Measuring autobiographical fluency in the self-memory system

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Rapid communication
Measuring autobiographical fluency in the self-memory system

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Autobiographical memory is widely considered to be fundamentally related to concepts of self and identity. However, few studies have sought to test models of self and memory directly using experimental designs. Using a novel autobiographical fluency paradigm, the present study investigated memory accessibility for different levels of self-related knowledge. Forty participants generated 20 "I am" statements about themselves, from which the 1st, 5th, 10th, 15th, and 20th were used as cues in a two-minute autobiographical fluency task. The most salient aspects of the self, measured by both serial position and ratings of personal significance, were associated with more accessible sets of autobiographical memories. This finding supports theories that view the self as a powerful organizational structure in memory. Results are discussed with reference to models of self and memory.

Keywords: Autobiographical memory; Self; Identity; Fluency.

From the perspective of the cognitive psychologist, the self is primarily a structure that operates to organize and make accessible information in the pursuit of an individual's goals (see Bredart, Delchambre, & Laureys, 2006; Conway, 2005). Support for this idea comes from tasks whereby materials encoded in reference to the self are subsequently better remembered (the self-reference effect, SRE; Rogers, Kuiper, & Kirker, 1977) or from studies that show that materials from time-points or events more pertinent to the self are more accessible in memory (for example, the reminiscence bump in autobiographical memory, Conway & Haque, 1999; Rubin, Wetzler, & Nebes, 1986). Thus the evidence for the self as a cognitive structure comes from memory research that manipulates encoding, or infers "selfhood" from the retrieval of particular events from certain time-points. There are other lines of thought, such as the idea that those with cognitive—or memory—impairments are less able to access and report self-concepts and identity statements (e.g., Addis & Tippett, 2004) or the idea that a sense of the self in the past is part of the very definition of episodic remembering (Tulving, 1983). However, there is much less support for the idea that particular memories are made salient according to current goals or the aspect of "self" that is currently most active.

1

Perhaps the most influential model to consider the self as a cognitive structure is Conway's (e.g., Conway, 2005) self memory system (SMS), which posits such an arrangement. In his model, Conway describes a "working self", a dynamic system that can maintain and access self-concepts and self-images pertinent to existing goals. Aspects of the self, and memories associated with them, become activated according to the current situation. Thus, the working self is a dynamic construct, which makes accessible collections of memories in a database, which supports identity. Likewise, the retrieval of particular memories from an autobiographical store will influence which aspects of the conceptual self are most active. The SMS makes a prediction that for aspects of the self that are most active, there will be a set of relevant "supporting" autobiographical memories, which are preferentially active: "Events that intensively engage the working self will be strongly associated with central working-self goals and so give rise to memories that, because of their close association with current goals remain highly available" (Conway & Pleydell-Pearce, 2000, p. 280). If this theory is correct, one should be able to find that autobiographical memories are easier to retrieve when cued by more important or active aspects of the self, which is what was examined here, using the Twenty Statements Test (TST; Kuhn & McPartland, 1954) in a version of the IAM task (I Am Memory task; Rathbone, Moulin, & Conway, 2008): a task that uses "I am" statements as autobiographical memory cues.

The TST is a task in which people spontaneously generate information about themselves by completing a set of 20 statements that begin with the words "I am . . . ". This information has been used in a number of research contexts (e.g., Madson & Trafimow, 2001; Rhee, Uleman, Roman, & Lee, 1995; Wang, 2001). It has been used to measure the strength of identity (see Addis & Tippett, 2004) and the organization of memories in the self-memory system (e.g., Rathbone et al., 2008). The use of this task in such a manner supposes that there is something diagnostic about the ease with which information about the self comes to mind. This is clear in

studies that suggest an impoverished self, where some people struggle to generate responses in this task (e.g., findings in Alzheimer's disease, Addis & Tippett, 2004), but it is also apparent when researchers take the serial position of generated answers as being indicative of the hierarchical structure of the self (e.g., Kuhn & McPartland, 1954). Previous research has shown that participants tend to give concrete or "consensual" self-concepts first in lists of "I am" statements (Kuhn & McPartland, 1954), reflecting the groups and categories with which they identify (e.g., being a student, a gardener). This is in contrast to abstract or "subconsensual" statements, which typically reflect traits or beliefs (e.g., being interesting, a worrier). Along with the idea that the SMS generates patterns of activation of memories from the autobiographical knowledge base, this study examined the relationship between the serial position of "I am" statements, their personal significance ratings, and the extent to which they could cue autobiographical memories.

It was hypothesized that there would be a relationship between the serial position of an "I am" statement and the number of memories that were accessible when cued by it. That is to say, salient self-concepts should be associated with a population of highly activated and accessible autobiographical memories. To examine this, a standard IAM task was used, which asked people to generate and rate 20 identity statements in the form of "I am" statements. By collecting ratings of personal significance, it was also possible to examine whether the self-concepts that came to mind first were most important. This allowed further examination of the nature of the accessibility of identity information in the self-memory system, by comparing the ratings of personal significance, for instance, with the rank of the generated identity. To look at the self-memory relationship an autobiographical fluency task was used. Autobiographical fluency is a measure of the ease of autobiographical memory generation (e.g., Dritschel, Williams, Baddeley, & Nimmo-Smith, 1992), with typical fluency tasks asking for as many memories as possible in a given time period, such as two minutes. Whilst commonly used to measure fluency of memories

across different lifetime periods (e.g., Piolino, Desgranges, Benali, & Eustache, 2002), the current study applied the autobiographical fluency paradigm to different "I am" statements generated in a standard IAM task.

Method

Participants
The sample consisted of 40 psychology undergraduates at a British university who completed the task for credits (mean age of 19.63 years, $SD = 5.01$), of whom seven were male.

Materials and procedure
A summary of the design is provided in Figure 1. Participants first completed the IAM task, providing 20 "I am" statements, which they were instructed should "reflect stable and enduring" aspects of their sense of self. Following this, they carried out a memory generation task in which the 1st, 5th, 10th, 15th, and 20th statements were each used as cues for a two-minute memory fluency task. They were instructed to recall times in their life when the statement in question felt like a significant part of their identity. They were asked to give a short title for each memory and then to move on to the next memory for a period of two minutes per self-concept. If a participant fell silent before the two minutes had passed they were prompted to generate memories for the full two minutes (e.g., "Can you think of any other memories to do with this identity?"). The order of memory generation was rotated, so that Participant 1 recalled memories for Statements 1, 5, 10, 15, then 20, and Participant 2 recalled them for Statements 5, 10, 15, 20, then 1, and so on (thus there were five counterbalanced memory generation orders). Following memory generation, participants were asked to rate each of the 20 IAM task statements (in order, from 1 to 20) out of 10, for how important and central each statement was in defining their sense of identity (10 out of 10 being very important; 1 out of 10 being

not important at all), following the work of Gordon (1968). Finally, participants gave an age at which each statement on the IAM task became a defining part of their identity (the age of emergence).[1] In sum, participants produced a set of 20 "I am" statements, each given a rating of personal significance and an age of emergence, with five of these statements (ranks 1, 5, 10, 15, and 20) used as cues in an autobiographical fluency task.

Results

The primary hypothesis concerned the fluency with which people can generate memories for self-concepts that are more or less central to their self (as measured by serial position) or that vary in significance. To this end, the first analysis examined the significance of self-concept according to serial position in the IAM task.

Personal significance
Two participants did not complete the ratings on personal significance so these analyses are based on the data of 38 participants. Table 1 shows the mean significance level for the five serial positions of the IAM task that were used for memory generation: the 1st, 5th, 10th, 15th, and 20th statements in the list. The mean ratings suggest that statements positioned earlier in the list were associated with higher personal significance scores.

A repeated measures analysis of variance (ANOVA) comparing the five levels of serial position showed a significant effect of serial position on ratings of personal significance, $F(4, 148) = 4.29$, $MSE = 4.11$, $p = .003$. To more fully investigate the relationship between serial position and personal significance in the IAM task, Pearson correlations were calculated for each participant between their personal significance rating and the serial position of all 20 identity statements. Each participant's correlation was therefore based on an examination of 20 position–rating pairs. The mean correlation was $-.23$ ($SD = .27$), which was significantly nonzero, $t(37) = -5.16$, $p < .001$. In general,

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[1]Data on age of emergence was collected for the purposes of a larger cross-study database. As these data were not relevant to the present study no results involving this variable are reported.
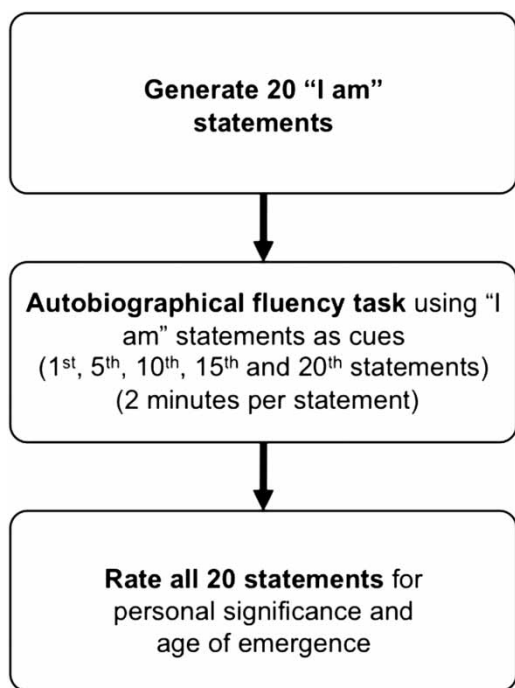
Figure 1. *Paradigm design.*

this suggests that a negative relationship exists between the serial position of an identity statement and its personal significance: The items generated first are rated as more important. By way of demonstration, the mean personal significance ratings (out of 10) for the first three statements were 8.16, 7.95, and 8.18, whilst the means for the final three statements were 6.16, 6.37, and 6.55.

Autobiographical fluency
Thus far, results indicate that the personal significance of identity statements declines according to their serial position. The mean number of memories generated in two minutes was calculated for each of the five statements on the IAM task used as cues (see Table 1). Serial position on the IAM task was related to number of memories generated, in that autobiographical fluency was highest for the self-concept given first on the IAM task. A repeated measures ANOVA on rank of IAM task item showed that there was a significant difference in number of memories generated as a factor of rank, $F(4, 156) = 3.417$, $MSE = 8.90$, $p = .01$, with the identity statement in first place generating more memories than the others (Bonferroni pairwise comparisons between Position 1 and Positions 5, 10, 15, and 20 were, respectively, $p = .06$, $p = .08$, $p = .09$, $p < .005$). As a Latin square was not used in the counterbalancing, further analysis was carried out to ensure that order effects were not responsible for the pattern of data. A one-way repeated measures ANOVA was calculated to investigate number of memories generated by the order in which the "I am" statements were used as cues. Results showed no significant order effect ($p = .25$), suggesting that increased memory generation is reliably linked with self-concepts that are most salient.

Abstract and concrete statements
A rudimentary analysis of the qualities of the self-concept generated compared abstract and concrete statements. Echoing the findings of Kuhn and McPartland (1954), 80% of participants' first self-concepts were concrete (e.g., I am a singer; I am a daughter). There were no significant differences in fluency or personal importance based on concrete/abstract analysis ($p > .4$).

Table 1. *Mean for number of memories generated and personal significance ratings by serial position of identity statement on the IAM task*

	Serial position of identity statement				
Variables	*1st*	*5th*	*10th*	*15th*	*20th*
Number of memories generated	9.45 (4.31)	7.53 (4.03)	7.83 (4.09)	7.58 (3.25)	7.28 (4.51)
Personal significance rating	8.16 (1.95)	7.11 (2.24)	6.76 (1.40)	6.50 (2.28)	6.55 (6.65)

Note: Standard deviations in parentheses. IAM task = I Am Memory task.

Discussion

This study set out with the aim of investigating how memories in the self-memory system become accessible with reference to self-concepts (SMS; Conway, 2005). First, results showed that personal significance was significantly higher for earlier generated self-concepts. Most importantly, the novel prediction was that for self-concepts generated earlier in the list, there should be a greater number of more accessible autobiographical memories. Indeed, people were able to generate significantly more memories for self-concepts in the first serial position. Thus it is proposed that personal significance of a self-concept and the accessibility of autobiographical memories are related, as indicated in the serial position of the IAM cues generated, and as predicted by the SMS model (Conway, 2005).

This is consistent with the idea that either the SMS operates to raise the accessibility of memories that are more significant and important to the self, or self-concepts are generated to make sense of or organize memories of events held in the SMS. Either way, more accessible memories are associated with more significant selves. In Conway's original model (e.g., Conway & Pleydell-Pearce, 2000), there is much emphasis on goals—the SMS is a dynamic system, which reacts to an individual's current goals. The SMS predicts that core self-identity is closely related to current goals, and research has shown that autobiographical knowledge related to current goals of the self is more accessible than autobiographical knowledge that is unrelated to current goals (Moberly & MacLeod, 2006). In this task, the goal was to provide a description of the self, using "I am" statements. Arguably, in constructing these statements, the working self activated memories and self-concepts that were in keeping with this goal. The nature of the SMS is exposed in the fact that, when participants were asked to generate these "I am" statements, they did not have the goal of generating autobiographical memories. Nonetheless, when the "I am" cues were later used as cues to generate memories, results showed that the accessibility of memories was higher for the first concepts that

came to mind in the IAM task. Thus, these data support the idea that the working self acts to provide an online, up-to-date description of the self, which is in turn related to sets of accessible memories in the autobiographical memory base. At the very least, the data suggest that when asking the question "Who am I?" the answers generated relate to sets of memories that can be more readily accessed the more salient the identity is.

It is proposed that the SMS acts like a hierarchical organizational structure, which is overseen by executive processes that operate to activate and suppress the relationships between events and self-concepts. These data can be compared with the fluency literature on other tasks. Fluency tasks (such as "generate as many animals as you can in the next minute") are typically seen as measures of executive function (e.g., Benton, 1968). They measure the capacity to generate a search and retrieve information from an information hierarchy. In neuropsychological groups verbal fluency correlates with the ability to generate autobiographical memories (Greene, Hodges, & Baddeley, 1995). In their study, Greene et al. (1995) documented the expected deficit in retrieval of autobiographical memory in Alzheimer's disease using a fluency task similar to the one used here. They also found that this deficit was related to executive function more generally but, in particular, verbal fluency as measured by initial letter verbal fluency. They propose that, as well as there being aspects of autobiographical memory that rely on the intact storage of personal information and experiences, proficient retrieval of autobiographical memories relies on setting up search parameters and carrying out verifications, much like the strategy used to carry out any other fluency task: "Executive impairment may lead to a poorer search and recollection process, and hence impaired retrieval of autobiographical memories" (Greene et al., 1995, p. 1666).

It is suggested that each element of the conceptual self in the SMS acts like a personal semantic category. Participants use each self-concept to cue incidents and experiences that are relevant to that cue. This is apparently easiest for self-concepts that first come to mind. The fluency literature indicates that more well-specified categories are easier

to generate from (e.g., preexisting categories such as "furniture" compared to ad hoc categories such as "things to take on a camping trip"). Moreover, larger categories and semantic, rather than phonetic, categories lead to higher levels of fluency (e.g., Diaz, Sailor, Cheung, & Kuslansky, 2004). It is possible to make inferences about self-concepts on this basis: Personally significant self-concepts may be broader and cue more memories according to their size and their inherent structure. For example, semantic category fluency tests (e.g., naming animals) yield higher levels of performance than letter-based fluency tests (e.g., Diaz et al., 2004; Riva, Nichelli, & Devoti, 2000). This difference is typically explained by differences in hierarchical organization between letters and semantic types. Retrieval by letters requires exploration of more subsets of categories than the retrieval of names of a specified semantic category (Riva et al., 2000). Even so, set sizes can be observed—the more exemplars that are available, the more you can generate (Diaz et al., 2004). Certainly, research on the SRE shows that the self organizes episodic memories. A self-concept that cues fewer memories is one where the participant needs to explore associated ideas and generate subordinate search cues. Again, this might allow some predictions about the value of different types of self-concepts cueing autobiographical memories. Future studies should examine how various self-concepts can be construed as semantic categories and to what extent they cue memories. But note that no differences were found according to whether the self-concepts were abstract or concrete. Also, participants were required to generate statements that reflected "stable and enduring" aspects of their sense of self, and as a result, the self-concepts were all rather personally significant—the lowest mean rating being 6.5 out of 10. Thus to use a comparison of self-concepts that either are or are not endorsed as characterizing the individual may further expose the nature of self-concepts as cues to autobiographical remembering.

A possible limitation of this study was that length of memory descriptions and ability to fill the two-minute period were not recorded, nor were ratings of memory vividness or level of detail

collected. These factors should be included in future tasks based on this fluency paradigm as they would further elucidate the self-memory relationship. One further possibility is that the narrowness/breadth of self-concepts had an effect on memory fluency, with broader self-concepts cueing a wider range of memories. However, whilst category broadness, or size, has clear effects in other fluency tasks (e.g., "animals" cues more exemplars than "vegetables"; Diaz et al., 2004), the predictions are less clear-cut when considering the impact of self-concept broadness on memory fluency. Thus, a self that is broad (in terms of spatial, temporal, and social context) may be associated with a wider range of possible events, but in fact cue fewer autobiographical memories. For example, the self-concept "friendly" is arguably a broad category of the self (in that it could apply across a range of social, spatial, and temporal contexts) but may not be particularly personally significant and thus may not cue many autobiographical memories. On the other hand, a very narrow self-concept (e.g., "I am someone who finds it hard to revise for exams") might cue a higher number of autobiographical memories—if this self-concept is particularly significant for that participant. Self-concepts are idiosyncratic, and thus identifying oneself as, for example, a "student" may be more important for some participants than others. Supporting this idea, there was variation in the ranking of identical statements. For example, three participants generated "I am a sister" as their first statement, and two generated this as their 10th statement. Finally, Conway (2005) posits a bidirectional link between self and memory. In this experiment the relationship was examined in one direction (more active self-concepts lead to more active memories), but it is still difficult to resolve whether memories cue self-concepts, self-concepts cue memories, or both. However, this novel paradigm represents a departure from the normal approach of conceptualizing self-concepts as being constructed from memories. For instance, Addis and Tippett (2004) found that the reduction in memory in Alzheimer's disease was related to deficits in self-knowledge. Because Alzheimer's disease is conceived as first and

foremost a memory deficit, this suggests that memory changes lead to changes in the accessibility of the self-concept.

To conclude, this study shows that more readily accessible self-concepts were rated as more personally significant and were more efficacious in cueing autobiographical memories. A next step might be to explore the utility of using different types of self-concept (e.g., positive/negative, or congruent/incongruent with the self) to cue autobiographical memories and to further "measure" access to self-concepts by examining the speed at which people can generate various statements about themselves. The present study supports the idea that the self is a powerful organizational structure in cognition.

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