

Early orientation of attention toward the half space ipsilateral to the lesion in patients with unilateral brain damage

Guido Gainotti, Patrizia D'Erme, Paolo Bartolomeo

Abstract

Posner has suggested that unilateral spatial neglect could be due to a difficulty in disengaging attention from its current focus to orient it toward the neglected half space. Clinical and experimental data suggest, however, that this disengaging difficulty could be only one aspect of a more complex disturbance also characterised by an early automatic orienting of attention toward the half space ipsilateral to the lesion. To test this hypothesis, two different investigations in unselected groups of patients with right and left brain-damage were carried out. The first investigation, to evaluate forms of lateral orienting of attention severe enough to provoke an overt gaze deviation, consisted of the systematic assessment of the phenomenon of "magnetic gaze attraction". The second investigation, to detect milder forms of automatic orienting of attention, analysed the temporal sequence followed in identifying the pictures represented in an "Overlapping Figures task", to see if patients tended to identify first figures lying in the half space ipsilateral to the lesion. In both investigations results consistently showed: a) that patients with right brain damage tend to orient attention automatically toward the ipsilateral half space more than patients with left brain damage; b) that this tendency is tightly linked to the presence of behavioural manifestations of hemi-neglect. These results are therefore consistent with the hypothesis that hemi-neglect is a multi-component syndrome with an early orienting of attention toward the half space ipsilateral to the lesion as the first of these components.

matically, and viewed the extinction phenomenon as a consequence of this inability.

Although this interpretation may adequately explain the extinction phenomenon, it can hardly account for some of the aspects of the unilateral spatial neglect syndrome. Clinical observations and neuropsychological data^{4,5} suggest that the difficulty in disengaging attention from its current focus could be but an aspect of a more complex disturbance also characterised by an early automatic orienting of attention toward the half space ipsilateral to the lesion. To verify this hypothesis, we carried out two simple neuropsychological investigations, which aimed to separately take into account severe and subtle forms of automatic lateral orienting of attention in patients with and without unilateral spatial neglect.

A clinical phenomenon which seems to express a severe form of automatic lateral orienting of attention is the "magnetic gaze attraction," described by Cohn⁶ in patients with homonymous hemianopia and considered by Friedland and Weinstein⁷ as an ocular motor disorder analogous to visual extinction. This phenomenon, which is usually observed while assessing the visual fields of the patient with the confrontation technique, consists of a tendency to orient the gaze toward the side ipsilateral to the brain lesion spontaneously as soon as the examiner outstretches his or her arms and before the administration of the stimuli. To study the relationships between "magnetic gaze attraction" and unilateral spatial neglect, we assessed systematically, in our first investigation, the frequency of this phenomenon in unselected groups of patients with right and left brain damage, with and without evidence of unilateral spatial neglect.

A second clinical phenomenon which seemed appropriate to study milder forms of early automatic orienting of attention was the scanning pattern shown by patients with brain damage while identifying pictures represented in an Overlapping Figures Test. It could be predicted that if patients tend to orient first toward stimuli lying in one half of space, they should identify first pictures placed in that part of the composite diagram, turning only later to pictures lying on the other side of the display. An analysis of the temporal sequence followed by right and left brain-damaged patients while identifying the pictures represented in an Overlapping Figures Test was therefore performed in our second investigation.

Among the "attentional" theories recently advanced explaining the unilateral spatial neglect syndrome, the cognitive interpretation proposed by Posner *et al* stems from the detailed analysis of the act of covert orienting of visual attention. According to the authors this orientation consists of three successive mental operations: 1) disengaging from the current focus of attention; 2) moving toward the target; and 3) engaging the target.

Posner *et al*¹⁻³ suggested that parietal lobe injuries specifically affect the ability to disengage attention from its previous focus auto-

**Institute of Neurology
of the Catholic
University, Rome,
Italy**

G Gainotti
P D'Erme
P Bartolomeo

Correspondence to:
Dr Gainotti, Neurological
Clinic, Catholic University,
Policlinico Gemelli, largo A
Gemelli 8, 00168 Rome,
Italy.

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Our general hypothesis was that if automatic orienting of attention toward the half space ipsilateral to the lesion is an important component of unilateral spatial neglect, then a strong relationship should exist between presence and severity of lateral orienting of attention and presence and severity of unilateral spatial neglect.

Thus a magnetic gaze attraction should be mainly (or almost only) observed in patients with severe hemi-neglect, whereas a tendency to point first to figures lying in the half space ipsilateral to the lesion should also be observed in patients with mild forms of hemi-inattention.

EXPERIMENT 1

Although the phenomenon of the "magnetic gaze attraction" has been described by Cohn⁶ in patients with both right and left hemianopia and has not been considered as part of unilateral spatial neglect syndrome, we studied more closely the relationships between magnetic gaze attraction and unilateral spatial neglect, particularly taking into account two problems: a) The relationship between magnetic attraction and laterality of lesions, to see whether magnetic attraction prevails in patients with right brain damage, as is usual with unilateral spatial neglect.⁸⁻¹⁰ b) The relation between magnetic attraction, homonymous hemianopia, visual extinction and unilateral spatial neglect. We predicted that if the magnetic attraction is part of the unilateral spatial neglect syndrome, then it should clearly prevail in patients with right brain damage with severe signs of hemi-neglect.

Subjects and methods

Subjects

Fifty three patients with right brain damage (RBD) and thirty three with left brain damage (LBD) participated in this experiment. Our patients were selected on the basis of clinical and neuroradiological evidence of unilateral brain damage. Mean age was 60.8 in RBD and 54.8 in LBD patients ($t = 1.99$; $p =$ not significant) and mean educational level (years of schooling) was very similar in patients with right (9.8) and in those with left (9.5) brain damage. The two groups were also well matched for cause (in each group vascular patients represented about 80% of the whole sample) and the intra-hemispheric locus of lesion.

Testing Procedures Four aspects of the patients' behaviour were considered in our first experiment:

- 1) The presence of a visual field defect, assessed by means of a perimetric examination;
- 2) The presence and severity of unilateral spatial neglect, assessed by means of a standard battery comprising tests of: overlapping figures identification;¹¹ searching for animals on a large board;¹¹ lines cancellation;¹² lines bisection;¹³ copying drawings;¹⁴ 3) The

incidence and severity of visual extinction;

- 4) The presence of magnetic gaze attraction.

For each test used to study visual neglect, the normative data obtained in control subjects distinguished normal from pathological performances. Within the latter, arbitrary cut-off points were drawn to distinguish two levels of severity of hemi-neglect. The following criteria were chosen to define "severe" and "mild to moderate" forms of unilateral spatial neglect: a rate of more than 40% omissions in the tests of line cancellation, copying drawings, overlapping figures identification and searching for animals was considered as an index of severe neglect. A displacement of the subjective centre exceeding 20% of line length in lines bisection tasks was also considered as an index of severe neglect. Conversely, performances characterised by less than 40% omissions (or by less than 20% displacement in lines bisection) were judged as indicative of mild to moderate forms of visual neglect.

Patients were classified as affected by a severe form of unilateral spatial neglect when their neglect was scored as severe in at least three out of the five tests of the battery. They were, however, considered to show mild to moderate forms of hemi-neglect when their performances had been rated as mild to moderate in at least three out of the five tests.

To detect visual extinction and magnetic gaze attraction toward the unaffected field, patients were submitted to a visual field assessment with the confrontation technique. They were seated at a distance of about 1 metre from the confronting examiner who held the arms outstretched and moved the fingers either in one hemifield or in both hemifields simultaneously, according to a previously randomised pattern. The sequence consisted of 36 stimuli distributed as follows: nine right and nine left single stimuli, 18 double simultaneous stimulations, administered in the superior or inferior quadrant of each hemifield or on the horizontal midline. For 12 RBD and for seven LBD patients a shortened version of 24 stimuli was used. The sequence was administered twice on a few occasions.

Patients were asked to fixate their gaze on the examiner's nose and to report each movement of the examiner's fingers. Patients were considered to show extinction when at least three out of 18 stimuli of the double stimulation series were not detected, whereas the omission of single stimuli was the exception. Furthermore, extinction was obviously also found in patients with visual field defect (quadrantanopia or hemianopia), together with a higher number of omissions of single stimuli applied to the affected field.

Patients were defined as affected by a severe form of visual extinction when more than 60% of contralateral stimuli were omitted on double simultaneous stimulation. Rates of unilateral extinction ranging from 16-60% were considered as mild.

Patients presented magnetic gaze attraction when the examiner detected the occurrence of

Table 1 Incidence of magnetic attraction, visual field defect (VFD), unilateral spatial neglect and visual extinction (VE) in patients with right and left brain damage. Incidence of VE and relative statistics after having excluded patients with VFD are reported in brackets

	Right brain damage	Left brain damage	Statistics
Magnetic attraction +	12	1	chi squared = 6.1 p = 0.013
Magnetic attraction -	41	32	
Total	53	33	
Visual field defect +	17	11	chi squared = 0.00 p = 0.30 (n.s.)
Visual field defect -	34	22	
Total	51	33	
Unilateral spatial neglect +	40	6	chi squared = 26.8 p < 0.001
Unilateral spatial neglect -	13	27	
Total	53	33	
Visual extinction +	39 (23)	15 (4)	chi squared = 8.4 (chi squared = 13.1) p = 0.004 (p < 0.001)
Visual extinction -	12 (11)	18 (18)	
Total	51 (34)	33 (22)	

spontaneous, automatic shifts of the patient's eyes toward the side ipsilateral to the lesion, as soon as the arms of the examiner were outstretched and before the administration of the stimuli. This phenomenon showed different degrees of severity, ranging from a brief eye shift followed by spontaneous re-engagement of fixation point to a gaze deviation which occurred for each item of the series of stimuli, and required verbal command to regain fixation. Patients were classified as showing magnetic attraction of gaze towards the ipsilesional side on the basis of the consistency of the phenomenon throughout the examination; progressively better control on maintenance of central fixation was acquired as the examination proceeded.

Results

1 Incidence of magnetic gaze attraction, visual field defect, unilateral spatial neglect and visual extinction in patients with right and left brain damage.

Table 1 reports the incidence of magnetic attraction, visual field defect, unilateral spatial neglect, and visual extinction in patients with right and left brain damage.

On confrontation test, a shift of the eyes toward the side ipsilateral to the lesion occurred in 12 of 53 (23%) RBD patients but only in one of 33 (3%) LBD patient. The magnetic attraction was brief and reversible in most patients, but was strong and persistent in two RBD patients, preventing them from correctly performing the confrontation test and the perimetric assessment of the visual field

defects. These patients were therefore discarded from the statistical analysis concerning these behavioural defects.

The incidence of visual field defect was very similar in patients with right and left brain damage, as there was a homonymous hemianopia or quadrantanopia in 17 of 51 patients with right brain damage and in 11 of 33 with left brain damage. A highly significant difference between the two hemispheric groups was observed when the incidence of unilateral spatial neglect was taken into account.

Finally, there was a highly significant difference between RBD and LBD patients when the incidence of visual extinction was considered (and this difference persisted even when patients with visual field defect were excluded from analysis).

2 Relationship between magnetic gaze attraction, unilateral spatial neglect, visual extinction and visual field defects.

To analyse the relationship between magnetic attraction, unilateral spatial neglect and visual extinction, we distinguished within the RBD patients, two levels of severity of visual neglect (mild to moderate versus severe) and two levels of consistency of visual extinction according to the criteria described in methods. Table 2 reports the incidence of the magnetic attraction in patients with right and left brain damage, as a function of the presence/absence of visual field defects and of the presence and severity of visual extinction and hemi-neglect.

Magnetic attraction was almost always found in patients with severe unilateral spatial neglect and with consistent visual extinction. Less

Table 2 Incidence of magnetic attraction in patients with right and left brain damage as related to the absence or presence of visual field defect and mild or severe forms of visual extinction and unilateral spatial neglect

	Right brain damage (n = 51)		Left brain damage (n = 33)	
	Magnetic attraction -	Magnetic attraction +	Magnetic attraction -	Magnetic attraction +
Visual field defect -	27	7	22	0
Visual field defect +	14	3	10	1
Visual extinction -	11	1	18	0
Visual extinction +	10	1	7	0
Visual extinction + +	20	8	7	1
Unilateral spatial neglect -	13	0	27	0
Unilateral spatial neglect +	12	2	5	1
Unilateral spatial neglect + +	16	8	0	0

striking is the link between magnetic attraction and visual field defect, as seven out of 10 RBD patients showed magnetic attraction in the absence of homonymous hemianopia or quadrantanopia.

Taken together, these results seem to show that magnetic gaze attraction and unilateral spatial neglect are highly interconnected. Both are significantly more frequent in right than in left brain-damaged patients and a magnetic attraction is almost only observed in patients with severe neglect for the contralateral half space.

EXPERIMENT 2

The results of experiment 1 showed that patients with right brain damage with severe unilateral spatial neglect often present a magnetic gaze attraction toward stimuli arising in the right half space. We aimed in experiment 2 to check if milder forms of lateral orienting of attention could be detected in patients with less striking signs of unilateral spatial neglect. An analysis of the scanning patterns shown by patients with right and left brain damage while

identifying pictures represented in an Overlapping Figures Test,¹¹ was deemed appropriate to solve this issue. The following hypothesis was advanced: if the first component of unilateral spatial neglect consists of an automatic orienting of attention toward the half space ipsilateral to the damaged hemisphere, then: A) Patients with right brain damage (presenting a higher incidence of unilateral spatial neglect) should tend first to identify figures lying in the half space ipsilateral to the brain lesion more than patients with left brain damage; B) The tendency to recognise first figures lying on the right side of the composite diagram should prevail in RBD patients with severe manifestations of unilateral spatial neglect, but should also be present in patients with milder forms of hemi-inattention.

Subjects and Methods

Subjects

Thirty five control subjects, 88 patients with right and 64 with left brain damage were examined. There was a partial overlap between the two experiments, as 46 patients with right and 28 with left brain damage who participated in experiment 1 also entered experiment 2. Control subjects had been admitted to hospital with neurological lesions below the brainstem or for symptoms not affecting the CNS. The localisation of lesions of patients with brain damage was determined by neurological examination, EEG and neuroradiological findings. No significant difference existed between control subjects and patients with right or left brain damage for age and education; aetiology and site of lesion of patients with brain damage were also well matched in the two groups.

Overlapping Figures Test

Six cards (14 × 21 cm) each bearing five overlapping figures of common objects were presented one at a time to the subjects at a distance of approximately 40 cm, thus subtending less than 20° of the subject's visual field. Each pattern consists of two figures overlapping on the right and two on the left side of the card, all of them overlapping a fifth centrally located figure. The first item was used as an introductory procedure, and the subjects were then requested to recognise the figures by pointing to identical figures interspersed with "distractors" on a multiple choice board placed just below the test card. An item from the Overlapping Figures Test is shown in the figure.

Three aspects of the subjects' behaviour were taken into account in this part of the study: 1) The tendency to explore first one side of the composite diagrams; 2) The presence of unilateral spatial neglect, evaluated with a criterion intrinsic to the Overlapping Figures Test; 3) The severity of neglect for figures placed on the half space contralateral to the damaged hemisphere.

1) The tendency to explore first one side of the overlapping figures was evaluated by recording the (right or left) space location of the figure first recognised by the subjects in each of

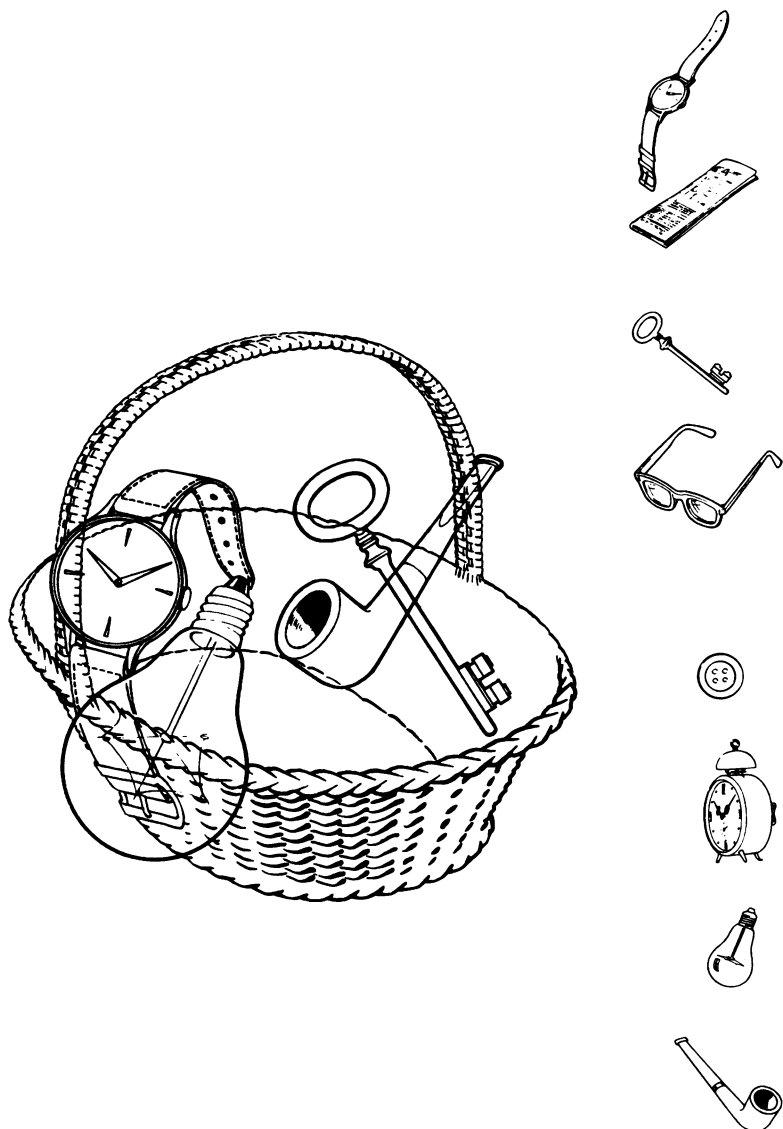


Figure An item from the Overlapping Figures Test. During the test, the display board, which is shown to the right of the composite diagram, was placed just below the stimulus pattern.

Table 3 Mean values for the first choice scores obtained by control subjects, and by patients with right and left brain damage in the Overlapping Figures Test

	n	Mean	(SD)
Control subjects	35	1.40	(1.03)
Patients with right brain damage	88	3.28	(1.59)
Patients with left brain damage	64	1.01	(1.07)

the five cards forming the test and counting the number of first recognitions made on the right side. The score ranged therefore from 0 (no right sided first choices) to five (five times first choices on the right side).

2) The presence of unilateral spatial neglect was evaluated by considering as affected by hemi-neglect patients who presented one or more omissions on the side contralateral to the damaged hemisphere, in the absence of ipsilateral omissions and patients who presented omissions on both sides, but at least twice as often on the contralateral as on the ipsilateral side.¹¹

3) Finally, the severity of hemi-neglect was assessed as severe when patients were unable to identify figures lying in the half space contralateral to the damaged hemisphere in the majority of items (at least three out of five) and as mild to moderate when patients were able to identify figures on both sides of space in the majority of items. This distinction aimed to check whether a tendency to orient their attention first to the ipsilateral side was also present in patients with mild forms or no signs of neglect. Although the Overlapping Figures Test had already been used in experiment 1, only the presence of neglect was evaluated in the same way as in that experiment, whereas the severity of neglect was assessed in a different manner. This was because in experiment 1 an overall evaluation of the severity of neglect was considered appropriate and that several independent tasks were used, choosing for simplicity a similar criterion of assessing severity across all these tasks. In experiment 2, a more specific aspect of the severity of neglect (namely the capacity to draw information from both sides of the stimulus) ought to be evaluated. We needed this procedure to ensure that at least in patients with mild or moderate neglect, the tendency to first report items on the

right side of the display was due to an early orienting of attention toward that side, rather than to a complete inability to explore the left half space.

The criterion of taking into account in the majority of items figures also lying in the half space contralateral to the damaged hemisphere was considered appropriate to solve this specific issue.

Results

1 *Tendency to identify first figures lying on the right and left side of the composite diagram in patients with unilateral brain damage and in control subjects.*

Table 3 gives the mean values for the first choice scores obtained by the three groups of subjects. Results show that RBD patients consistently analysed the stimulus pattern by identifying first figures lying on the right side of space. This behaviour significantly differs from that observed in control subjects and in patients with left brain damage: both groups showed a marked tendency to make their first choice on the left side of space and did not differ significantly from each other.

2 *Relationships between severity of unilateral neglect and early orienting of attention.*

Thirty seven of 88 (42%) RBD patients and seven of 64 (11%) LBD patients showed unilateral spatial neglect according to the criteria mentioned in methods. Eleven of 37 RBD neglect patients showed an almost complete inability to identify figures lying in the left half space and showed a severe form of unilateral spatial neglect, whereas the other 26 RBD neglect patients (and all the LBD patients) accomplished the task by identifying figures on both sides of space and showed a mild to moderate form of hemi-neglect. The difference between the frequency of unilateral spatial neglect in patients with right and left brain damage was highly significant at the statistical control (chi squared = 17.4, $p < 0.001$).

Table 4 reports the mean values of the first choice scores obtained by normal controls and by patients with right and left brain damage showing: a) no neglect; b) a mild to moderate neglect; c) a severe form of neglect.

Data reported in table 4 show that patients with left brain damage (with and without unilateral spatial neglect) are indistinguishable from the normal controls, whereas all three groups of patients with right brain damage (without, with moderate and with severe unilateral spatial neglect) significantly tend to start their identification from figures lying on the right side of space, more than the controls. Also patients with right brain damage who do not make omissions show a statistically significant tendency to identify first items on the right side of the pattern, compared with control subjects.

Table 4 Mean values for the first choice scores obtained by control subjects and by patients with right and left brain damage showing respectively: no neglect, a mild to moderate neglect, or a severe neglect

	Number	Mean	(SD)	One-way ANOVA
Controls	35	1.40	(1.03)	F = 31.063
RBD USN -	51	2.64	(1.55)	
USN +	26	3.92	(1.35)	p < 0.001
USN + +	11	4.72	(0.46)	
LBD USN -	57	1.05	(1.10)	
USN +	7	0.71	(0.75)	

Post-hoc statistics (non-orthogonal comparisons):

RBD USN -	versus Controls	F = 21.00	p < 0.01
RBD USN +	versus Controls	F = 61.78	p < 0.01
RBD USN + +	versus Controls	F = 60.29	p < 0.01
LBD USN -	versus Controls	F = 1.70	p ns
LBD USN +	versus Controls	F = 1.78	p ns

Legends: RBD = patients with right brain damage; LBD = patients with left brain damage; USN - = patients without unilateral spatial neglect; USN + = patients with mild to moderate neglect; USN + + = patients with severe neglect.

Discussion

The results of our research strongly suggest

that a bias in early orienting of attention toward the half space ipsilateral to the damaged hemisphere represents a mechanism underlying both dramatic and less severe forms of unilateral spatial neglect.

In experiment 1 the phenomenon of magnetic attraction of gaze toward the unaffected field during the confrontation test occurred far more frequently in patients with right brain damage than in those with left brain damage and was much more strongly associated with severe hemi-neglect than with homonymous hemianopia. Both these results are at variance with Cohn's findings which pointed to a relationship between magnetic attraction and visual field defects⁶ and suggest that the magnetic attraction is a part of the most severe forms of unilateral spatial neglect. Furthermore, since the gaze orientation toward the hand placed in the half space ipsilateral to the damaged hemisphere occurred before an actual stimulus was presented, these data show that hemi-neglect cannot be reduced to a difficulty in disengaging attention from its previous focus. They suggest that a series of events, beginning with an early orienting of attention toward the ipsilesional side, followed by a difficulty in disengaging attention from that side in order to orient it toward the contralateral half space, subserves the clinical syndrome of unilateral spatial neglect.

The results of experiment 2 confirm this and show that it can be generalised from the severe to the milder forms of hemi-neglect. When we substituted a subtler index of lateral orienting of attention (such as, the tendency to identify first the parts of a composite diagram lying just to the right or to the left of the midline) for a strong indicator (such as, an overt gaze deviation), the following results were obtained: a) Patients with right brain damage tended to identify first figures lying on the right side of the pattern, whereas the opposite trend was shown by normal controls and by patients with left brain damage; b) The tendency to identify first figures lying in the right half space was particularly strong in patients with right brain damage with severe unilateral spatial neglect, but was also clear in those with moderate hemi-neglect. Furthermore, even patients with right brain damage without clinical signs of unilateral spatial neglect on the Overlapping Figures Test tended to identify figures lying on the right side of the composite pattern significantly more than control subjects.

The tendency to identify first figures lying on the right side of the pattern was not limited to patients with severe hemi-neglect, but was also present in those with mild or no clinical signs of hemi-inattention; this is an important methodological point. It shows that neglect patients do not begin their identification from figures lying on the right side of the diagram simply because they limit their exploration to this part of the composite picture, as a similar pattern of behaviour is also present in patients with right brain damage with mild or no neglect who identify first the right-sided figures, but subsequently report also the left-sided stimuli. Together, these findings strongly suggest that a

bias in early orienting of attention toward the right half space is an important and frequent component of unilateral spatial neglect shown by patients with right hemisphere damage. Similar conclusions have been recently reached by Mark, Kooistra and Heilman.¹⁵ In an ingenious experiment they tested 10 RBD neglect patients on two versions of a cancellation task. In the control task, patients cancelled lines by drawing over them, whereas in the experimental task they erased them. Since patients made significantly more omissions in the drawing-over condition than in the erasing condition, the authors concluded that in the first condition neglect was increased by stimuli which still occupied the non-neglected half space, over-attracting the patients' attention. Thus the claim that an attentional bias may account for part of unilateral spatial neglect shown by RBD patients seems supported by data obtained with different methods in different laboratories.

Conversely, the observation that patients with right brain damage without clinical signs of neglect also tended more than control subjects to begin their identification from the right side of space clearly shows that this early orientation bias is only the first component of a series of events involved in the neglect syndrome. This component almost inevitably leads to the clinical syndrome of unilateral spatial neglect when it is very strong (as in our two patients with a persistent gaze deviation toward the extreme right side of space) and when it is accompanied by other components of the unilateral spatial neglect syndrome. If, however, patients are conscious of the tendency to orient automatically their attention toward one half of space and if therefore they manage to intentionally direct it toward the contralateral half space, then the early orientation bias can be counterbalanced and patients can achieve a complete space exploration. In this case patients invert the left-to-right scanning pattern usually shown by normal controls and by patients with left brain damage and progressively extend their exploration from the right to the left side of space.

Thus the results of experiments 1 and 2 clearly support the hypothesis, recently advanced by Karnath,¹⁶ that unilateral spatial neglect must be considered as a multi-component syndrome and that the first of its components consists of a spontaneous orienting of attention toward the half space ipsilateral to the lesion.

Our data also show that this early ipsilateral orienting of attention is much more frequent and severe in patients with right brain damage than in those with left brain damage, thus raising the problem of the mechanism underlying this asymmetry in orientation bias.

It might seem that Kinsbourne's theory,^{17, 18} viewing neglect as a bias in lateral orienting tendencies, should be the model which best fits our data. Even this theory, however, seems unable to fully account for our results. Kinsbourne¹⁸ views the preponderance of left-sided over right-sided hemi-neglect as an exaggeration of a physiological asymmetry between rightward and leftward orienting tendencies. This asymmetry should be present but is very

subtle in normal subjects and should be magnified in patients with brain damage by a disruption of the interhemispheric inhibition systems. If this interpretation was correct, normal subjects should show a mild tendency to orient first their attention to the right-sided figures of the Overlapping Figures Task, because of their more powerful rightward orienting tendencies. This prediction was refuted by our results, as normal controls showed an early orientation bias, but in the direction opposite to that anticipated by Kinsbourne's theory. They tended more significantly than it would be expected by chance to identify first figures lying on the left side of the composite diagram ($t = -6.289$; $p < 0.001$).

Further, our results are consistent with those obtained by other authors (for example, De Renzi, Faglioni and Scotti;¹⁹ Chédru, Leblanc and Lhermitte,²⁰) who have studied the activities of visual searching in normal controls and in patients with unilateral brain damage. Despite the different methods used in these investigations, in each case control subjects showed a consistent tendency to begin their activity of visual searching from the left side of the display.

It is therefore very unlikely that the striking prevalence in patients with right brain damage of the phenomenon of magnetic gaze attraction and of other subtler indicators of ipsilateral orienting of attention simply reflects the magnification of physiological asymmetries in lateral orienting tendencies.

It may be that these major interhemispheric differences reflect the selective disruption in patients with right brain damage of a mechanism linked to the orienting reaction. If one accepts that this automatic activity might be disrupted much more by right-sided than by left-sided lesions, then a series of outcomes could be predicted: a) The field of automatic orienting of attention should be severely imbalanced by large right hemispheric lesions, so that stimuli arising in the right half space could easily capture a patient's attention and automatically orient the gaze in that direction. Observations consistent with this prediction have been made by several authors (for example, Mesulam,²¹ Riddoch and Humphreys,²² Karnath,¹⁶ De Renzi, Gentilini, Faglioni and Barbieri,⁴ Marshall and Halligan.⁵)

A rightward orienting behaviour could also be provoked by non lateralised stimuli or by conditions which act phasically increasing the arousal level and hence activating the orienting tendencies of the patient. The striking prevalence of magnetic gaze attraction in patients with right brain damage could be explained on these grounds. b) The prevalence of unilateral spatial neglect in patients with right brain damage should be greater in tasks requiring a partly automatic orienting of attention than in those based on a more intentional activity of visual searching. This prediction is also confirmed by the literature available on the unilateral neglect syndrome (Gainotti, D'Erme and De Bonis²³). The most striking differences

between patients with right and left brain damage have been obtained on tasks (such as drawing tasks or overlapping figures) which require partly automatic orienting of attention toward the parts of the figures lying in the neglected half space, whereas less clear (or even non significant) interhemispheric differences have been obtained on visual searching tasks based on the active voluntary exploration of large parts of extrapersonal space.^{11 19 20 24} c) Finally, the notion of a possible dissociation between lost automatic orienting tendencies and preserved possibility of intentionally directing attention toward the contralateral half space could have important implications for the rehabilitation processes.

The behavioural difficulties resulting from an impaired tendency to automatically orient attention toward new or behaviourally relevant stimuli arising on the neglected half space could be overcome by teaching the patient to pay a deliberate, continuous attention to that part of space. Although this rehabilitative strategy has been explicitly mentioned by only a few authors (Seron, Deloche and Coyette²⁵), some techniques empirically used in rehabilitation programmes probably act through this mechanism. Thus Weinberg *et al*²⁶ suggest pacing the patient's visual exploration of the contralateral half space to improve hemineglect, but the efficacy of this training procedure probably results from causing a shift in the patient's scanning strategy, thus forcing him to pass from a partly automatic to a much more controlled use of the scanning eye movements.

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DEPICTIONS OF AN ODYSSEY

Depictions of an odyssey

by Peter MacKarell.

Edited by Sheila Paine.

Published by NSEAD, Corsham, Wiltshire.

On the walls of a top floor at Guy's Hospital, London, are a series of small gouache paintings. Visitors and hospital staff are captivated by the colourful works which painfully illustrate the impact of optic neuritis on an artist's perception of light and form. This book is a posthumous and touching tribute to the painter and patient, Peter MacKarell.

In 1980 Peter MacKarell experienced the onset of multiple sclerosis to which he succumbed eight years later. The artist's struggle with his illness, his fortitude and persistently enquiring nature are described in various ways in the book. It is well written, but the text is eclipsed by MacKarell's paintings.

The foreword is by Richard Hoggart who was warden of Goldsmith's College where the artist was a teacher. It is a warm and generous introduction which describes the artist's "incarceration" in various hospitals, each of which affected the artist's creativity. For example, gloom and despair characterised a period in a ward for the young and chronically disabled. The first chapter by the writer Bevis Hillier covers the artist's career as an illustrator and cartoonist. The second is by a fellow painter, Stanislaw Frenkiel, who movingly describes the changing styles, techniques and subjects of the painter as his circumstances and vision alter with the illness.

The last two chapters are by the artist himself. He writes about the optic neuritis which heralded the onset of his disease. He describes the puzzling circumstances of deteriorating vision, blindness and recovery. His series of highly personal pictures illustrate this experience. A later sequence of pictures painted during convalescence now hang in the Institute of Ophthalmology.

The last chapter contains some excerpts from an illustrated journal he kept for his daughter whilst he was in a nursing home. His decline is all too apparent. In the closing pages he struggles to make sense of the confused images of



Pageswim. "One evening my lad asked me to look up a word in the French dictionary and I found that I could not make out the print because at each point I attempted to focus, the individual letters were obscured by an infuriating and irritating bouncing grey dot. Although I was alarmed I was somewhat relieved to find I was able to watch the television pictures on the *News at Ten*. Somewhat shaken by these events I went to bed." (From *Depictions of an Odyssey*, Peter MacKarell 1990, National Society for Education in Art and Design.)

shape and colour, analysing them with an artist's training, and reflecting fondly on earlier painters who had influenced him.

Peter MacKarell was a supremely talented artist who must have been a great inspiration to his family and friends.

T GIBSON