

# The role of context in remembering familiar persons: Insights from semantic dementia

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## Abstract

Semantic dementia (SD) is a progressive condition characterized by an insidious and gradual breakdown in semantic knowledge. Patients suffering from this condition gradually lose their knowledge of objects and their attributes, concepts, famous persons, and public events. In contrast, these patients maintain a striking preservation of autobiographical memory. The aim of the present study was to examine in a patient suffering from SD the role of context in the ability to recall knowledge of familiar persons. In an experiment, patient J.M. was asked to name and identify familiar persons that appeared on family photographs from recent and remote periods of her life. In the first experimental condition, the pictures represented personally familiar persons present in a specific spatial and temporal context. In a second experimental condition, the pictures showed personally familiar persons who were presented without any specific episodic context. Results indicate that the patient was able to name and identify familiar persons irrespective of the context of presentation (with/without context) and of the time period (recent/remote). No temporal gradient was found using family photographs. Finally, in contrast with familiar persons, J.M. presented a severe anomia for celebrities. Results are discussed in light of recent research in the field.

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## 1. Introduction

Semantic dementia (SD), the temporal variant of frontotemporal dementia (FTD), is a progressive condition characterized by an insidious breakdown in semantic knowledge (Hodges, Patterson, Oxbury, & Funnell, 1992). In this syndrome, patients gradually lose their knowledge about the world. This semantic loss concerns objects and their attributes, facts, knowledge about famous persons and famous public events, and word meaning. During the neuropsychological evaluation, this loss of knowledge becomes apparent through specific tests tapping semantic memory such as picture naming, matching semantically related pictures and words (i.e., Pyramids and Palm Trees Test), category fluency, matching words or pictures to definitions, defining concepts in response to their names, drawing

objects from names and specific tests evaluating knowledge about famous public events and persons. In everyday conversation, speech is fluent and appears to be normal. However, word finding difficulties, impoverished vocabulary and difficulties understanding complex sentences and certain words quickly become apparent. Patients suffering from SD appear to be independent in daily life although simple household chores such as cooking may become increasingly difficult. SD patients are greatly aware of their difficulties and typically complain of their memory loss.

Contrasting with impaired semantic memory, autobiographical memory and anterograde day-to-day episodic memory are relatively preserved in SD (Hodges et al., 1992; Snowden, Neary, & Mann, 1996a; Snowden, Griffiths, & Neary, 1996b). Patients are able to recollect personal events of their lives (sometimes with vivid detail) and anterograde day-to-day episodic memory remains usually intact, at least in the initial stages of the disease. A number of studies have uncovered an inter-

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esting phenomenon in SD: patients show a better preservation of very recent events and semantic facts when compared with other time-periods (Graham & Hodges, 1997; Graham, Pratt, & Hodges, 1998; Graham, Simons, Pratt, Patterson, & Hodges, 2000; Nestor, Graham, Bozeat, Simons, & Hodges, 2002; Snowden et al., 1996a, 1996b). This temporal gradient, inverse to that observed in memory disorders resulting from hippocampal pathology (Alzheimer's disease notably), has been interpreted as support for the standard model of consolidation (Graham & Hodges, 1997; Hodges & Graham, 1998). According to this model, the hippocampal complex is essential for the retrieval of recent memories. Repeated activation of hippocampal–neocortical connections eventually leads, over time, to the formation of permanent neocortical connections which can be activated independently of the hippocampal formation by the event. In SD, the primary locus of atrophy concerns the temporal neocortex. According to this model of memory consolidation, the selective atrophy of the temporal neocortex in SD (at least in the early stages) will result in a progressive loss of long-term autobiographical and semantic memories, while the relative sparing of the hippocampal complex will allow normal encoding and retrieval of recently experienced events. However, due to the disruption of the temporal neocortex and to the temporary role of the hippocampus in storing new information, the consolidation of these new memories will only be momentary. An alternative theory, the multiple traces theory (Nadel & Moscovitch, 1997), suggests that the hippocampal complex plays a permanent rather than a temporary role in the retrieval of episodic memories. According to this model, the hippocampus is involved in the storage and retrieval of recently experienced events (covering the past few years of life). After this time, episodic memories become independent of their context of acquisition and become more semantic in nature. It is assumed that the temporal neocortex plays a critical role in the storage of these semantic representations.

The locus of atrophy in SD affects predominantly the temporopolar regions of the brain (anterior and inferior temporal poles), at least in the early stages, with a highly asymmetrical pattern of atrophy affecting predominantly the left hemisphere. In a recent voxel-based morphometric study of SD patients, Mummery et al. (2000) found the temporopolar regions to be most affected in this condition, with sparing of hippocampal structures. Other volumetric MRI studies, however, have found hippocampal structures to be greatly diminished, with a gradient of severity along the antero-posterior axis affecting predominantly the anterior portions of the hippocampi. The extent of atrophy was always more important in the left hemisphere than in the right (Chan et al., 2001; Galton et al., 2001). These different findings relative to hippocampal atrophy are

likely to result from methodological differences, and may particularly be due to the stage of the disease at which patients are recruited in these studies. Altogether, the neuropathological process underlying SD acts primarily upon the ventral inferotemporal pathway of the brain, touching the temporal poles in the early stages of the disease and spreading later to the hippocampal complex. Temporal atrophy almost invariably prevails in the left hemisphere in SD. In a rarer form, however, affecting predominantly the right hemisphere, the main syndrome is progressive prosopagnosia (for example, see Evans, Heggs, Antoun, & Hodges, 1995; Joubert et al., 2003).

The purpose of the present paper was to better understand the ability to recollect specific knowledge about familiar persons in SD. More specifically, the main objective of this study was to determine if person-based autobiographical knowledge was better recalled when it was imbedded in a specific episodic context. In order to do so, we examined in a patient suffering from SD whether the spatial and temporal context in a photograph facilitated her ability to recognize and identify familiar persons she knew from recent or more distant periods of her life. A second rationale for our study is that most studies have investigated autobiographical memory in SD using *verbal* questionnaires, such as the Autobiographical Memory Interview (AMI, Kopelman, 1990) or the Crowitz Test (Crowitz & Schiffman, 1974). To this day, very few studies have tested recall of autobiographical knowledge in SD using *visual* material, such as family pictures. This is due in part to the difficulty in accessing family photo albums of patients and the willingness of family members to cooperate, also because it is very time-consuming and because of the lack of normative data for this kind of approach. Nevertheless, it remains an interesting, ecological and alternative approach to studying the nature of autobiographical memory in SD. The use of visual material may offer new insights in this syndrome, which is known to affect primarily verbally-based conceptual knowledge.

## 2. Case history—Patient J.M.

J.M., a 49-year-old right-handed woman, was referred to the Service for increasing memory complaints and word finding difficulties. Despite her important memory problems, she remained independent in daily life and was well aware of her deficit. J.M. did not have any previous history of neurological insult or psychiatric disorders. SPECT findings revealed significant cortical perfusion in the left temporal lobe along with a mild cortical perfusion in bilateral frontal structures. MRI scans revealed a very severe atrophy of the left temporal pole (see Fig. 1). According to her family, she did not present any apparent changes in behavior since the onset of her disease.

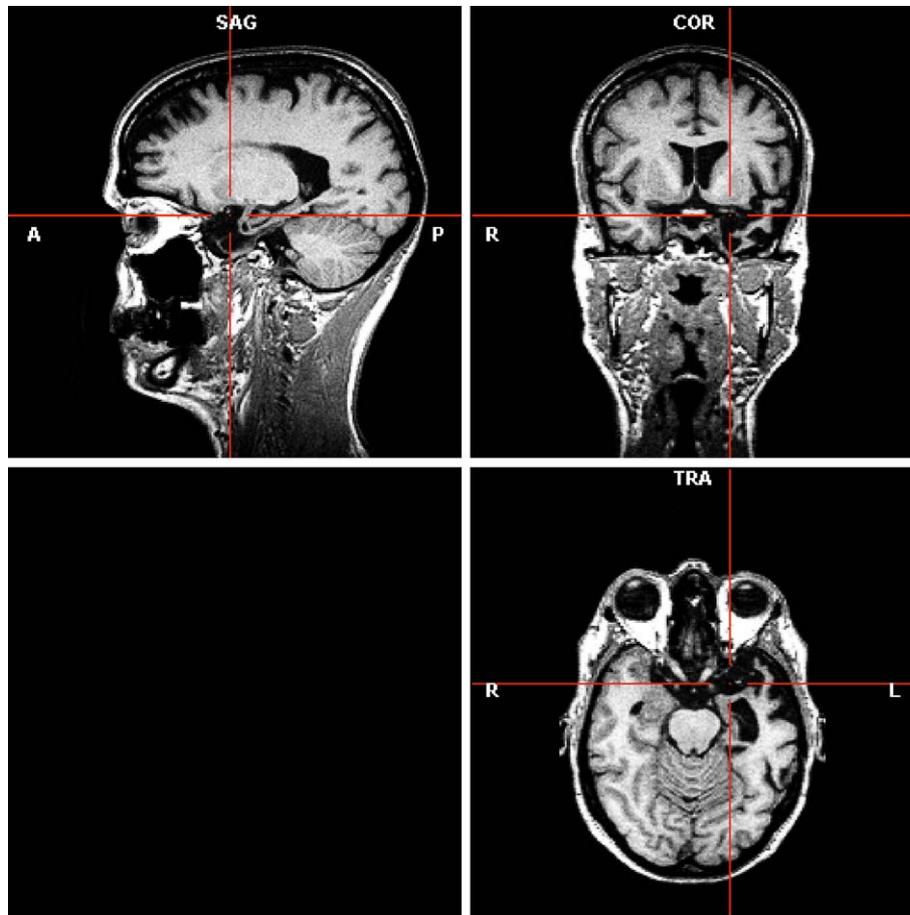


Fig. 1. MRI scans of J.M. show a very severe atrophy of the left temporopolar region. Right hemisphere structures remain preserved (radiological conventions: left is right).

### 3. General neuropsychological evaluation

During neuropsychological evaluation, patient J.M. showed a severe picture-naming deficit, reflecting her word-finding difficulties in normal conversation. Elaborate text comprehension was also affected. J.M. also showed a pattern of surface dyslexia, a key feature in semantic dementia. Surface dyslexia in SD may reflect the loss of semantic knowledge about irregular words, which cannot be read by means of conventional graphophonemic conversion rules (as opposed to regular words and non-words). Executive functioning was mildly impaired. Overall, J.M.'s neuropsychological evaluation shows an important word-finding deficit due to semantic breakdown, along with a mild executive functioning deficit (see Table 1).

### 4. Semantic memory

#### 4.1. Picture naming (DO80)

The DO80 is a test used to evaluate the ability to name line-drawings of living and non-living entities.

Patient J.M. was severely impaired at this test, scoring only 18/80 (mean score = 74/80).

#### 4.2. Pyramids and Palm Trees Test of semantic matching (Howard & Patterson, 1992)

In the Pyramids and Palm Trees Test (PPTT), the subject is instructed to match an image with a semantically related image beneath it that is presented along with another foil image. For example, when shown the drawing of a pyramid, the subject has to match it either with a palm tree or with a pine tree. In the verbal part of the PPTT, the subject has to match two semantically related printed words among a set of three printed words. J.M. showed a marked deficit at matching semantically related targets in both the visual and verbal parts of the PPTT (Howard & Patterson, 1992). J.M. scored 46/52 on the visual part of the PPTT and 41/52 on the verbal part of the test (mean control group = 98.5%, SD = 5.8% or 3 errors for both visual and verbal modalities).

The *Famous events battery* (Thomas-Antérion, Laurent, Lemesle, Laporte, & Michel, 1994) is a test of general knowledge of public events and figures

Table 1  
Patient J.M.'s general neuropsychological evaluation

General	
MMSE	18
Language	
Picture naming (DO80)	18/80*
Verbal comprehension (HDAE)	Altered
Reading	
Irregular words	52%*
Regular words	82%
Non-words	45%*
Visuoconstructional skills	
Rey figure—copy	36/36
Visuoperceptual and visuospatial skills	
Benton line orientation test	15/30*
VOSP subtests	
Dot counting	100%
Position discrimination	100%
Number location	70%
Cube analysis	80%
PEGV—categorical matching	90%
PEGV—functional matching	100%
Facial processing	
Benton facial recognition test	47
Famous/non-famous familiarity test	119/124
WMS-R facial recognition subtest score	
Immediate recall	8*
Delayed recall	5*
Praxias	
Test of praxias	30/30
Executive functioning	
BREF (batterie rapide d'évaluation frontale)	11/18*
Fluency	
Lexical fluency (letter P in 2 min)	3*
Category fluency (animals in 2 min)	5*
WCST (short version)	
Number of categories	2*
Number of perseverations	8*
Trail making test—part A	81 s*
Trail making test—part B	295 s*
Conflicting tasks and Go No go	20/20
WAIS-R matrices subtest	7*
Forward digit span	4*
Backward digit span	3*
Memory	
Visual recognition memory test (DMS-48)	
Immediate recall	98%
Delayed recall (1 h)	88%
Rey figure—immediate recall	17/36

\* Indicates significantly impaired scores.

throughout the decades 1920–1990s. It consists of two parts. In the visual part of the test, the subject is shown a picture of a famous public event, such as the explosion of the atomic bomb, or the assassination of JFK. In a recall condition, the subject is asked to provide as much information about the picture as possible. The verbal part of the test is identical in nature to the visual part, but instead of the subject seeing a picture, a question is

asked aloud. For example: “What does the death of Marilyn evoke to you?” Results from the test indicate that patient J.M. was severely impaired at recalling both visual and verbal semantic knowledge: she scored 27% in the visual part and 22% in the verbal part of the test (mean control group score = 75.69% correct response in the visual part and 82.63% in the verbal part).

#### 4.3. Naming and identification of famous persons from photographs

J.M. was asked to name 40 faces of famous persons. Famous personalities included actors, singers, and politicians from each of the decades 1950–1990s. Relying upon these photographs, J.M. was then instructed to provide as much information as possible about each famous personality. A famous person was considered to be correctly identified if at least two semantic attributes were provided about that person without any mistakes (i.e., *Marylin Monroe is an American actress who committed suicide*). Patient J.M. was only able to name 2.5% of the famous personalities correctly (mean control score = 90%), and 45% correctly upon phonological cueing. However, J.M. was able to identify correctly 95% of these persons from their photographs albeit being unable to remember their names (mean control group = 95%), thus suggesting a possible disconnection between lexical—phonological proper-noun representations and semantic knowledge of famous persons.

## 5. Autobiographical memory

### 5.1. The Kopelman Autobiographical Memory Interview (AMI, Kopelman, 1990)

The AMI is a semi-structured interview which aims at quantitatively measuring the ability to recall specific autobiographical memories in one's own past. The purpose of the test is to evaluate a patient's ability to recall life episodes that occurred in a specific spatial and temporal context (episodic memory) throughout three different periods of life: youth, early adulthood, and recent life. For example, the patient is instructed to recall an important incident that occurred before starting going to school. The interview also aims at measuring ‘personal semantics’, or general factual knowledge about one's own life that is not episodic in nature (i.e., the names and birthdays of family members, the name of school teachers, etc.). Results of J.M.'s performance are presented in Fig. 2. She was impaired at both the *Episodic autobiographical memory* and the *Personal semantic memory* sections of the AMI when compared with normal control subjects. Consistent with previous studies, J.M. was notably better at recalling specific events she had lived in recent life than events she had

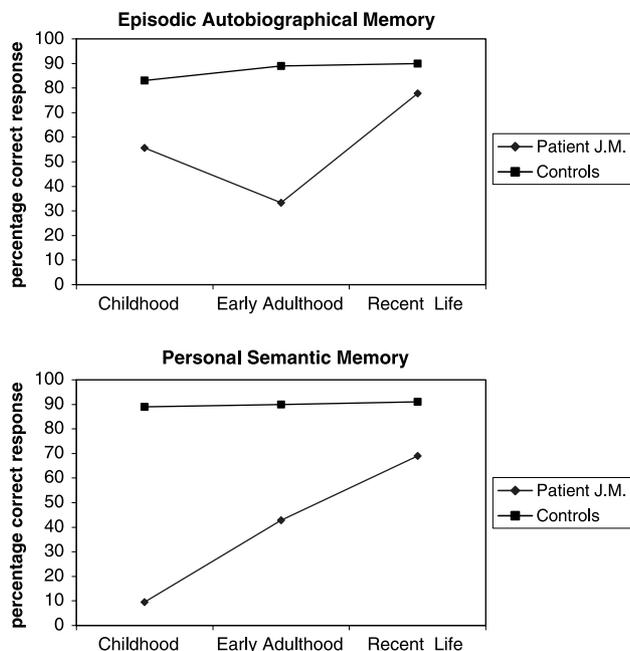


Fig. 2. J.M.'s performance on the Autobiographical Memory Interview.

lived during childhood or early adulthood. Similarly, she was better at recalling personal semantic facts from recent years than from the more remote past. It is also noteworthy to mention that patient J.M. performed much better when she had to recall episodic autobiographical knowledge than when she had to recall semantic autobiographical knowledge.

## 6. Experiment

### 6.1. Method

The purpose of the present experiment was to determine whether episodic context facilitated the recollection of autobiographical memory in SD. Our hypothesis was that due to the well-established role of the hippocampi in episodic memory, which are usually preserved in early SD, episodic autobiographical memories would be better preserved than factual autobiographical knowledge ("personal semantics"). In order to test this hypothesis, we asked patient J.M.'s husband to kindly lend us family pictures of specific events they had lived in recent or remote periods of their lives. We asked the husband to select pictures that had not been viewed by J.M. in recent years. Once the pictures were collected, they were scanned and converted into jpeg format. Pictures were then divided into two experimental conditions. In the first condition (*episodic autobiographical memory*), pictures showed familiar persons including family members and friends who were present during a particular event at a given place and time (i.e., the

birthday party of a friend celebrated in the couple's garden). Half of the pictures included events that had occurred in recent life (within the past five years) and the other half included events that had occurred in more distant periods of life (within 10–25 years). In a second experimental condition (*semantic autobiographical memory*), the same family pictures were used, but this time images were cropped and zoomed around a single familiar person in the picture. In other words, the specific environment surrounding the familiar person was removed from the picture. Thus, in this condition, familiar persons were ridded of any contextual (spatial and temporal) cues that could have facilitated the identification of these persons. In this condition, pictures also covered two periods of life. Half of the pictures showed familiar persons who had been photographed in recent life and the other half showed familiar persons who had been photographed in more distant periods of life (some of them dating back to 25 years before).

### 6.2. Procedure

Twenty pictures from the *semantic autobiographical memory* condition were presented to patient J.M. during a first evaluation. Pictures were presented one by one on a computer screen, and the patient had to name and identify each familiar person whose face appeared on the screen. One point was awarded to J.M. if she could name the person correctly and another point was awarded if she could identify the person (she was asked to provide at least two facts about each person). A third point was given to J.M. when she could determine if the picture of the familiar person was recent (less than five-years-old) or old (more than 10-years-old). The authenticity of J.M.'s responses was confirmed by her husband. During a subsequent evaluation that took place several weeks later, the 20 pictures from the *episodic autobiographical memory* condition were presented one by one on a computer screen (until she had finished providing a response). In this condition, the same familiar persons were present on the pictures but this time included all the contiguous details that allowed to identify the place, time, and the specific event that were associated with each familiar person. Our hypothesis was that such contextual episodic information would strongly favor the identification of familiar persons and that the preservation of autobiographical memory in SD relied upon the spatiotemporal context and the auto-etic nature of the experience (the memory of having lived a particular experience with one's body) (Piolino, Desgrances, & Eustache, 2000). In this condition, one point was awarded if J.M. could name the familiar person(s) on the picture. Another point was awarded if she could identify the same person(s). A third point was given if J.M. could identify the place where the picture

had been taken; a fourth point was awarded if J.M. could identify the period of her life during which the picture had been taken (recent or old). Finally, J.M. was awarded a fifth point if she could remember having lived that particular event with her body (autonoetic awareness). Once again, all answers were verified by her husband.

### 6.3. Results

In the *semantic autobiographical memory* condition, patient J.M. was able to name and identify correctly all 20 pictures of faces of familiar persons (friends, family members) when they were presented in the absence of any episodic context (60/60 points). She was as good at naming and identifying pictures of familiar persons that had been taken a long time ago (some of them dated back to 25 years) than pictures of persons taken in recent years (i.e., her baby-born niece). It is interesting to note that her preserved ability to name familiar persons from face contrasted sharply with her inability to remember the names of celebrities from photographs (see Table 2). Similarly, when the names of 15 familiar persons were read aloud (they were given to us by the husband), she could also provide accurate information concerning these individuals. Thus, there was no apparent dissociation between J.M.'s ability to identify personally familiar persons in the visual and verbal modalities.

In the *episodic autobiographical memory* condition, patient J.M. obtained a perfect score on the 20 pictures (100/100 points): she was able to name and identify correctly all the familiar persons present on the family photographs. Furthermore, she was able to describe with great precision the place and time where the pictures had been taken, and could remember having lived each specific event (her feeling of autonoetic awareness). Once again, in this condition, she obtained a perfect score, irrespective of the time period. In summary, J.M.'s recollection of context-free autobiographical knowledge (personal semantics) was as good as that of episodic autobiographical knowledge.

## 7. Discussion

Patient J.M. was first seen in the context of increasing memory complaints and severe word-finding difficulties. Her speech was fluent and her comprehension appeared to be intact in normal conversation. General neuropsychological evaluation showed a severe naming deficit, altered text comprehension and a mild dysexecutive syndrome. She did not present changes in behavior and was fully aware of her deficit. She remained completely independent in daily life and did not get lost in familiar or new environments. Tests of semantic memory indi-

Table 2  
Tests of semantic memory

	J.M.
Semantic matching	
PPTT (Pyramids and Palm Trees Test)	
Visual part	46/52*
Verbal part	41/52*
Cultural knowledge	
WAIS-R Information subtest	3*
Real objects	
Naming	10/34*
Identification	34/34
Knowledge of famous public events	
Meve (Protocole de mémoire événementielle, Thomas-Antérion, C.)	
Visual part	27%*
Verbal part	22%*
Knowledge of famous persons	
Test of famous persons (40)	
Naming from picture	2.5%*
Naming from picture with phonological cueing	43%
Identification from picture	95%
Semantic memory battery	
PECD (Protocole d'évaluation des connaissances décontextualisées, Joubert, S. & Pitiot, L.)	
Knowledge about objects and animals	
Picture naming	10%*
Visual semantic matching	100%
Verbal semantic matching	80%*
Naming from definitions	0%*
Knowledge from pictures: multiple choices	80%*
Knowledge from words: multiple choices	66.7%*
Categorical judgments	72.5%*
Structural, functional, and categorical knowledge	56.7%*
Drawing from memory	0%*
Knowledge of famous public events	
From picture	33.3%*
From name	26.7%*
General knowledge of the world	
Cultural knowledge	6.7%*
Structural knowledge	13.3%*
Sentence completion	0%*
Initials	7.5%*
Road signals	10%*

\*Indicates impaired scores.

cate that she was impaired at matching visually and verbally semantically related entities, and that she had lost most of her knowledge about famous public events that had occurred throughout the years 1920–1990s (Thomas-Antérion et al., 1994). Furthermore, J.M. showed a severe anomia for the names of celebrities although she was able to provide accurate semantic information about these persons upon seeing their faces. In contrast, she was able to name and identify correctly all the personally familiar persons presented to her on photographs and upon verbal presentation of their

names, as well as identifying the specific event associated with each photograph.

The purpose of this study was thus to determine if *personal semantic knowledge* (factual information about personally familiar individuals) was significantly more impaired when it was presented without any *episodic context* than with a specific context. Results of this study clearly indicate that patient J.M. *knew* as well as she did *remember* about her own life. She could perfectly name and identify personally familiar persons irrespective of time period and context. She was also proficient at recalling context-specific episodes of her life: she could accurately identify the specific event that was associated with each person as well as the place and time it had occurred. She was able to spatially and temporally identify each specific episode (recent or distant) represented on the family photographs. The fact that personal semantic knowledge was intact in J.M. suggests that preservation of autobiographical memory in SD cannot be explained only in terms of the integrity of episodic memory. *Personal semantics* may thus bear a distinct functional status, different from that of episodic and semantic memory strictly speaking. “Personal semantics” may share permanent and frequently re-activated connections with episodic memory (autobiographical events). Such context-free autobiographical knowledge, although semantic in nature, may thus be more resistant to cortical damage than other types of semantic knowledge that have become less susceptible to being associated with any form of episodic experience.

Moreover, a dissociation was observed between J.M.’s preserved ability to recall the names of family members, relatives, and friends she had known personally and her inability to recall the names of celebrities (actors, singers, and politicians) upon presentation of their photographs. This dissociation was quite noticeable during testing. Although she was unable to remember the names of famous persons upon seeing their faces, she could provide accurate semantic information concerning these celebrities from their faces. These results thus show that our patient presents with an anomia restricted to proper nouns of famous persons. One possible explanation for this is that proper names of personally familiar persons may be better preserved than those of famous persons due to the greater familiarity and emotional salience of information acquired through personal experience (Haslam, Kay, & Hanley, 2002). Alternatively, proper noun representations for personally familiar individuals and for famous persons may share distinct underlying neural circuitry. Finally, results from this study corroborate the idea that proper name linguistic knowledge may be subserved by the left anterior temporal regions of the left hemisphere, whereas homologous regions of the right hemisphere may be involved in non-verbal semantic information about persons (Fukatsu, Tsukiura, Yamadori, Yama-

dori, & Otsuki, 1999; Gainotti, Barbier, & Marra, 2003). Consistent with this view, J.M.’s severe and selective anomia for famous persons is associated with a predominant atrophy of the the left anterior portion of the temporal lobe.

Furthermore, we observed in this study a dissociation between J.M.’s relatively poor scores on the AMI (particularly on the *personal semantics* part of the test) and her perfect scores at naming and identifying familiar persons and specific episodes of her life in both recent and distant past upon presentation of family pictures. The usual temporal gradient found in SD (Westmacott, Leach, Freedman, & Moscovitch, 2001) was also found for patient J.M. using the AMI in the present study: she could significantly better recall autobiographical episodic and semantic facts from recent life than from other life periods (this gradient was particularly evident for *personal semantics*; see Fig. 2). In contrast, this gradient was not found in the experiment using family pictures: she scored perfect when asked to name and identify familiar persons and events she had lived in her distant and recent past. The results of the present study thus indicate that when presented with family photographs, patient J.M. performed significantly better and did not present the same temporal gradient than on the AMI. While J.M. was unable to recall more distant autobiographical memories using a semi-structured test such as the AMI, she was perfectly able to do so using family photographs. It is conceivable that autobiographical memory tests like the AMI which require significant executive engagement such as retrieval, attentional, and strategic processes are likely to be more difficult for SD patients than recognizing and identifying pictures of familiar persons and life events upon presentation of photographs, and this may particularly be true for more remote events. Retrieving distant memories may thus prove to be more “effortful” in terms of mental processes than retrieving more recently lived episodic memories. First, these results thus suggest that visual cues may serve more efficiently than verbal cues to access autobiographical memories. Second, results of the present study suggest that the reverse temporal gradient found in our patient using the AMI may in fact reflect, difficulties in conscious, effortful, and retrieval processes.

In conclusion, we report that case of J.M., who presents with a very left-lateralized form of SD. The purpose of the present article was to study the role of episodic context in retrieving person-based knowledge using family pictures. Results indicate that *semantic autobiographical knowledge* was retrieved as well as *episodic autobiographical knowledge* in the experimental condition but not on the AMI. Contrarily to classical findings in SD, we did not find any gradient in memory loss using family pictures. We suggest that poorer performance on the AMI than on the experimental condition may reflect difficulties in effortful retrieval processes.

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