.14$, $p < .01$), as illustrated in Figure 2. An effect size of this large magnitude gives credence to the idea that multiple strategies could confound the interpretation of RTs in cued recall experiments—especially if the amount of direct retrieval differs as a function of cue type. Figure 3 shows the frequency distributions and cumulative distributions for RTs as a function of retrieval strategy. These data indicate that the speed of directly retrieved and generated memories is characterized by two different distributions, albeit with some degree of overlap. This, in turn, suggests that the participants were able to distinguish memories that spring immediately to mind from those that had to be actively searched for with some effort.

The LME analyses indicated there was no significant interaction between cue type and retrieval strategy. Direct retrieval, when it occurred, was equally fast for both object and emotion cues. At the same time, generated memories were equally slow under each cueing condition. The absence of any difference in the speed of generation implies that generation is no more difficult when memories are cued by emotions than when they are cued by objects and argues against an ease-of-retrieval account for cue-based differences in overall RT.

Strategy prevalence and cue types. The overall prevalence of self-reported direct retrieval, irrespective of cue type, was 60%. This figure is over seven times the frequency of direct retrieval reported by Haque and Conway (2001) and does not concur with the notion that generation is a default strategy for recalling autobiographical memories or the idea that direct retrieval is rare in memory tasks using the word-cue technique.

The critical analysis, from the dual-strategies perspective, was whether memories cued by object terms are more likely to be directly retrieved than those cued by emotion terms. When cue types are taken into account, objects were found to elicit direct retrieval on 13% more trials than emotion cues (Figure 4). We confirmed a main effect of cue type using a mixed-effects logistic regression conducted on the log of the ratio of direct and generative retrievals ($b = 0.65$, $z = -3.39$, $p < .01$). Although a 13% difference appears modest, the 10-s difference in RT between retrieval types suggests that significant biases can occur even when differences in strategy mix are fairly small.

From this analysis, it appears that direct retrieval is considerably more common in word-cueing tasks than has previously been considered. Moreover, the dual-strategies prediction that a higher proportion of faster, directly retrieved memories accounts for the differences in RT between cue types—because object cues elicit more directly retrieved memories than emotional cues. The ease-of-generation account, on the other hand, fails to explain the RT data, given that the speed of generation did not differ as a function of cue type.

Verbal protocols and retrieval strategies. If this interpretation is correct, then an examination of the verbal reports should also lead to the same conclusions. When memories are directly retrieved; verbal content should be unrelated to retrieval, meager, or most likely nonexistent; and RTs should be fast. When memories are generated, the verbal record should be germane to the retrieval of appropriate memories, relatively detailed, and RTs should be comparatively slow.

Initially, a team of coders attempted to predict retrieval strategies on each analyzable trial on the basis of the content of verbal protocols alone. The coders listened to each verbal report and independently judged if memories had been directly retrieved or generated, while blind to how participants had answered the response strategy question. When coders disagreed, a consensus decision was settled on after a period of joint discussion. We then compared the degree of concordance between the coders' final judgments and our participants' self-reported strategy. The result indicates that coders could consistently predict response strategies from the verbal reports ($\kappa = .82$). Concordance implies that participants were capable of answering the response strategy question reliably and that their verbal protocols were an accurate reflection of their strategy reports.

Next, we examined the protocols to see how their contents differed as a function of the participants' self-reported retrieval strategy. A two-category coding framework was developed to distinguish between responses involving verbal output indicative of overt thinking, searching, or elaboration, and responses that did not (for examples of coded protocols, see Table 1). The first category, which we call *Vocalizations Indicating Search*, included

[2] Confidence intervals that mix within- and between-subject responses are not valid for drawing inferences regarding statistical probability and are used here only to illustrate the variability within these data. Instead, we employ linear mixed-effects models to infer statistical differences.

Figure 1. Median reaction times by cue type. Exp. = experiment.

(a) expressions associated with generative retrieval, such as descriptions of the search process, (b) task-related vocalization, such as comments about the cue words, comments about the participants themselves, or comments about other aspects of the task, and (c) utterances that might imply nonarticulated thinking (e.g., "Umm . . . Ah . . .").

An alternative category, which we have called *Silent/Vocalizations Without Search*, was evoked when participants were either silent during retrieval or when they made vocalizations unrelated to memory search or the task in general. This category was used to imply direct retrieval and included the complete absence of any vocalization prior to recollection. The category Silent/Vocalizations Without Search was also used when participants suddenly retrieved memories without any verbal report but followed this up by a postretrieval description of the memory content itself. In these instances, retrieval seemed to occur before vocalization took place. We also assigned this category when participants failed to retrieve an event immediately but remained silent for a short period of time. First, each verbal report from a randomly selected subset of eight participants was assigned to one or the other of the response categories. Next, reliability measures were calculated between our coder's category assignment and the participant's self-reported retrieval strategies. The result was a robust level of inter-rater agreement ($\kappa = .85$).

Table 2 presents the frequency of coder ratings for protocol content as a function of the participants' self-reported retrieval strategy. Protocols coded as Silent/Vocalizations Without Search were associated with participants' self-reported direct retrieval, while protocols coded as Vocalizations Indicating Memory Search were most likely to be associated with self-reported generative retrieval, $\chi^2(1, N = 688) = 467.93$, $p < .001$. These data support the contention that direct retrieval typically occurs with an absence of overt thinking. Conversely, generative retrieval is very likely to involve vocalizations associated with memory search, cue elaboration, and/or the use of additional task-relevant information.

Once more, these results indicate that people are able to both recognize and report how their memories are recalled. Table 2 shows that this pattern of results holds when memories are cued by object terms, $\chi^2(1, N = 348) = 214.07$, $p < .001$, and also when they are cued by emotion terms, $\chi^2(1, N = 340) = 250.05$, $p < .001$.

Discussion

By measuring memory retrieval strategies both directly through self-reports and indirectly through verbal protocols, we were able to assess the prevalence and speed of directly retrieved and generated autobiographical memories. This allowed us to compare the ease-of-retrieval explanation for RT differences to different cues with a dual-strategies account. One possibility recognized by the dual-strategies position was that there might be a greater proportion of faster direct retrievals when memories are cued by objects than when they are cued by emotions. The alternative, standard interpretation predicted that the proportion of direct retrievals would be too low to effect omnibus RTs and, more specifically, that generated memories would be slower when memories were cued by emotion terms than by objects, reflecting greater difficulty

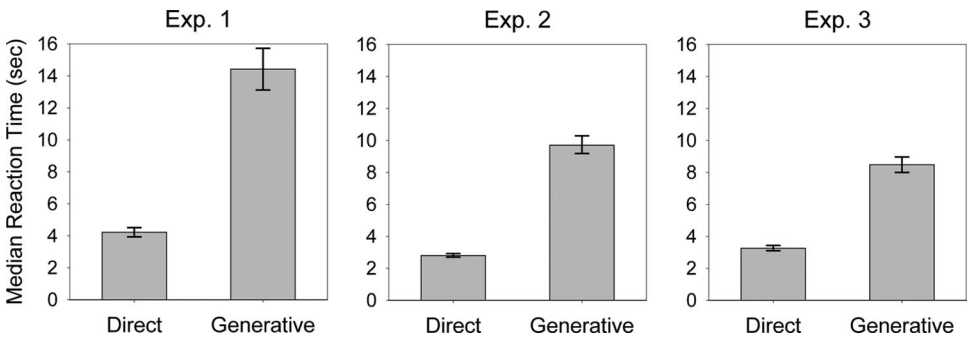

Figure 2. Median reaction times by retrieval strategy. Exp. = experiment.

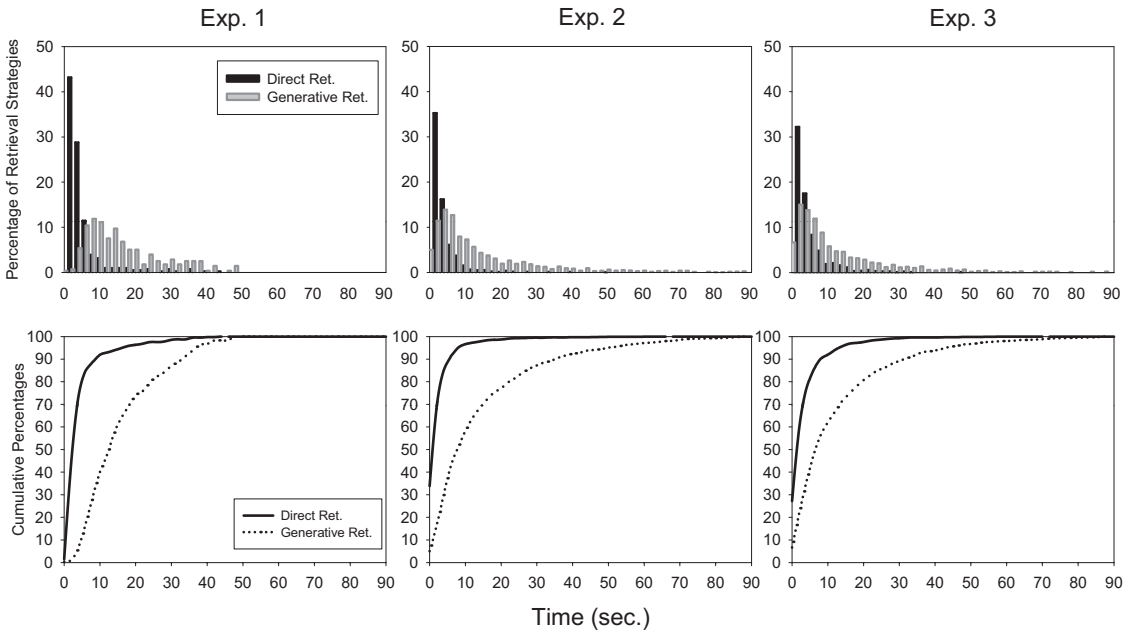

Figure 3. Reaction time frequency distributions (top) and cumulative distributions (bottom). Exp. = experiment; ret. = retrieval.

in generative retrieval. However, no evidence for the standard interpretation was found.

We conclude that memories are produced by two independent retrieval strategies and that direct retrieval of autobiographical memories is more frequent than is currently accepted. When we decomposed the RTs as a function of response strategy, we found that the difference between RTs as a function of cue types could be readily explained by differences in the proportion of directly retrieved and generated memories—each weighted by very different processing speeds. In other words, overall RTs were a weighted blend of fast direct retrieval and slower generative retrieval and that object cues tended to elicit more direct retrieval than emotion cues.

Experiment 2

In Experiment 1, we collected verbal protocols, RTs, and strategy reports using a straightforward Crovitz word-cue task. Although these measures converge on the same conclusions, this does not rule out the possibility that the think-aloud protocols could have *reacted* with the respondents' self-reported retrieval strategies (Ericsson & Simon, 1993). On one hand, respondents may have felt compelled to offer verbal justifications in reply to our request for think-aloud reports. In which case, participants might have searched or elaborated more often than if they had been allowed to complete the task in silence (Nisbett & Wilson, 1977; Russo, Johnson, & Stephens, 1989; Wilson, 1994). On the other hand, some participants may have been reluctant to disclose personal information in the presence of a stranger, resulting in a bias for nonverbalization and the underreporting of generative retrieval. To address these possibilities, participants in Experiment 2 performed the same cued recall task silently and alone, providing us with the prospect of eliminating potential task demands and reactive effects associated with the protocol method.

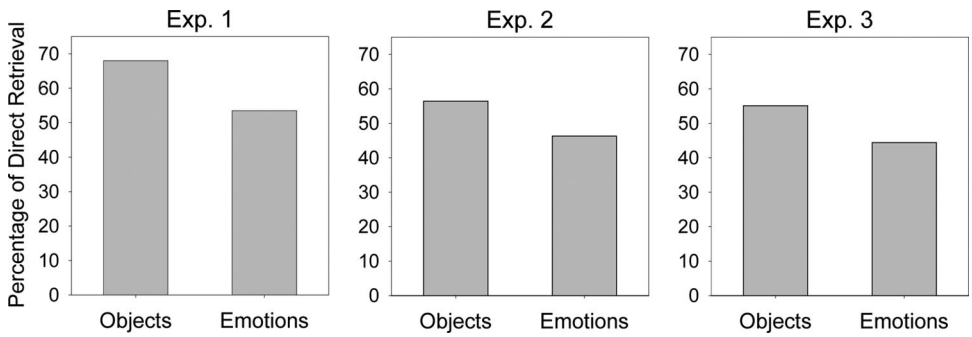

Figure 4. Percentage of direct retrieval by cue type. Exp. = experiment.

Table 1
Examples of Categorized Protocol Responses

Vocalizations Indicating Search
Verbalization of search process (cue: *frustrated*)
"I'm just thinking about anything that I did in school passed a little while with regards my grades . . . umm, I'm thinking about work . . . umm thinking about trips that I want but didn't go on, thinking about things that I wasn't able to attend that I said I would . . . hmm." [Participant then presses the spacebar.]
Task-related verbalization (cue: *surprised*)
"Hmm . . . I am not . . . usually I am not very surprised at things. I am usually prepared for most of the things that happen. Probably at movies but not in real life, so I think." [Participant then presses the spacebar.]
Utterances (cue: *chair*)
"Ummm . . . Hmm . . . Aaaammm . . . Ummm, chair, OK." [Participant then presses the spacebar.]
Silent/Vocalizations Without Search
Nonverbalization (cue: *bored*)
[Almost immediately after reading the cue word, the participant presses the spacebar.]
Verbalization of the reported memory (cue: *pill*)
"The last time I took a pill [At this moment, the participant presses the spacebar] was last Monday because I had a headache so I took a pill before going to bed."
Staying silent (cue: *frustrated*)
[After being silent for a short period of time, the participant presses spacebar.]

In Experiment 1, we only asked participants to decide whether memories had come immediately to mind. We anticipated that directly retrieved memories would elicit positive responses and that generative retrieval would elicit negative responses. Our aim was to present a question that did not directly refer to generative processes, such as search or elaboration, in order to focus on the characteristics of direct retrieval. However, this raises the possibility of a confirmation bias, with participants biased towards affirmation. We addressed this methodological concern by modifying the retrieval reporting format. In a *direct-only* condition, a third of participants received the same strategy question as Experiment 1. In a *generate-only* condition, a third of participants were asked to decide if they had "actively searched in order to find a memory" and to respond with either "yes" or "no." We expected that affirmative responses to this question would reflect generative retrieval and negative responses direct retrieval. The final third of our participants, in a *direct-and-generative* condition, were asked to choose between both retrieval strategies. Using the same terminology, we asked participants to decide if memories had come "immediately to mind" or if they had been "actively searched for;"; if neither of the strategy options applied or the respondent could not decide conclusively between them, we asked them to select, "I cannot decide between the two options listed above."

Table 2
Distribution of Experimenter-Rated Retrieval Strategies by Participants' Self-Reported Strategies: Omnibus and Cue Type

	Direct		Generative	
Variable	*N*	%	*N*	%
Omnibus				
Silent/Vocalizations Without Search	361	52	12	2
Vocalizations Indicating Search	49	7	266	39
Total	410		278	
Object cues				
Silent/Vocalizations Without Search	202	58	8	2
Vocalizations Indicating Search	28	8	110	32
Total object cues	230		118	
Emotion cues				
Silent/Vocalizations Without Search	159	47	4	1
Vocalizations Indicating Search	21	6	156	46
Total emotion cues	180		160	

This direct-and-generative condition served two important control functions. First, if people can accurately identify and report different retrieval strategies, then the proportion of direct and generative retrievals should not differ between the direct-and-generative reporting format (that requires the respondent to select between alternative options) and the other two reporting conditions (which requires either affirmation or negation). Second, allowing for nonresponse or indecision permitted us to explore the possibility of additional retrieval strategies and to test the validity of our strategy menus. If participants are not, in fact, capable of distinguishing between direct and generative retrievals, if the responses analyzed in Experiment 1 are not drawn from two distinct populations as we have claimed, and if the prevalence of direct retrieval in Experiment 1 is an artifact of how the strategy questions are phrased, then the prevalence of indecision responses should be high.

Method

Participants. Three hundred University of Alberta undergraduates participated for course credit (151 females, median age = 18; 149 males, median age = 18). Participants were tested individually in sessions lasting approximately 20 min.

Procedure. The procedure was the same as the one used in Experiment 1, with three differences. First, participants were not required to provide verbal protocols when retrieving memories. Second, participants were tested in solitude. Third, we manipulated the retrieval strategy question. In the direct-only condition, the retrieval strategy question was identical to that in Experiment 1, with participants pressing the *Y* key to indicate direct retrieval, or the *N* key, which implied generative retrieval. In the generate-only condition, participants pressed either the *Y* key to indicate that the memory had been generated or the *N* key, implying that the memory had been directly retrieved. In the direct-and-generative condition, participants were asked, "How did you retrieve this memory?" and shown a response menu that asked them to choose

one of three options buttons using the computer mouse: (a) "The memory came almost immediately into mind"; (b) "I actively searched to find a suitable memory"; or (c) "I cannot decide between the two options listed above." Participants in this condition were instructed to choose option (c) only if they were uncertain how their memory had come to mind or when they felt that the alternative options failed to account for their retrieval experience.

Results

With the practice trials removed, there were potentially 5,400 trials. However, 208 cues failed to produce memories within the 90-s time limit. In the direct-and-generative condition, only 6% ($n = 95$) of trials resulted in indecision responses, implying that on 94% of trials, these participants were capable of distinguishing between direct and generative retrieval by selecting corresponding responses from the options menu. To make valid comparisons among the three strategy reporting formats, we eliminated these indecision responses from further analyses. An additional 48 observations with RTs equal or greater than 2.5 standard deviations away from their strategy type group means were also excluded, leaving 5,049 analyzable trials.

We executed the same analyses as in Experiment 1, with the exception of adding the three strategy reporting formats as another fixed factor in the LME analysis. We fitted an LME regression model using log RT as the dependent variable, with cue type, retrieval strategy, and strategy question format as fixed factors, and individual participants and cue words as random factors. Similar to Experiment 1, we investigated all main effects and two-way and three-way interactions using a stepwise variable elimination method. Predictors that did not turn out to be significant were therefore removed from the model fit.

Cue types and retrieval strategy RT. Before conducting our primary analysis, we checked for differences in the omnibus RTs and RTs for both direct and generative retrievals as a function of the three strategy reporting formats. None of these tests proved significant, indicating that neither the speed of direct retrieval nor generative retrieval was biased by response format. However, it was noted that overall RTs had decreased by about 25% compared with Experiment 1 but that this decrease applied equally to both directly retrieved and generated memories. It appears that producing verbal reports had either increased cognitive load or perhaps sporadically diverted attention away from the act of retrieving memories or otherwise influenced the retrieval process in a way that inflated overall RT. However, the effect in Experiment 1 appears unbiased in respect to retrieval strategy.

Once again, object-cued memories were retrieved significantly faster than those cued by emotions, with a difference of 1.9 s between the median RTs for each cue type ($b = 0.27$, $p < .01$, see Figure 1). In terms of retrieval strategies, a similar three-fold difference in RTs between direct and generative retrieval was observed ($b = 1.20$, $p < .01$). Figure 2 shows a substantial main effect of retrieval strategy on RTs that is almost as large as the one obtained in Experiment 1. The frequency and cumulative frequency distributions described in Figure 3 also indicated that these data were drawn from two different strategy populations. No interaction between cue type and retrieval strategy was found by the LME analysis, which would be predicted if direct retrieval was equally fast and generation was more difficult under emotion cues than object cues. On the other hand, the dual-strategies perspective does predict the absence of an interaction since the different retrieval processes are assumed to be unaffected by the cues that evoke them. More important, this approach also predicts that the prevalence of direct retrieval should be higher when memories are cued by objects than by emotions and that the three-fold difference in speed of retrieval accounts for the cue-type difference in RTs.

Strategy prevalence and cue types. The percentage of directly retrieved memories again was found to be much higher than is typically assumed and also greater when memories are cued by object terms (56% in direct-only condition; 55% in generate-only condition; 57% in direct-and-generative condition) than when they were cued by emotion terms (47% in direct-only condition, 47% in generate-only condition; 43% in direct-and-generative condition). We fitted a logistic mixed-effects model using frequency of direct retrievals as a dependent variable, cue type and strategy question as fixed variables, and subjects and cue words as random factors. This analysis showed a significant main effect of cue type on the prevalence of strategies type ($b = -0.41$, $z = -1.98$, $p < .05$). This cue-type difference in retrieval strategy can be seen in Figure 4.

Discussion

In Experiment 2, we excluded the verbal protocols to prevent the possibility of reactivity between task requirements and the participants' strategy responses. We also extended the reporting format to test for confirmation biases and to provide converging evidence for the credibility of self-reported strategies. These changes resulted in an overall decrease in RTs compared with Experiment 1, which appears to reflect a reduction in cognitive demand associated with verbal protocols. These data also showed that the prevalence of direct retrieval cannot be attributed to a confirmation bias to the retrieval questions, since no differences were found when the meaning of the questions was reversed or when both retrieval strategies were presented simultaneously.

In all other respects, the results supported the conclusions we drew from Experiment 1 by showing again that direct retrieval is much faster and at least as common as generative retrieval. Experiment 2 also replicated the dual-strategies prediction that object-cued memories were faster to retrieve than emotion-cued memories and that this RT difference occurred because object cues were more likely to evoke more direct retrieval than emotion cues. No evidence was found for an ease-of-retrieval difference between object-cued and emotion-cued memories, irrespective of how those memories were recalled.

Experiment 3

In the previous studies, direct retrieval was described as instances where memories came immediately to mind and generative retrieval as a process involving purposeful search. However, concepts of *time* and *effort* implied by these definitions might have evoked responses that reflect how participants decide to answer the retrieval strategy question, rather than the retrieval process itself. For example, participants could base their answers on perceived retrieval times rather than the phenomenological characteristics of retrieval. So if memories came to mind relatively quickly, participants may have then judged the retrieval process as immediate,

which we have taken to mean direct retrieval. Conversely, when retrieval was perceived as relatively slow, participants may have treated the retrieval process as effortful by comparison, irrespective of how the memories were actually recalled. Therefore, asking people about retrieval processes in a straightforward way could potentially confound time and effort with self-reported retrieval strategies.

To overcome this possibility, instead of asking participants to consider time or effort, we asked them to tell us about *information* use during retrieval. The rationale was to measure a different, yet defining, characteristic of autobiographical memory retrieval that would still allow us to distinguish between retrieval types. This characteristic is definitive because of a long-standing consensus that generative retrieval involves searching for and using personal information from one's own life (Burt, 1992; Conway & Pleydell-Pearce, 2000; Conway et al., 1999; Reiser et al., 1985). For example, recalling the people we know, activities we have engaged in, familiar objects, or places that we frequent can often serve as contextual cues that allow us to access specific events and forms the basis of memory generation (Barsalou, 1988; Burt, 1992; Lancaster & Barsalou, 1997; Wagenaar, 1986). In contrast, the involuntary memory literature indicates that direct retrieval does not involve the recollection of supporting information because the event comes straight to mind.

In Experiment 3, participants were asked to decide if they had accessed additional information during recall, which implies generative retrieval, or whether the memory was retrieved without recalling additional information, which implies direct retrieval. If the proportions of direct and generative retrievals are found to be equivalent to those reported in Experiment 2, and if the same RT differences are observed, we could conclude that our participants were not confounding time and effort with memory retrieval during Experiments 1 and 2. Moreover, we would also conclude that the distinction we have made between the direct and generative retrieval of autobiographical memories is a genuine one.

Method

Participants. Two hundred and two University of Alberta undergraduates participated for course credit (112 females, median age = 18; 90 males, median age = 19). Participants were tested individually, each session lasting approximately 20 min.

Procedure. The procedure and materials were the same as used in Experiment 2, but with the strategy choice question adapted to reflect the accessing and use of personal information during recall. In a *no-information* condition, participants were presented with a statement saying, "This memory was triggered by the cue word, so I did not have to use information about my life to help me recall this memory." Participants pressed either the *Y* key, which we inferred to be a directly retrieved memory, or the *N* key, which we inferred to be a generative retrieval. Participants in an *information* condition were presented with the statement, "This memory wasn't triggered by the cue word, so I had to use information about my life to help me recall this memory." They pressed either the *Y* key to indicate that they had used additional information to recall the memory (generative retrieval) or the *N* key, implying they had used direct retrieval.

Results

Four percent of cues failed to elicit memories in the allotted time ($n = 131$). A further 56 outlying values (0.16%) were also removed, leaving 3,449 analyzable trials. In other respects, our analysis is equivalent to the one in Experiment 2.

Cue types and retrieval strategy RT. Overall RTs and frequency of direct retrieval were consistent across the two forms of the strategy question, indicating that our dependent variables were not biased as a function of question format (information vs no-information). This was supported by nonsignificant effects of question format on either RTs or strategy frequencies.

In line with the two previous experiments, a robust main effect of cue-type on RT was observed with object-cued memories being retrieved about 1.5 s faster than emotionally cued memories ($b = 0.21$, $p < .01$. See Figure 1). RTs for retrievals that involved the accessing and use of personal information, a hallmark characteristic of generative retrieval, were more than 5 s slower than memories that did not involve the recall of task-relevant information ($b = 0.90$, $p < .01$). More important, the pattern of RTs for direct and generative retrievals closely replicates the pattern and effect size obtained in Experiment 2 (Figure 2). Frequency distributions for RTs as a function of retrieval strategy shown in Figure 3 once again suggest that these data are drawn from different populations and that this distinction still holds when references to time and effort are eliminated from the procedure's instructions. This indicates that the participants are basing their self-reports on the experience of memory retrieval rather than on judgments based on time or effort. Again, no significant cue by strategy type interaction was found, and no effect of cue type on the generative RTs that would indicate any differences in ease of retrieval was found.

Strategy prevalence and cue types. The frequency of direct retrieval replicated the pattern of results obtained in Experiment 2 (Figure 4), with object cues eliciting 11% more direct retrieval than emotion terms. Once again, the data support the contention that direct retrieval is very common (>50%) when participants are deliberately cued to recall autobiographical memories. As before, direct retrieval was more common when memories were cued by object terms than when cued by emotion terms. A logistic mixed-effects model analyses confirmed that object terms are more likely to be associated with direct retrieval than emotion terms ($b = -0.47$, $z = -2.69$, $p < .05$).

Discussion

We conjectured that asking participants to consider whether retrieval was time-consuming or effortful might have conflated our timing measures with self-reported retrieval strategies. We addressed this issue by changing the strategy reporting format; in this experiment, we asked participants to gauge whether or not task-relevant information played a role in the retrieval process. Since accessing and using additional information is a characteristic of generative retrieval, but not direct retrieval, we were able to measure the speed and frequency of direct versus generative retrieval without asking our participants to consider either time or effort. These results replicated those reported in Experiment 2 and indicate that direct retrieval is very common in cued autobiographical memory tasks. Indeed, it seems that direct retrieval is at least

as common as generative retrieval. Once again, we found that memories cued by objects were retrieved faster than those cued by emotion terms. Furthermore, this difference can be accounted for by a dual-strategies perspective, which accurately predicted that the amount of direct retrieval would be greater when memories are cued by objects than when memories are cued by emotions. With this modified procedure, we still failed to find RT differences that would suggest an ease-of-retrieval explanation for the robust cue type RT difference reported here.

Of course, we cannot completely rule out the possibility that respondents were unable to report having used task-relevant information, especially if some memories were recalled too quickly to be assessed in the prescribed way. If this were the case, our measures might underestimate the prevalence of generation because very fast generated responses might appear to the participants to have been directly retrieved.

There are three reasons for rejecting this alternative account. First, generation is typically characterized as requiring effortful search and evaluation processes. It seems reasonable to assume that respondents are aware that this effort is being made and therefore are capable of reporting the evaluation of task-relevant information. Second, generation is unambiguous in regard to the phenomenological experience of recollection, insofar that the process is necessarily declarative in nature (e.g., Ericsson & Simon, 1993) and requires executive control in order to regulate search (Berntsen, 2010). Lastly, the ability to articulate the contents of memory during the act of remembering has been used extensively as evidence for generative retrieval (e.g., Haque & Conway, 2001; Norman & Bobrow, 1979; Reiser et al., 1986; M. D. Williams & Hollan, 1981). It seems inappropriate that the absence of any declarative content can also point to the same conclusion.[3]

General Discussion

This project was undertaken with two goals in mind. The first was to explore the possibility that direct retrieval can occur when memories are deliberately sought and to measure the prevalence of direct retrieval for voluntarily recalled memories, should they exist. Our second goal was to compare a commonly accepted ease-of-retrieval account for RT differences to different cue types with a dual-strategies account that emphasized the prevalence of both direct and generated memories. We approached these questions using three converging methods, each designed to differentiate direct from generative retrievals: concurrent verbal reports, retrieval times, and finally a measure of information use during retrieval. Across three experiments, we found that autobiographical memories were recalled by two different retrieval mechanisms—a fast and direct retrieval route, which seems effortless and nonstrategic, and a slower generative route, which includes searching memory for task-relevant information. It is important to note that we also found that direct retrieval was at least as common as generative retrieval. This finding argues against a commonly held belief that personal memories are usually generated in tasks that use the Crovitz word-cueing task (Conway & Pleydell-Pearce, 2000; Haque & Conway, 2001; Rubin & Schulkind, 1997a, 1997b; cf. Conway, 2005; Reiser et al., 1986).

Across these experiments, we also replicated the classic cue-type effect: on average, participants were slower at retrieving autobiographical memories when they were cued with emotion terms than when they were cued with object terms (Conway & Bekerian, 1987; Fitzgerald, 1980; Larsen & Plunkett, 1987; Robinson, 1976). We were able to decompose this effect by showing that participants were more likely to use direct retrieval when they were cued with objects than when they were cued with emotions, whereas no RT differences were found for either directly retrieved or generated memories as a function of cue type. Therefore, these experiments provide no evidence that memories are harder to generate with emotion cues than with object cues.

One way to account for these results is to assume that direct retrieval in a voluntary context takes place only when a cue is closely associated with a particular event memory and that the goal of generation is to identify potential useful cues (i.e., generate to find cues directly linked to an event memory). According to this view, generation is a back-up strategy (Siegler & Jenkins, 1989) that can be used when the current cue fails to directly access an appropriate memory. In the same way that experimenter-provided cues sometimes fail to access retrievable event memories, participant-generated cues may also fail at the first attempt. Thus, several iterations through the generation–evaluation process may be required before a cue, or set of cues, succeeds in accessing a specific memory (Norman & Bobrow, 1979).

This account implies that it was common for the cues used in these experiments to be closely associated with specific event memories. By the same argument, the difference in the frequency of direct retrieval as a function of cue type implies that the object terms used in these experiments were more likely to be closely associated to event memories than were the emotion terms. In other words, consistent with prior research (Conway & Bekerian, 1987; Fitzgerald, 1980; Larsen & Plunkett, 1987; Robinson, 1976), this study indicates that event memories are more likely to be indexed by concrete information than by abstract concepts such as feelings.

The fact that people often use direct retrieval under conditions that elicit voluntary memories raises questions about the nature of voluntary versus involuntary memories. On the one hand, involuntary memories, by definition, must be directly retrieved because generation requires active control over memory search. On the other hand, recalling voluntary memories draws on both direct and generative retrieval, indicating that direct retrieval is (in part) independent of retrieval intentions. This implies the existence of relatively stable event representations and enduring associations that link memory representations to concepts that ground them in meaning and index them for retrieval. If generation is a back-up strategy for identifying task-relevant cues, then all autobiographical recall can be viewed as terminating in direct retrieval. In this view, the only difference between direct and generative retrieval is that generative search processes precede direct recall due to a dearth of effective cues. This conclusion is consistent with Berntsen (2009, 2010), who argued that both voluntary and involuntary retrieval processes access the same underlying event representations and that these representations are all created by the same

[3] Perhaps methods that collect behavioral data will inevitably conflate RT with self-reports. However, converging evidence for a distinction between direct and generative retrieval might be obtained from neurological correlates, such as functional MRI data, collected under experimental conditions similar to those described in Experiments 2 and 3.

encoding processes. Furthermore, both Rubin and Berntsen (2009) and Rasmussen and Berntsen (2011) have claimed that involuntary memories come to mind at least as frequently as voluntary memories. It is therefore reasonable to suggest that the direct retrieval observed when people deliberately recall personal memories is functionally identical to the retrieval processes involved when involuntary memories spring to mind.

Our data suggest that the same representations are accessed when personal memories are retrieved involuntarily in response to cues provided by the (external or internal) environment. If so, the present study narrows the theoretical distance between voluntary and involuntary memory; prior research has demonstrated that voluntary and involuntary memories are very similar in terms of their phenomenal properties (e.g., vividness, rehearsal, intensity, importance, unusualness, pleasantness, and age of memory; Berntsen, 1998, 2009; Berntsen & Hall, 2004; Schlagman & Kvavilashvili, 2008), and the present research indicates that they also are often accessed in the same way. In this view, the function of generation is to produce cues that trigger the automatic retrieval of an event memory, and what distinguishes voluntary memories from involuntary memories is the requirement to engage this process even when an initial cue fails to evoke an accessible response.

Despite the similarities, qualitative differences between voluntary and involuntary memories have been reported (e.g., involuntary memories are more specific, are associated less with problem solving and social sharing and more with day dreaming and periods of boredom than voluntary memories; Berntsen, 1998, 2009; Rasmussen & Berntsen, 2011; Rubin & Berntsen, 2009). There are two possible explanations for these differences. One possibility is that directly retrieved memories have the same properties regardless of whether they have been recalled voluntarily or involuntarily, and it is generated memories that demonstrate these differences. The second possibility is that cues that trigger involuntary memories differ in some important ways (e.g., more specific, more richly contextualized) from those that are presented to participants in word-cue experiments. Given that we can now distinguish directly retrieved voluntary memories from generated ones, we should be able to evaluate the first possibility in a straightforward manner. For example, one might collect voluntary and involuntary memories from the same group of participants. In addition, these participants would be required to provide strategy reports for the voluntary memories and to rate all memories using the same set of scales. Investigating the second possibility could be achieved by developing cue sets that are more specific and more personally relevant than the ones that are typically used in cued retrieval studies. So although we do not currently have an explanation for why voluntary memories (in the aggregate) elicit different ratings than involuntary memories, we believe that this is a tractable problem and a potential fruitful direction for future research.

The robustness of the present findings raises difficult questions about why the prevalence of direct retrieval has not previously been recognized and why evidence for it has gone unreported. For example, Reiser et al. (1986) characterized the retrieval of autobiographical memories as a problem-solving activity involving repeated cycles of accessing, evaluating, and elaborating on retrieved knowledge. They also collected verbal protocols of participants trying to retrieve personal events in response to event descriptions. However, these researchers reported that only 40% of protocols involved an effortful retrieval strategy, implying that perhaps 60% of memories may have been directly retrieved. Since Reiser and colleagues (1986) did not measure RTs, we do not know whether these discounted responses were also the most rapid ones. Nevertheless, it still seems that their problem-solving model of retrieval does not account for the majority of their protocol data.

Even in cases where RTs have been measured, the evidence is far from straightforward. For instance, Conway and Bekerian (1987, Experiment 1) used three types of cue to elicit autobiographical memories (sports, furniture, and emotions), while also collecting reaction times. These researchers compared mean RTs of 22.9 s (sports), 28.2 s (furniture), and 35.8 s (emotions), yet also reported that on more than 75% of the trials, memories had been recalled within 3 s. It certainly seems possible that these deeply skewed data might have concealed a large proportion of direct retrievals. If that were the case, then the furniture versus emotion cue difference might reflect differences in the proportion of directly retrieved memories and not structural differences in the organization of autobiographical memories suggested by the authors.

The prevalence of direct retrieval also raises issues in regard to theories on the organization of autobiographical memories that employ cues to generate data and response times as evidence. Specifically, the research presented here is inconsistent with the strong reconstructive assumptions that underpin Conway's self-memory system (SMS) model (Conway & Pleydell-Pearce, 2000; Haque & Conway, 2001). SMS theory assumes that event retrieval requires a top–down search through a hierarchically structured knowledge base and that event memories are assembled in response to task demands from active retrieval indices and fragments of associated event-specific knowledge. Instead, the present study provides evidence that supports Barsalou's contention that "an event [memory] can be retrieved directly with a wide variety of cues" (1988, p. 229). Likewise these data are in line with Berntsen and Rubin's (2004) observation that "memories cued by neutral words . . . [can be] brought to mind via an associative, nonstrategic search process" (p. 430). Given that autobiographical memories are recalled through more than one retrieval process, it follows that theories on the structural organization of personal memories that rely on reaction times as evidence, such as the SMS model, need to be critically evaluated.

Put another way, direct retrieval implies the existence of prestored event representations. Research on involuntarily memories demonstrates that direct retrieval is common in natural settings, and the present study demonstrates that voluntary memories are often directly retrieved. Together, these two lines of evidence provide strong support for the existence of prestored event representations and suggest that these representations are very common. Given this situation, it is parsimonious to conceive of the modal back-up retrieval strategy as one that involves the generation and evaluation of potential effective retrieval cues rather than one that involves the (re)construction of a plausible event representations from fragments of personal knowledge. If this conclusion is correct, it provides an empirical challenge to the SMS model in its current form and other strongly reconstructive accounts of autobiographical memory (Bluck, Alea, & Demiray, 2010; Bluck & Habermas, 2000; Botzung et al., 2008; Burgess & Shallice, 1996; Conway, 1990, 2005; Conway & Bekerian, 1987; Conway &

Loveday, 2010; Conway & Pleydell-Pearce, 2000; Conway et al., 2004; Grysman & Hudson, 2011; Mace, 2007, 2010; Sumner, Griffith, & Mineka, 2011; J. M. G. Williams et al., 2007; cf. Brown, Hansen, Lee, Vanderveen, & Conrad, in press). Because the strength of this challenge depends, in large part, on the nature of indirect retrieval process, the apparently subtle distinction between generation and (re)construction assumes a very real theoretical significance. Thus, despite the prevalence of direct retrieval in the world and in the lab, we believe that we have to learn more about what people do when they deliberately search for specific autobiographical memories.

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