A Reverse Temporal Gradient for Public Events in a Single Case of Semantic Dementia

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Abstract

A patient with semantic dementia (DM) was tested on a Public Events Test comprising famous events from three time periods (1989–1991, 1992–1994 and 1995–1997). DM was impaired on both recognition and identification of these events compared to two matched control subjects. Furthermore, he showed evidence of a reverse temporal gradient on both components of the test, recognizing more items and producing more detailed information about events from 1995 to 1997 compared to events from the other two time periods. The results from this experiment are congruent with data from other published studies in which patients with semantic dementia show reverse temporal gradients on tests of autobiographical and semantic knowledge.

Introduction

Patients with semantic dementia have a progressive, yet relatively isolated loss of semantic memory, the component of long-term memory which comprises our knowledge of the world, facts, concepts and the meanings of words (Snowden et al., 1989, 1996a; Hodges et al., 1992a, 1994, 1995) and show deficits on a range of tests which depend on the integrity of semantic memory (see Hodges et al., 1992a,b, 1994; Hodges and Patterson, 1995). For example, patients perform poorly on picture naming, word–picture matching, category fluency, picture sorting and generation of definitions to the spoken word. By contrast, phonological and syntactic abilities, working memory and visuoperceptual skills are relatively preserved (Hodges, 1994). The term semantic dementia is relatively recent, and patients with this syndrome have been reported in the literature under the heading of temporal lobe Pick’s disease (Hodges and Patterson, 1995), selective loss of semantic memory (Warrington, 1975; Schwartz et al., 1979) and progressive fluent aphasia (Mesulam, 1982; Snowden et al., 1992, 1996b). A review of the available neuropathological data on 14 patients with the syndrome of semantic dementia who reached post-mortem revealed that all had either Pick’s disease (focal lobar atrophy with Pick bodies or Pick cells) or an identical histological pattern without Pick bodies or cells (Hodges et al., 1998).

The progressive loss of semantic knowledge seen in the disease provides researchers with a unique opportunity to investigate the neural and cognitive basis of episodic and semantic memory. In particular, recent studies have shed light on the crucial role of time (distant versus current) in the preservation and loss of long-term memories in the disease (Snowden et al., 1996a; Graham and Hodges, 1997; Hodges and Graham, 1998). For example, patients with semantic dementia have shown better retrieval of autobiographical information on the Autobiographical Memory Interview (Kopelman et al., 1989) from the recent time period compared with childhood and early adulthood (Snowden et al., 1996a; Graham and Hodges, 1997). Graham and Hodges also found clear preservation of very recent autobiographical memories in a single-case study using the Galton–Crovitz cued word technique (Crovitz and Schiffman, 1974).

A further study, by Hodges and Graham (1998), which investigated the integrity of recent semantic knowledge in semantic dementia, demonstrated better knowledge of current famous personalities compared with those from the early 1990s, 1980s and 1950s in a single case (DM). Four other patients showed reverse temporal gradients in their recognition of famous names, but were too severely impaired on the component in which they had to produce semantic information about famous people to show a temporal gradient like that of DM.

The data from these experiments have been interpreted as evidence in support of the separate, but interactive, roles played by the hippocampal complex and neocortex.
in the representation and retrieval of long-term memories. This influential theory proposes that the acquisition and storage of long-term memories (semantic and autobiographical) proceeds via two separate neuroanatomical areas in the human brain: the medial temporal lobe and the neocortex. As this theory has been discussed at length in many publications, we shall only briefly summarize it here (for more details see Squire, 1992; Alvarez and Squire, 1994; McClelland et al., 1995; Murre, 1996, 1997; Graham et al., 1997a,b; Hodges and Graham, 1998).

It is thought that, initially, the retrieval of new autobiographical experiences is crucially dependent upon the medial temporal lobe (particularly the hippocampus and related structures). Over time, repeated reinstatement of a recent event leads to the formation of a permanent representation of that experience within the neocortex. At this point, the hippocampal complex is no longer necessary for the retrieval of the event. The acquisition and storage of semantic knowledge is thought to occur in a similar way, except that the information is eventually stored in the neocortex without temporal and spatial characteristics (McClelland et al., 1995).

Considering the disorder of semantic dementia, the preservation of recent autobiographical and semantic knowledge has been explained in terms of the initial preservation of the hippocampus and related medial temporal lobe structures in the disease. In support of this view, a neuropathological study of a case who died 3 years after initial presentation revealed relatively little hippocampal atrophy (Harasty et al., 1996). By contrast, the patient had severe temporal neocortical damage, a result that is congruent with a number of published MRI scans which show evidence of atrophy to the temporal lobes in patients with semantic dementia (see Hodges et al., 1994; Graham and Hodges, 1997). The neuroanatomical damage to lateral temporal lobe structures seen in the disease is thought to account for the progressive loss of semantic and autobiographical information from the distant past.

In this paper, we provide further evidence for a time-based loss of semantic knowledge in semantic dementia. As we have already mentioned, Hodges and Graham (1998) were able to test a patient (DM) relatively early in the disease and found that he had poorer knowledge of famous personalities from the distant past compared to people who were currently famous. In this study, we tested DM’s recognition and identification of public events, such as ‘The Mars Pathfinder Landing’ and ‘The Tiananmen Square Massacre’ taken from three time periods (1989–1991, 1992–1994 and 1995–1997). We postulated, in accordance with the studies mentioned above, that DM would show better knowledge of more recent famous events (e.g. ‘The Indonesian Smog Disaster’) compared to public events from the more distant past (‘The Downing Street Bombing’).

Case history

DM (born 16.1.36), a retired surgeon, presented in April 1995 with a 2-year history of word-finding difficulties. Since then, he has shown increasing anomic problems in his spontaneous speech and more recently, occasional stammering and phonological paraphasias. The mild dysfluency seen more recently in DM is unusual in cases of semantic dementia (see Hodges et al., 1992a). The fact that DM has started to produce these types of speech error suggests that he may be evolving into a mixed (fluent and non-fluent) case of progressive aphasia, in which his speech problems reflect damage at the semantic and phonological levels.

DM has also shown progressive difficulty with spoken and written comprehension to the extent that, at time of writing, he has started to complain of difficulty in comprehending newspaper text and television shows. In an attempt to arrest his word-finding problems, DM has been repeatedly practising words he frequently forgets for the last 3 years (see Graham et al., submitted for publication, for a detailed study of the effects of DM’s repeated home drill).

Formal neuropsychological tests in April 1995 confirmed DM’s anemia: on a 48-item picture naming test from Hodges’ semantic battery (Hodges et al., 1992b; Hodges and Patterson, 1995), DM named 34 out of 48 items (controls = 43.6 ± 2.3; z score = −4.2). He was also impaired on a naming-to-descriptions test in which he had to identify which animal or object was being described (e.g. ‘what do you call the small green animal which leaps around ponds?’), scoring 15 out of 24 (controls = 22.4 ± 1.3; z score = −5.7). On category fluency tests, DM performed within 2 SD of a group of age-matched control subjects: he produced 36 exemplars in response to four semantic category labels for living things (z score = −1.8) and 41 for a set of four man-made categories [z score = −1.7; controls generate 58.3 (SD = 12.3) and 55.4 (SD = 8.6) for living and man-made respectively]. While DM showed a rather mild degree of anemia at presentation, his performance on these aforementioned tests was certainly below that expected of such a highly educated man.

DM showed less impairment on tests of word and picture comprehension, scoring within the control range on the word–picture matching test from the semantic battery (46 out of 48, controls = 47.4, SD = 1.1) and on the picture version of the Pyramid and Palm Trees Test (Howard and Patterson, 1992) of semantic association (49 out of 52, controls = 51.2, SD = 1.3). On tests which use an ‘odd man out’ word synonymy paradigm (adapted from Breedin et al., 1994), DM’s semantic impairment was more obvious: he scored poorly on a Verb–Noun Synonymy Test (verbs = 69%, nouns = 62%; controls score at ceiling) and an Abstract–Concrete Synonymy Test [abstract nouns = 81% (control range 86–100%); concrete nouns = 77% (control range 90–100%)]. A year later, his
performance on these tests had deteriorated: 50% (nouns); 69% (verbs); 65% (abstract); and 65% (concrete).

DM was also impaired on a specially designed, more stringent, test of semantic knowledge, in which he had to name and point to coloured photographs of instruments used in general surgery (his speciality before retirement). When he first presented, DM was unable to name any of these previously familiar objects and could only correctly select 20/32 on a four-choice spoken word–picture matching test. The results from these tests, in conjunction with the difficulties he showed on the standard neuropsychological battery, confirmed to us that he had some degree of semantic impairment.

Like other patients with semantic dementia, DM showed no impairment on tests of visuospatial ability (Judgement of Line Orientation; Benton et al., 1983), auditory–verbal short-term memory as measured by digit span from the Wechsler Adult Intelligence Scale (1981) or non-verbal problem-solving, such as Raven’s Progressive Matrices (1962). On tests of episodic memory he performed well on recall of the Rey Figure [15.5/36, controls, 15.2 (SD = 7.4), Osterrieth, 1944], although he did show a mild impairment on the words version of the Warrington Recognition Memory Test (1984), scoring 36/50 (controls = 47, SD = 2.8).

On the Autobiographical Memory Interview (Kopelman et al., 1989, 1990; Greene et al., 1995), DM showed only a mild impairment in November 1995, scoring a total of 57.5/63 for personal semantic facts and 24/27 for autobiographical memories (see Table 1, Hodges and Graham, 1998). Two years later, in July 1997, DM scored 43/63 and 18/27 for the personal semantic and autobiographical components of the AMI, respectively [see Table 1 for a breakdown of the data by component (childhood, early adulthood and recent life) and for the performance of the control subjects]. It is clear from Table 1 that, in 1997, DM shows evidence in support of an evolving reverse temporal gradient on both components of the AMI, a similar pattern to that seen in other patients with semantic dementia (see Graham and Hodges, 1997).

Furthermore, DM showed a reverse temporal gradient on a test based upon his ability to produce information about famous people when shown their faces. In April 1998, DM was given a Famous Faces test which comprised 70 photographs of celebrities from 1950–1980 (predominantly from the 1950s and 1960s) and 70 photographs of celebrities who were currently famous. He, and two age and education-matched control subjects, were shown all 140 faces (in a random order) and asked to name the famous person and to produce a piece of information about them (e.g., current Prime Minister, Scottish golfer, etc.).

Table 2 shows that DM was profoundly impaired on the naming component of the test, scoring 11 out of a possible 140. Initially, it may seem surprising that DM showed no effect of time on his face-naming ability, but a more detailed analysis of the data revealed that all 11 of the items correctly named were being practised regularly by DM at the time of testing (e.g., Politicians in his lifetime: Harold MacMillan, Winston Churchill, Harold Wilson, John F. Kennedy, Anthony Eden and John Major, and Royalty: ‘The Queen’, ‘Princess Diana’, ‘The Queen Mother’, ‘Duke of Edinburgh’ and ‘Prince Charles’). We have previously demonstrated that DM’s word production benefits from repeated practice with word lists and picture/face books (Graham et al., submitted for publication), and the naming data from this Famous Faces Test is further evidence in support of our other study.

DM was also strikingly impaired on the identification component of the Famous Faces Test compared to the control subjects (1950s–1980s: Wilcoxon, $z = 7.0$, $P < 0.001$; Current: Wilcoxon, $z = 5.7$, $P < 0.001$) and,

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<tr>
<th>Table 1. DM’s and 30 age-matched control subjects’ (see Greene et al., 1995) performance on the Autobiographical Memory Interview (Kopelman et al., 1989, 1990; Greene et al., 1995) in November 1995 and July 1997</th>
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<td><strong>Autobiographical memory interview</strong></td>
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<td>**Table 2. DM’s and two age and education matched control subjects’ performance on a Famous Faces Test comprising 70 famous people from 1950–1980 (predominantly 1950s and 1960s) and 70 currently famous people. The test was given to DM in April 1998</td>
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unlike his naming of famous faces, showed an effect of time (Mann–Whitney, $z = 3.3$, $P < 0.001$). He produced more information to the faces of currently famous personalities compared to those for celebrities from the 1950s–1980s. By contrast, the controls showed no effect of time and produced similar amounts of information across the two different two periods. The results from DM are consistent with those published in Hodges and Graham (1998), in which DM was found to have a reverse temporal gradient for knowledge of famous people in a Famous Names Test.

Coronal T1 weighted MRI images of DM’s brain (November 1995), revealed that DM’s atrophy was confined to the left temporal lobe and involved the pole (panels 1 and 2) and to a much smaller extent the inferior region of the mid and posterior temporal lobe (panels 3 and 4), sparing the hippocampal complex (see Fig. 1). The preservation of the hippocampi in DM was further confirmed by volumetric analyses (Mummery et al., 1999). Positron emission tomography images of DM’s brain were obtained by courtesy of the Wellcome Functional Imaging Laboratory (Drs Mummery, Wise and Price): DM’s hypoperfusion was limited to the left temporal lobe and involved the inferior and middle portion only (see panels 1 and 2 of Fig. 5, Hodges and Graham, 1998). Further details of DM’s case history can be found in two other papers from our research group (Graham et al., submitted for publication; Hodges and Graham, 1998).

Fig. 1. Coronally oriented, T1 weighted, magnetic resonance imaging (MRI) scans for DM’s brain revealing focal atrophy of the left temporal lobe involving the pole (panels 1 and 2) and the inferior and middle temporal gyri (panels 3 and 4).

### Materials and methods

A Famous Events Test was specially designed for the study. In a pilot experiment prior to testing DM, 72 public events were selected from the ‘Chronicle of the Year’ books (a total of eight public events from each of 9 years: 1989–1997). Each of the exemplars was given a title designed to convey enough information about the event that it could be recognized (e.g. ‘The Downing Street Bombing’, ‘The Exxon Valdez Disaster’, ‘The Windsor Castle Fire’). A further 216 ‘possible’ non-famous events were created using similar types of titles (e.g. ‘The Barcelona Bombing’, ‘The Shell Montez Disaster’, ‘The Tate Gallery Fire’).

Recognition and identification of the public events were tested by presenting each famous event (‘The Mars Pathfinder Landing’) with three non-famous foil events (‘The Harrow Rail Disaster’, ‘The London Zoo Escape’ and ‘The Radbone Trial’). The position of the target event (1, 2, 3 or 4) and the order of the events, as measured by time period, was random. The subject was asked to select the item out of the four that corresponded to a famous event (recognition). The subjects were given the following instructions: ‘You will see four possible public events on the sheet in front of you. One of these is a real event – it has actually happened. The other three events are false and have never happened – we have made them up. Which event do you think is the real one?’.
If the subject correctly selected the real event, they were asked to produce as much information as possible about that event with the aim of uniquely identifying the event to the experimenter (identification). It was stressed that each definition should be as accurate and specific as possible, so that a naive subject would be able to identify the event from the description provided. If a subject incorrectly selected a non-famous foil in the recognition part of the test, the experimenter told the subject the correct item and asked them to produce as much information as possible about the event.

The test was given to two control subjects, who like DM had been educated to degree level. They were both older than DM at time of testing (DM: 61 years, controls: 67.5 years, SD = 3.5). These pilot data were used to exclude any event which was not recognized by one (or both) of the control subjects. As three events were not recognized by both controls in 1989 and 1997, a total of three events (including those that one or both of the controls had not recognized) were omitted from each year. This modification resulted in a test with a total of 45 events, 5 from each of the 9 years (1989–1997). These events were subsequently split into groups of 15 from three time periods: 1989–1991; 1992–1994; and 1995–1997. The events used in the test are shown in Appendix 1.

DM was given the modified Public Events Test with the same instructions used in the pilot study.

Scoring

For the recognition component of the test, the total number of famous events correctly recognized was calculated (maximum of 45). In the second component (identification), the definitions were scored from 0–3 (maximum 135) as follows:

0 = don’t know or an unrelated/incorrect response.
1 = superordinate (e.g. The Camilla-Gate Scandal: ‘To do with Camilla Parker-Bowles, don’t know).
2 = a definition that described the event but did not distinguish it from similar ones (e.g. The Tiananmen Square Massacre: ‘A number of people in China thought that communism was collapsing and thought it was all right to protest against the government. The government didn’t back down and shot them.’).
3 = a unique definition (e.g. The Brent Spar Affair: ‘Shell had an oil rig on Brent Spar field which they wanted to take to the Atlantic and sink it. Greenpeace invaded it so they couldn’t. Shell backed down and towed it into a Norwegian fjord.’).

If a definition included inaccurate information (for instance, an incorrect date or fact concerning the people/group involved), this was ignored and the definition was scored on the basis of the rest of the material.

To avoid any bias, the descriptions of the events produced by DM were scored by two of the experimenters (KG and KP). Fifty percent of DM’s ratings (scored over ‘0’) were given the same score by the two judges. In all but one example, the two raters differed by a point. In order to account for any possible biases, the average of DM’s scores was used in all statistical analyses.

Results


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Results

Figure 2 shows DM’s and the control subjects’ performance on the recognition component of the Public Events Test. As the initial test was modified by taking out any items that the controls had not recognized, the controls performed at ceiling on this component of the test. By contrast, DM showed impaired performance in all three time periods. There was a significant effect of time over the three time periods ($\chi^2 = 5.9$, $P < 0.05$), which reflected DM’s superior performance in 1995–1997 compared to the other two time periods (1995–1997 versus 1992–1994: $\chi^2 = 5.4$, $P < 0.05$; 1995–1997 versus 1989–1991: $\chi^2 = 4.0$, $P < 0.05$; 1992–1994 versus 1989–1991: $\chi^2 = 0.13$, $P = 0.07$). In one analysis (1995–1997 versus 1989–1991), the minimum expected cell frequency was < 5, a situation in which it is more appropriate to use a Fisher’s exact test rather than Pearson’s $\chi^2$ test (p152; Howell, 1997). A one-tailed Fisher’s exact test on this data revealed that the difference between the two time periods was marginally non-significant ($P = 0.054$).

The performance of the control subjects and DM on the identification component is shown in Fig. 3. There was no significant effect of time on the control subjects’ performance (Kruskal–Wallis test: $H = 0.51$, $P = 0.78$). By contrast, not only was DM profoundly impaired on the
identification component of the test, producing very little information about the public events used in the test, but he showed a significant effect of time (Kruskal–Wallis test: $H = 6.2$, $P < 0.05$). Further analyses using Mann–Whitney U-tests demonstrated that DM, as for the recognition component, was significantly better at producing information about public events from the most recent time period (1995–1997) than from the other two time periods (1995–1997 versus 1992–1994: $z = 2.2$, $P < 0.05$; 1995–1997 versus 1989–1991, $z = 2.0$, $P < 0.05$; 1992–1994 versus 1989–1991; $z = 0.15$, $P = 0.88$).

It is important to note that there was also a difference in the quality of DM’s responses on the identification component of the Public Events Test across time, as measured by the distribution of the rated scores for his memories. In the most recent time period (1995–1997), the majority of items for which DM produced information (7/10) averaged a score of 2 or above, suggesting that he possessed some semantic knowledge about those events. By contrast, DM seemed only able to produce superordinate-like information in the two earlier time periods (1989–1991 and 1992–1994), as most of his memories were scored between 0.5 and 1.5.

Discussion

Our study has shown that a patient with semantic dementia (DM) was profoundly impaired in his ability to recognize and identify major public events from the last 9 years. In particular, DM’s semantic knowledge of the circumstances of public events was poor. We had postulated in the

Introduction to this paper, that DM would show a reverse temporal gradient (i.e., that he would be significantly better at recognition and identification from 1995 to 1997 compared with the two earlier time periods, 1989–1991 and 1992–1994). Figures 2 and 3 confirmed this prediction, although it should be noted that DM was still significantly impaired compared to the controls in 1995–1997 on both components of the test.

Reverse temporal gradients in semantic dementia

The result from this paper is congruent with a number of other studies concentrating on the effect of time on long-term memory in semantic dementia. As mentioned in the Introduction, it has been shown that patients with semantic dementia show reverse temporal gradients on tests of autobiographical memory and person-specific semantic knowledge (Snowden et al., 1996a; Graham and Hodges, 1997; Hodges and Graham, 1998). A single case, AM, showed a striking effect of time on his ability to produce autobiographical memories from four time periods using cue words (e.g., holiday). A detailed analysis of his autobiographical memories revealed that he was only able to produce specific and detailed memories from the last 2 years of his life (Graham and Hodges, 1997). The case described here, DM, showed a time-dependent loss of semantic knowledge about famous personalities when tested using a Famous Faces Test (see Table 2) and a Famous Names Test (Hodges and Graham, 1998). Hodges and Graham found that DM was significantly better at producing information about personalities from the current time period compared to the 1950s, 1980s and 1990–1993. The difference between DM’s knowledge of famous personalities in the current time period (1994–1996) and in the period from 1990–1993 was congruent with AM’s ‘short’ 2-year autobiographical history.

The data obtained in this study confirm that DM has a time-specific loss of semantic knowledge: not only is his ability to produce information about famous personalities better in the current time period compared to other time periods, but so is his knowledge of public events. These results suggest that the loss of long-term memories (both semantic and autobiographical) in patients with semantic dementia, at least based on AM’s and DM’s data, is time dependent (i.e. the retrieval of recent memories is significantly better compared with the retrieval of more distant memories). As we have postulated in other papers, we believe that the reverse temporal gradients seen in semantic dementia reflect the initial preservation of structures in the medial temporal lobe in the disorder.

Furthermore, it is interesting that, like his performance on the Famous Names Tests (see Hodges and Graham, 1998), DM was only able to produce detailed information for events for a short time period (1995–1997). This pattern is consistent with that of AM on the Crovitz test of autobiographical memory, and provides more data in
support of the view that autobiographical and semantic memory are only preserved for a short period of time in semantic dementia. These findings can be considered in terms of the theory described above: if the normal process of consolidation, from medial temporal lobe to neocortex, is disrupted by the infero–lateral temporal lobe atrophy seen in the disorder, the retrieval of recent events will become increasingly reliant, perhaps to an exaggerated extent, on the hippocampal complex. This growing dependence on the medial temporal lobe will result in faster, compared to normal, overwriting of memories (increased rates of forgetting, see Murre, 1997). There is some preliminary evidence in support of this hypothesis: DM showed a rapid loss of newly learnt vocabulary in an experiment designed to investigate the effects of practice (see Graham et al., submitted for publication). This theory may explain why the reverse temporal gradients seen in semantic dementia are ‘step-like’ in nature, with better performance for a short period of time spanning 1–2 years.

At this point, a cautionary comment is required: while our studies of reverse temporal gradients have given us a measure of how long autobiographical memories and semantic knowledge might be preserved in patients with semantic dementia, it is important to note that the results from the studies are only applicable to this disorder. This fact relates to the hypothesis presented above, that patients with semantic dementia show abnormally fast forgetting of hippocampally dependent memories because the damage to the temporal neocortex disrupts normal cortical consolidation. The data from semantic dementia, therefore, do not necessarily inform us about the time span of cortical consolidation in normal subjects with a functioning semantic system, nor can we use the 2-year time period as a foundation for determining the expected degree of retrograde amnesia in patients with selective damage to the hippocampal complex. More specifically, we are not maintaining that the 2-year preservation of memories seen in semantic dementia is true for normal controls or other patient groups, as a number of factors, many of which are currently unknown, must influence cortical consolidation in humans. Factors which have been proposed include the rate of decay from the hippocampus, the rate of incorporation of hippocampal traces into the neocortex and the salience of the experienced event (McClelland et al., 1995; Graham and Hodges, 1997). It is clear from this brief review that a considerable amount remains to be learnt about which factors (physiological and psychological) might influence cortical consolidation.

**Neural basis for public events and autobiographical memory**

Despite the clear temporal gradient in DM’s identification score, one should not forget that DM actually showed moderately poor performance on the Public Events Test, even in the most recent time period. Over the last 2 years, we have been unable to find another patient who could perform such a Public Events Test: in general, the language used in the test is too complicated to allow us to examine knowledge of events rigorously. For example, typical responses by other patients with semantic dementia when asked to produce information about the event ‘The Brent Spar Affair’ have been, ‘I’ll tell you if you tell me what spar means’. As discussed in Hodges and Graham (1998), DM is a unique patient in the sense that he presented at a far earlier stage of the disease than many of our other cases, allowing us to test semantic knowledge of people and events while DM’s spoken and written language comprehension was still relatively good. The data from DM (and the poor performance of more severely affected patients on Famous Names and Public Events Tests) suggest that these types of semantic knowledge, as well as more general semantic knowledge, are affected relatively early in the disease. Furthermore, as DM has been shown to have selective left temporal lobe damage (on MRI and PET imaging), it seems reasonable to assume that knowledge of public events, like knowledge of objects, the meanings of words etc., are represented in this area of the brain.

By contrast, DM does not seem to have such a profound loss of his own autobiographical memories compared to the integrity of his knowledge about people and events. Hodges and Graham (1998) reported data showing that DM’s performance on the Autobiographical Memory Interview (Kopelman et al., 1989, 1990) in November 1995 was within 2 SD of control subjects. Since then, DM’s performance on the AMI has declined, revealing a reverse temporal gradient (see Table 1), but is still notably better than his performance on the Public Events Test and the Famous Faces Test described here. It is perhaps not surprising, for at least three reasons, that patients with semantic dementia might show such a differential impairment on the two types of long-term memory.

We have suggested, elsewhere, that there is probably an ‘experiential’ difference between watching a public event on television and taking part in one’s own autobiographical experiences (Graham et al., 1997b). For example, one could envisage the situation where a patient with semantic dementia may not remember watching the funeral of Princess Diana on the television, but remembers attending a best friend’s funeral around the same time. If, however, the patient had been present at Princess Diana’s funeral, we would predict that his/her memory for the event would be much better than if he/she had watched the proceedings on television.

A second reason that memory for public events might be more impaired in semantic dementia is related to the ability of the patient to aid their comprehension in more naturalistic settings. While DM can ask people that he meets to speak slowly or to explain confusing situations, this is impossible when watching the television and, to a lesser extent, reading the newspaper. As mentioned in the case-history, DM has reported increasing difficulty
understanding newspaper text over the last 2 years: initially, a committed reader of a broadsheet newspaper ‘The Times’, he downgraded to a tabloid, ‘The Daily Express’ soon after we first saw him, and, more recently, DM has reported that he is no longer able to keep up with the television soap opera ‘Coronation Street’.

A third factor which may explain DM’s discrepant performance on autobiographical and semantic memory tests may be the selective nature of his neuroanatomical damage. There is some evidence that the neuroanatomical locus of autobiographical memories may be lateralized in damage. There is some evidence that the neuroanatomical damage involves both temporal lobes. AM, the patient reported in Graham and Hodges (1997), had bilateral damage (left greater than right) and showed a striking loss of autobiographical memories for almost all his life. By contrast, although DM’s performance is poor on tests of autobiographical memory (given at the same time as the Public Events Test), his degree of impairment on autobiographical memory is much better than those obtained for the group of six patients with semantic dementia. The data from DM may provide important information with respect to furthering our understanding of the neuroanatomical representation of autobiographical memory, as neuroimaging has revealed no damage to his right temporal lobe. It seems plausible, therefore, that DM’s better, although not entirely preserved, autobiographical memory reflects the selective damage to his left temporal lobe. If, and when, the pathology progresses into the right temporal lobe, we would predict that DM will show a more profound loss of autobiographical memories (similar to that seen in AM and other cases of semantic dementia).

In summary, we have demonstrated that a patient with semantic dementia (DM) showed a reverse temporal gradient on a test in which he had to recognize and identify famous events from the recent and more distant past. DM was significantly better at recognition and identification of events from 1995 to 1997 compared with events from 1989 to 1991 and 1992 to 1994. We believe that this finding, in combination with the documentation of similar reverse temporal gradients on tests of autobiographical memory and knowledge of famous people in DM and other patients with semantic dementia, is further evidence of the fundamental impact of time on the loss of long-term memories in the disease. As we have argued elsewhere, the preservation of recent semantic and autobiographical memory (compared with memories from the more distant past) probably reflects the involvement of the hippocampal complex in the temporary storage of recent memories. By contrast, loss of more distant semantic knowledge and autobiographical memories can be attributed to the progressive atrophy of the temporal neocortex seen in the disorder.

DM’s performance on tests of autobiographical memory and public events also allow us to speculate about the neural basis of these types of long-term memory. The profound impairment shown by DM on the Public Events Test, in conjunction with evidence of selective damage to his left temporal lobe, suggests that knowledge of public events may be heavily reliant upon the left temporal lobe. The better preservation of DM’s autobiographical memory, compared to his public event memory, is support for the view that a severe retrograde memory impairment may only occur with bilateral damage to the temporal lobes.

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References


List of the exemplars used in the Public Events Test

1989
- The Salman Rushdie Incident
- The Tiananmen Square Massacre
- The Exxon Valdez Disaster
- The Oliver North Conviction
- The Berlin Wall Dismantled

1990
- The Maastricht Treaty
- The Warrington Bombing
- The Braer Tanker Disaster
- The Camilla-Gate Scandal
- The BCCI Scandal

1991
- Desert Storm
- The Kremlin Coup
- The Birmingham Six Freed
- The BCC Scandal

1993
- The Maastricht Treaty
- The Warrington Bombing
- The Braer Tanker Disaster
- The Camilla-Gate Scandal
- The Waco Siege

1995
- The Brent Spar Affair
- The Tokyo Subway Gas Attack
- The Philip Lawrence Murder
- The Barings Bank Scandal
- The Parkhurst Jailbreak

1997
- The Saudi British Nurses Trial
- The Southall Train Crash
- The Death of Dodi and Diana
- The Indonesian Smog Disaster
- The Hong Kong Handover

Appendix 1

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A reverse temporal gradient for public events in a single-case of semantic dementia

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Abstract
A patient with semantic dementia (DM) was tested on a Public Events Test comprising famous events from three time periods (1989–1991, 1992–1994 and 1995–1997). DM was impaired on both recognition and identification of these events compared to two matched control subjects. Furthermore, he showed evidence of a reverse temporal gradient on both components of the test, recognizing more items and producing more detailed information about events from 1995–1997 compared to events from the other two time periods. The results from this experiment are congruent with data from other published studies in which patients with semantic dementia show reverse temporal gradients on tests of autobiographical and semantic knowledge.

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O129

Primary diagnosis of interest
Semantic dementia

Author’s designation of the case
DM

Key theoretical issue
- A patient with semantic dementia (DM) showed evidence of a reverse temporal gradient on a test in which he had to recognize and produce information about public events

Key words: autobiographical memory; public events; semantic dementia; semantic memory; temporal lobes

Scan, EEG and related measures
MRI, PET

Standardized assessment
Hodges semantic battery, Pyramids and Palm Trees test, Breedin et al. (1994), Synonymy test, Judgement of Line Orientation, WAIS-R, Raven’s Progressive Matrices, Rey Complex Figure, Warrington Recognition Memory Test, AMI

Other assessment
Surgical knowledge test, Famous faces test, Famous events test

Lesion location
- MRI (1995): left temporal pole with inferior region of the mid and posterior temporal lobe, sparing of the hippocampal complex
- PET: hypoperfusion to inferior and middle portion of left temporal lobe

Lesion type
Neurodegenerative disease (frontotemporal dementia)

Language
English