

*Short report*

## Selective impairment of topographical memory: a single case study

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**SUMMARY** We describe a patient who developed topographical memory loss after a closed head injury. His symptoms and the psychological test results indicate a selective deficit of topographical memory, his perceptual and spatial skills being relatively unimpaired.

Impairment of topographical memory is identified in a patient who gets lost in familiar surroundings and fails to recognise familiar landmarks. This syndrome is mainly reported in patients with posterior cerebral lesions, and is frequently associated with both spatial and perceptual deficits (Paterson and Zangwill, 1945; Hécaen and Angelergues, 1963; Assal, 1969). On the other hand, Pallis (1955) reported a patient with topographical memory loss associated with marked perceptual disturbances (prosopagnosia, achromatopsia, metamorphopsia) but whose spatial skills were well preserved. Whitty and Newcombe (1973) reported that spatial impairment was more commonly associated with topographical difficulties than was perceptual impairment. More recently it has been suggested that topographical memory loss may occur as a selective impairment of memory for one class of visual material. De Renzi *et al.* (1977) reported a single case study of a patient in whom both spatial and perceptual skills were intact, and visual memory, apart from a clear failure on the route learning test, was normal.

In this study we describe a patient in whom topographical memory loss occurred as a relatively circumscribed deficit, and we have attempted to establish that his topographical difficulties can best be accounted for by selective impairment of memory for topographical information.

### **Patient**

The patient (JC), a 46 year old male shopfitter, was referred to the Psychology Department of the

National Hospital in 1976 for assessment of his memory difficulties. He had sustained a severe head injury in a car accident in 1973 from which he made a slow but uneventful recovery. He was unconscious for one week, and he had a retrograde amnesia for two to three weeks and a post-traumatic amnesia of several months. For at least a year after the accident he complained of impairment in all aspects of memory, and he reported that he had had difficulty in making decisions and organising his daily life.

His present complaint, four years after the accident, is of a failure to recognise buildings, streets, and other landmarks, which incapacitates him to the extent that he gets lost in familiar surroundings. He describes looking at a building, being able to see and describe it clearly, yet, if he looks away and then looks back again, it looks different as though someone had put another unfamiliar building in its place. The street in which he lives seems unfamiliar and each day he might be going along it as if for the first time. He recognises his own house by the number or by his car when parked at the door. On one occasion he failed to recognise as familiar a shop window on which he had worked as a fitter for some two months. His ability to visualise buildings he had known before the accident is poor, and when he actually sees a well-known building, such as the Houses of Parliament, it is not at all as he remembered it.

JC's life style as a shopfitter depends on his ability to drive his car to frequently changing places of work. He complains of considerable difficulty in getting about, and says that learning new routes presents a real problem. He can, however, use a map easily and follow verbal instructions. He relies heavily on street names, station names, and house numbers. For example, he knows that

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to get to the shops he has to turn right at the traffic lights and then left at the Odeon Cinema, but if he misses these specific landmarks, he may get lost. When he changes his place of work he draws a plan of the route to work and a plan of the interior of the "new" building. He relies on these maps and plans, and it is clear that they provide him with an entirely effective method of getting around both places and buildings.

Apart from these topographical difficulties JC reports only a minor degree of difficulty in recognising people's faces, especially people he has met recently, and a minor degree of nonspecific forgetfulness. He is, nevertheless, able to read a book and follow a film or play without difficulty. He has noticed no difficulties in writing, drawing, or making scale plans. He is able to carry out his work as a shopfitter with no loss of efficiency.

The neurological examination was normal. His visual acuity is 6/6 uncorrected in both eyes, and the visual fields are full to confrontation and a red pin. An EEG performed in 1975 was normal.

### Psychological assessment

#### INTELLECTUAL LEVEL

JC was tested on the WAIS and obtained a verbal IQ of 107 and a performance IQ of 109 (each scale prorated from three test scores). In view of his educational and occupational record there is little or no indication that these figures are below his optimal level.

#### MEMORY

JC was tested on a memory scale (EK Warrington, unpublished) comprising six subtests which have been standardised on 200 normal subjects. Further details of the test procedure and rationale for their inclusion in the memory battery are provided by Warrington and Weiskrantz (1968, 1974) and Warrington (1974). Raw scores are converted to scale scores, each subtest having a mean scaled score of 10 with a standard deviation of 3. JC's individual scaled scores (corrected for age) for each of these subtests are given in Table 1. His overall memory quotient was 98.

Table 1 *Memory test scores*

<i>Test</i>	<i>Scaled score</i>
Recognition memory for words	15
Recognition memory for faces	8
Learning incomplete drawings	9
Learning incomplete words	7
Verbal retention tested by prompting	11
Verbal recognition tested by yes/no recognition	9

#### SPATIAL AND PERCEPTUAL SKILLS

A series of tests designed to examine various aspects of his spatial and perceptual skills was administered. These included perception of unusual view objects, face discrimination, identification of fragmented letters, and three tasks with a spatial component, namely judgment of position, counting dots, and cube analysis. A full description of these tests has been given previously (Whiteley and Warrington, 1977). JC's scores, together with the mean scores obtained by 20 normal subjects (age range 40–54 years), are given in Table 2. JC's performance was entirely normal on all these tasks.

Table 2 *Spatial and perceptual skill test scores*

<i>Test</i>	<i>JC score</i>	<i>Control subjects</i>	
		<i>Mean score</i>	<i>Range</i>
Unusual views	17/20	18.8/20	10–20
Faces, same/different	20/20	18.1/20	15–20
Fragmented letters	17/20	19.7/20	19–20
Dot position judgment	18/20	18.2/20	15–20
Counting dots	10/10	9.8/10	8–10
Cube analysis	14/16	14.9/20	10–16

#### TOPOGRAPHICAL MEMORY AND PERCEPTION

Three tests were devised to examine different aspects of topographical skills—perception of buildings and topography, and identification of well-known buildings. Twenty patients with peripheral nerve injuries, ranging in age from 36–56 years, were tested as control subjects. They were all English and had lived in London for at least 10 years.

*Topographical perception* Photographs of buildings, both in an urban and a country setting previously unknown to the subject, were taken from different views. Two photographs either of the same building or of different buildings were presented side by side, and the task was to judge whether the photographs were of the same building. There were 20 pairs of photographs, 13 were of the same building and seven were of different buildings. JS's score, together with the mean score and range of scores obtained for the control subjects, are given in Table 3. His performance on this task was clearly entirely normal.

*Topographical memory (for previously unknown buildings)* A recognition memory test for buildings was devised such as to be comparable with the forced-choice recognition memory tests for words and faces described above as part of the memory battery. The test comprised 47 photographs of previously unknown buildings which were presented to the subject singly at a three

Table 3 Topographical memory and perception test scores

Test	JC score	Control subjects	
		Mean score	Range
Same/different buildings	20/20	18.2	15–20
Memory for unknown buildings	31/47	42.6	35–46
Identification of well-known buildings	11/20	14.8	7–20

second rate, the subject responding “yes” or “no” to each according to whether he liked or disliked the architecture. Retention of these 47 test items was tested using a forced-choice technique; each test stimulus was presented together with a distraction item and the subject was asked to indicate the building seen in the presentation trial. The mean score and range of the 20 control subjects and JC’s score is given in Table 3. JC’s score is significantly above chance, but is nevertheless clearly worse than the poorest control subject (at least three standard deviations below the mean).

*Recognition of well-known buildings* The test stimuli comprised 20 well-known buildings in London (Buckingham Palace and so on). Subjects were asked to identify each one. The mean score of the control subjects and JC’s score are given in Table 3. JC’s performance on this test is at the lower limits of normal.

## Discussion

A clear cut impairment of recognition memory for new topographical information has been demonstrated in JC, other aspects of his cognitive function being entirely normal in the case of his perceptual and spatial skills, and relatively preserved in the case of memory for other classes of information. On a battery of tests selected to be sensitive to perceptual and spatial deficits, excluding the perception of objects and faces, his performance was average or better than average. More crucial for the present argument, on the test devised to maximise topographical perception (the same or different buildings test), by no means an easy task for normal subjects, his performance was without error. This finding provides good evidence that his perception of this class of visual information is entirely normal. It is, therefore, reasonable to suggest that his very poor score on the recognition memory test for topography is due to the memory load of the task. On a test of recognition memory for words he scored at a good average level, while on a comparable test of recognition memory for faces his performance

was relatively poor, scoring at one standard deviation below the mean. Further, on one test of learning using fragmented visual stimuli, his performance was somewhat weak but on other tests of verbal memory his performance was entirely normal. We would suggest that his visual memory is less good than his verbal memory, and that his memory for one class of visual memory, topography, is selectively impaired. One can only speculate as to whether JC’s syndrome is essentially like that of MA, the patient with route learning difficulties reported by De Renzi *et al.* (1977). Unfortunately, it was not possible to test JC on a maze learning task but, judging from his everyday dependence on skilful map reading, his performance might well have been normal. Is it possible that topographical memory loss can be divided into two components—memory for topographical spatial information and topographical features information—with the latter taking the brunt in the present case? At any rate it seems clear that the syndrome, topographical memory loss, can occur in a similar way to prosopagnosia as a selective memory deficit for one class of visual information.

This case does not further our knowledge of the anatomical correlates of the syndrome but, accepting that a visual memory deficit has been established, and extrapolating from the association of medial temporal lobe lesions with a variety of visual memory deficits, we would expect the right posterior temporal regions to be more critical in maintaining this skill than more posterior regions in the parietal lobe.

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