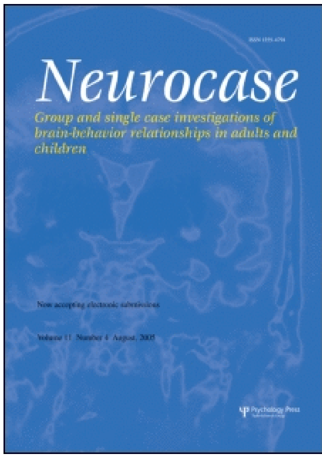

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Attention and Emotion in Anosognosia: Evidence of Implicit Awareness and Repression?

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Attention and Emotion in Anosognosia: Evidence of Implicit Awareness and Repression?

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Accounts of anosognosia for hemiplegia have long suggested some implicit knowledge of deficit, where lack of awareness is driven by the emotionally-aversive consequences of bringing deficit-related thoughts to consciousness. The present study investigates this issue using an attentional-capture paradigm, presenting words associated with hemiplegia-related deficit. As anticipated, non-anosognosics showed reduced latencies (i.e., facilitation) for emotionally threatening words. In striking contrast, anosognosics showed *increased* latencies (i.e., interference), a finding which supports the claim of implicit awareness. The effect appears to be due to newly-learned associations to disability-related words: where anosognosics show a pattern of performance previously described as repression.

Keywords: Anosognosia; Emotion; Repression; Implicit awareness; Attention.

Introduction

Anosognosia, or denial of deficit, is a remarkable neuropsychological disorder, which bears on important conceptual issues such as self-deception (Ramachandran 1996a; Trivers 2000). It occurs most commonly, and in its most severe form, after large lesions to the right hemisphere. In the most extreme cases these patients produce frankly delusional beliefs about the hemiparetic limb (Bisiach, Perani, Vallar, & Berti 1986; Ellis & Small 1993; Feinberg 2001; Feinberg & Keenan 2005; McGlynn & Schacter 1989; Ramachandran 1995; Weinstein & Kahn 1955). For example, they may be convinced, despite having striking motor impairments, that their limbs can move normally, or that an immobile limb has actually moved, or they may move the opposite limb in response to a direct request to move the paretic side (Feinberg, Roane, & Ali 2000; Kaplan-Solms & Solms 2000; McGlynn & Schacter 1989; Ramachandran 1995, 1996b). In a milder manifestation of this disturbance (anosodiaphoria), patients recognize that they are paralyzed, but seem indifferent towards their deficits (Critchley 1953; Feinberg 2001; Feinberg & Keenan 2005). In addition, these patients usually employ cognitive strategies to account for the obvious evidence of their disability: for example rationalizing that the limb is temporarily dysfunctional because of a recent bout of exercise (Kaplan-Solms & Solms 2000; Ramachandran 1995; Ramachandran & Blakeslee 1998).

Early accounts of the disorder suggested that anosognosia might be secondary to neglect, though this argument has been undercut by a number of cases of dissociation (Bisiach et al. 1986; Jehkonen, Ahonen, Dastidar, Laippala, & Vilkki 2000; Marcel, Tegner, & Nimmo-Smith 2004). More recent accounts suggest, for example, that the disorder is due to disruption of a system that generates awareness (Schacter 1990, 1992), or as a secondary consequence of sensory feedback mechanisms (cf. Bisiach et al. 1986; Heilman, Barrett, & Adair 1998).

However, such accounts have invariably struggled to explain the *delusional* aspects of the patients' presentation: the question is why the beliefs are so strongly held in the absence of credible evidence (see Vuilleumier 2004 for a recent review). Alternative accounts have focussed on the possible role of emotion or motivation in anosognosia (Bisiach & Geminiani 1991; Ramachandran 1996a; Vuilleumier 2004). In particular, such accounts suggest that denial of deficit might represent a form of a 'defence' against becoming aware of disability. However, the traditional accounts of this sort (Weinstein & Kahn 1953) failed to offer a credible explanation for why the disorder should occur mainly after central (rather than peripheral) lesions, why the lesion site should be

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right-lateralised, and why the disorder should be selective to only some classes of deficit (Bisiach & Geminiani 1991; Vuilleumier 2004). Nevertheless, the idea has recently been revived, partly because of the demonstration that anosognosia can be modified by pharmacological (Spalletta, Ripa, Bria, Caltagirone, & Robinson 2006) or psychological manipulations (Kaplan-Solms & Solms 2000; Marcel et al. 2004; Ramachandran & Blakeslee 1998). In addition, there have been remarkable reports of the temporary remission of anosognosia and somatoparaphrenic delusions after unilateral caloric stimulation (Bisiach, Rusconi, & Vallar 1991; Ramachandran 1995).

In addition, the theoretical account which underpins the motivational claim has also become better developed. In particular, it is claimed that anosognosia might be due to a lesion of a right-lateralised emotion-regulation system (Kaplan-Solms & Solms 2000; Turnbull, Jones, & Reed-Screen 2002; Turnbull, Evans, & Owen 2005). This idea has some face validity, given that the lesion site in anosognosia also appears to be centrally important for emotion (Borod 2000; Damasio 1996; Davidson & Irwin 1999; Spalletta et al. 2006). Indeed, patients with right hemisphere lesions frequently develop emotional changes, such as anxiety and depression (Gainotti 1972, 2005; Spalletta et al. 2006; Starkstein, Berthier, Fedoroff, Price, & Robinson 1990; Starkstein, Fedoroff, Price, Leiguarda, & Robinson 1992). In addition, while anosognosic patients show an apparently normal range of emotions, they may have difficulty tolerating aversive emotional states, especially when experiencing feelings of sadness and loss in relation to themselves (Turnbull et al. 2002, 2005).

These emotion-related explanations also suggest the possibility that these patients might have some degree of implicit awareness of their deficit: such that they can be modified by anti-depressant medications (Spalletta et al. 2006), and by psychological interventions that change the affective consequences of the patients' motor disability, such as the manipulation of the first- versus third-person perspective (Marcel et al. 2004), offering the patient non-aversive explanation for paralysis (Ramachandran 1996b), and also reports of dramatic fluctuations in emotions observed during psychoanalytic sessions (Kaplan-Solms & Solms 2000; see also Moss & Turnbull 1996; Turnbull et al. 2002, 2005).

However, many of these findings have been clinical reports or anecdotal accounts. There have been few, if any, attempts to *directly* test the idea of implicit awareness, using systematic empirical methods.

The present study is an attempt to directly investigate the issue of implicit awareness of deficit in anosognosia. We assessed implicit processing related to motor deficit in neurological patients with left hemiplegia and varying levels of anosognosia. We used the well-established 'dot probe' paradigm (MacLeod, Mathews, & Tata 1986) that measures response times (RT) in the context of attentional capture. In such tasks, attention is modified by stimuli which are emotionally salient, such as threat-related words (e.g., Bradley 1998; Bradley, Mogg, White, Groom, & Bono 1999; MacLeod et al. 1986; Mathews & MacLeod 1986; Mogg, Bradley, Williams, & Mathews 1993). In the present study, we constructed lists of *target* words referring to common actions, normally-mobile body parts, and other words related to mobility and disability, for example 'WALK' and 'LEG'. We also constructed a list of *neutral* words, equivalent to the target words in length, frequency, and word class, but unrelated to mobility or disability. We expected that, relative to the neutral words, the target words *would* be emotionally salient to people with stroke-related mobility deficits. In non-anosognosic patients, who are explicitly aware of their mobility problems, we therefore expected attentional capture to the target words. In healthy participants, we expected no difference between the target words and the neutral words. But what might anosognosics show? Although this group shows relatively little explicit acknowledgment of their disability, there may still be levels of cognitive processing which are sensitive to the loss of movement and function. If so, then these patients may also show attentional bias for the target words relative to the neutral words.

Method

Subjects

Patient sample

Seven patients (four male, three female) with right hemisphere lesions (mean age = 70.7; *SD* = 11.5) participated in our study. Selection criteria were: (a) cerebro-vascular accident, involving the middle cerebral artery territory of the right hemisphere, and (b) the presence of some degree of left-sided motor weakness (including hemiplegia). However, because the present study requires reading, (c) the presence of severe neglect was an exclusion criterion. Anosognosia was scored as a continuous variable using two scales: the 'Awareness Interview' (AI) (Anderson & Tranel 1989), and the 'Anosognosia for Hemiplegia Questionnaire' (AHQ) (Feinberg et al. 2000). Two patients ('non anosognosics') had a score of 0 in both scales; the other five patients ('anosognosics') had a score greater than 0 in one or both scales. Scores on the anosognosia scales varied widely across the patient group, covering virtually the entire range. For example, using the Anderson and Tranel scale, two patients scored 0, two patients scored 2, and the remaining three patients scored 4, 5, 6 (see Table 1).

Table 1. Patients' information: demographic information, and score on the Anosognosia for Hemiplegia scale (Feinberg), Awareness Interview (Anderson), Motricity Index

Patients	Lesion site	Hand	Anderson scale (0–16)	Feinberg scale (0–10)	Motricity Index (0–5)	LBisect % dev sc	Bells left	Bells total	Absolute RT values for neutral words	Absolute RT values for target words
Non-anosognosics										
WB (M, 85)	Right subcortical white matter	Right	0	0	3	–5.6	100%	100%	790.79	750.57
KB (M, 48)	Right fronto–parietal	Left	0	0	5	–10.3	100%	97%	956.50	858.23
Anosognosics										
JL (M, 76)	Right prefrontal	Right	2	0	1	+5.5	87%	91%	866.04	876.34
JR (M, 76)	Right temporo–parietal	Right	2	0	2	–6.0	100%	91%	613.87	585.5
GH (F, 70)	Right dorsolater–prefrontal	Right	3	3.5	4	–4.2	87%	91%	1034.68	1053.98
HW (F, 67)	Right fronto–parietal	Right	5	5.5	4	–12.8	73%	60%	996.63	1070.20
MB (F, 73)	Right internal capsule	Right	6	7.5	2	–3.3	46%	57%	886.12	990.15

Also, the Line Bisection test, reported as the percentage deviation score (LBisect % dev sc) and Bells Test, reported as the percentage of bells detected in both visual fields (Bells Total), and the percentage of left-hemispace bells detected (Bells Left). Also the absolute response times for Neutral and Target words.

Healthy volunteers sample

Twenty undergraduates (three males, 17 females) from the Psychology Department of University of Wales, Bangor (mean age = 19.6; *SD* = 0.87) participated. Undergraduates were used as a neurologically-normal control group, since they had no motor disability. Exclusion criteria were a history of psychiatric or neurological disorder. All had normal, or corrected to normal, acuity and normal colour vision.

Materials and measures

All patients completed the following:

1. Anosognosia for Hemiplegia Questionnaire (Feinberg et al. 2000): A scale to rate level of awareness of hemiplegia. Range 0–10. Higher scores reflect greater unawareness.
2. Awareness Interview (Anderson & Tranel 1989): A scale to rate the level of awareness of a range of impairments. Range 0–16. Higher scores reflect greater unawareness.
3. Motricity Index (Collin & Wade 1990): A scale to assess degree of motor impairment. Range 0–5. Higher scores reflect greater motor disability.
4. Line Bisection Task (Schenkenberg, Bradford, & Ajax 1980): A test hemi-spatial attention. Rightward bisections are common in left neglect, and are scored as positive. Scores of >14% are outside normal limits (Ferber & Karnath 2001).
5. Bell Test (Gauthier, Dehaut, & Joanette 1989): A measure of spatial attention. A score of less than 86% in one hemispace suggests hemi-spatial inattention. A score of less than 92% overall suggests a global attentional impairment (Gauthier et al. 1989).

Based on the Feinberg et al., (2000), and the Anderson and Tranel (1989) scales, five of the seven patients showed some degree of anosognosia (see Table 1).

6. Dot Probe Tasks are widely used to measure the extent of attentional capture (MacLeod et al. 1986). In the typical presentation format, words (either threat-related or neutral), are followed by a coloured probe. Participants are asked to ignore the target word, and focus on the probe: pressing a colour-key that matches the presented colour (see Figure 1). Thus, they make a neutral response (pressing a button), to a neutral stimulus (colour of the probe). However, probe detection latencies are modified by the emotional impact of threat-related stimuli (Bradley 1998; MacLeod et al. 1986; Mathews & MacLeod 1986; Mathews, Ridgeway, & Williamson 1996). In the present study words were selected based on their relatedness to motor impairment and its consequences.

Four lists of words were generated, based on different 'disability' themes ('body parts affected by paralysis', 'impossible actions', 'paralysis-related words', and 'mobility-related words') (see Appendix 1). Each set contained 10 target and 10 neutral words, matched for

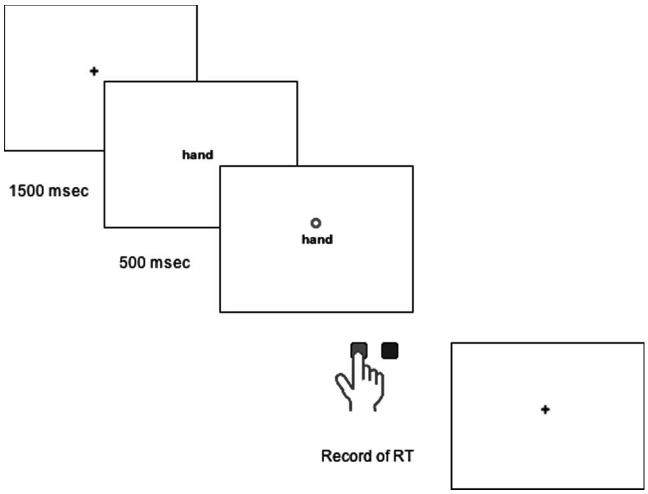

Fig. 1. Presentation sequence for the Dot Probe task.

frequency (from Kilgarriff 1997) and word length (see Table 2).

Each word category was presented in an individual 40-trial block (i.e., one block with 'disability' and neutral items, one block with 'mobility' and neutral items etc.). Each 40-trial block consisted of the randomised presentation of the 10 target and 10 neutral words, with each word appearing twice in a block. Written instructions explaining the procedure of the task were displayed initially on the computer screen. Each block took roughly 2–4 min to complete. Participants took a 5-min break between blocks.

Procedure

All patients initially were assessed with the Line Bisection Task (Schenkenberg et al. 1980), the Bells Test (Gauthier et al. 1989), the 'Anosognosia for Hemiplegia Questionnaire' (Feinberg et al. 2000), the 'Awareness Interview' (Anderson & Tranel 1989), and the Motricity Index (MI) (Collin & Wade 1990). Then they were administered the dot probe task. In this modified version of the classic dot probe task, words and probes were displayed in the centre of the screen. Words were presented using a G4 Apple laptop computer 14-inch screen. A fixation point appeared centrally on the screen, lasting 1500 ms, followed by a word in the same spatial location. The word was Monaco, font size 36. After 500 ms, a dot probe either red or blue in colour appeared randomly above or below the word. The word itself remained in the location until response.

Subjects were told that a word would appear on the computer screen, followed by a probe (either blue or red). Participants were instructed that the word was irrelevant to the task, and to ignore it. They were required to report quickly and accurately the colour of the probe, by pressing one of two keyboard keys, whose colour label matched the colour of the probe on the screen. Small coloured labels were placed on the relevant keys for this purpose. Subjects' response times in responding to the probes were recorded by the computer. Immediately after the selection, the word and the probe were removed and the fixation point automatically reappeared on the screen. Subjects were given a practice block of neutral words, and rehearsed until they felt confident performing the cognitive and manual demands of the task.

Results: Dot probe task

Individual outliers were defined as RTs that deviated more than three SDs from the individual mean latency time, and were removed to exclude potentially unreliable data. Outliers constituted 1.61% of the Healthy Control group's data set while the Patient group produced outliers ranging from 0.25 to 2.54%. In the Healthy Control group the mean error rate was 2.86%, while the Patient group produced errors ranging from 0 to 3.80%.

Data transformation

There was no significant difference in response latency, for neutral words, between anosognosic and non-anosognosic groups [$t(5)=0.044$; $p > .05$]. Healthy Controls had a mean overall RT for neutral words of 508 ms, and of 507 for target words. The *absolute* response times for each participant are in Table 1. To control for individual differences, a 'Difference Response Time' value was calculated for each participant, based on the mean Target response time minus mean Neutral response time. This Difference RT (DRT) score is therefore a measure of the extent to which a participant may be selectively slowed in response

Table 2. Dot Probe task stimuli: Stimulus categories and their properties

Category	Target words	Mean frequency	Mean length	Neutral words	Mean frequency	Mean length
Body parts	10 target nouns (e.g., hand)	6881	4.4	10 target nouns (e.g., nose)	6195	4.8
Impossible actions	10 target verbs (e.g., run)	3737	4.2	10 target verbs (e.g., talk)	5852	4.3
Paralysis	10 target adj. (e.g., disabled)	726	8.8	10 target adj. (e.g., cosy)	728	7.5
Mobility	10 target adj. (e.g., strong)	5955	7.2	10 target adj. (e.g., large)	6216	7.2

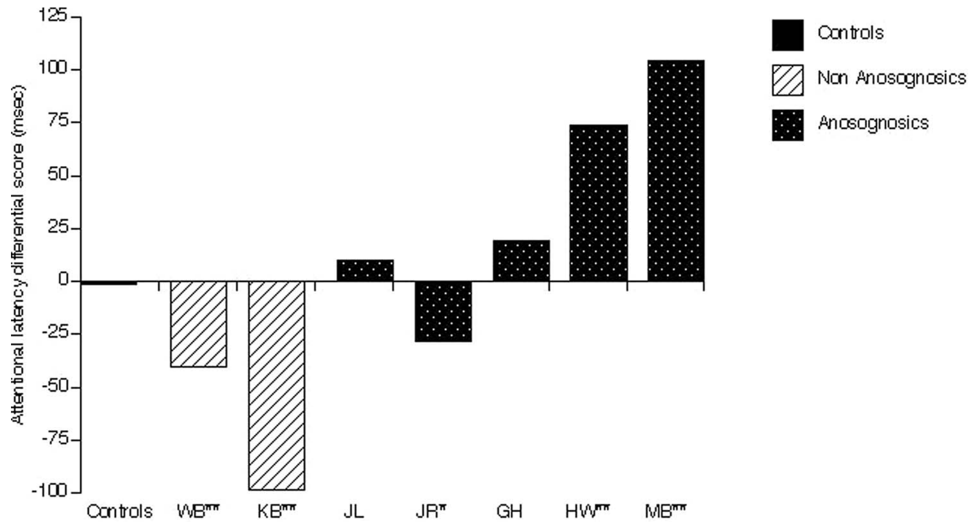

Fig. 2. Mean difference response times for the Dot Probe task: Mean Difference response times for the Dot Probe task for Controls and the seven patients. Patients are placed in left to right in sequence, based on the severity of anosognosia (using the Feinberg, and Anderson, scales). Significance values are represented as: $*p < .05$; $**p < .01$.

to the (emotionally-valenced) target words. For the healthy controls and seven participants these data are shown in Figure 2. There was no significant correlation between the DRT and RT for the neutral words ($r^2 = .07$, $p > .05$)

Individual differences

Healthy controls showed virtually no difference between the response times to Target and Neutral words (see Figure 2). In contrast, there was a wide range of variability in the performance of patients on the task. Some showed latencies that were faster for Target than Neutral words (WB, KB, JR), and *vice versa* (JL, JH, HW, MB). Each patient was compared with the entire healthy control group using Crawford and Howell's (1998) modified independent samples *t*-test, a statistical method used in single cases research. Two participants showed latencies that were significantly *faster* for target than neutral words (WB: $t(19) = -3.17$, $p < .005$; KB: $t(19) = -7.9$, $p < .001$, and JR: $t(19) = -2.2$, $p < .05$. Two were significantly *slower* for target than neutral words (HW: $t(19) = 6.11$, $p < .001$, and MB: $t(19) = 8.59$, $p < .001$)

It is of some interest that the effect of response times is significantly different in patients classified as non-anosognosic (WB and KB) as compared with anosognosics [$t(5) = 2.48$; $p < .05$]. In particular, the relative slowing in response to target words appears to increase in patients who are *more* anosognosic. This finding suggests that there might be a more general relationship between response times and the severity of anosognosia, when measured as a continuous variable.

Given the continuous nature of anosognosic symptoms, it is appropriate to evaluate the degree of anosognosia in relation to different scores. Two Pearson product-moment correlations were performed. The first (see Figure 3A) investigated overall differential response times as a function of the Anosognosia for Hemiplegia Questionnaire (Feinberg et al. 2000). The second (see Figure 3B), investigated these response times as a function of the Awareness Interview (Anderson & Tranel 1989).

As suggested by Figure 3 there was a high (and significant) positive correlation between differential response times and both the Feinberg scale ($r^2(7) = .77$; $p < .005$), and the performance on the Anderson and Tranel awareness scale ($r^2(7) = .91$; $p < .001$).

In addition a correlation was performed on the Difference response time scores as a function of motor disability, as measured by the Motricity Index (MI) (Collin & Wade 1990). There was no significant correlation between these two variables ($r^2(7) = .11$; $p > .05$), suggesting that the relationship between differential response time and awareness is not confounded by the effects of severity of motor disability.

Finally, correlations were performed on the DRT and the spatial attention bias, as measured by the Bells test. There was a significant negative correlation between the DRT and the Bells Test score on the left hemifield ($r^2(5) = -.9$; $p < .01$), as well as a significant negative correlation between the DRT and the Bells Test overall score ($r^2(5) = -.9$; $p < .05$). These correlations demonstrate that greater evidence of neglect (lower Bells) was correlated with larger DRT scores. Importantly, a general attention impairment in word processing, for example, would not explain our findings, as there was no correlation between the Bells Tests and RT only on the neutral words, either for Bells score on the left ($r^2(5) = .11$; $p > .05$), or Bells

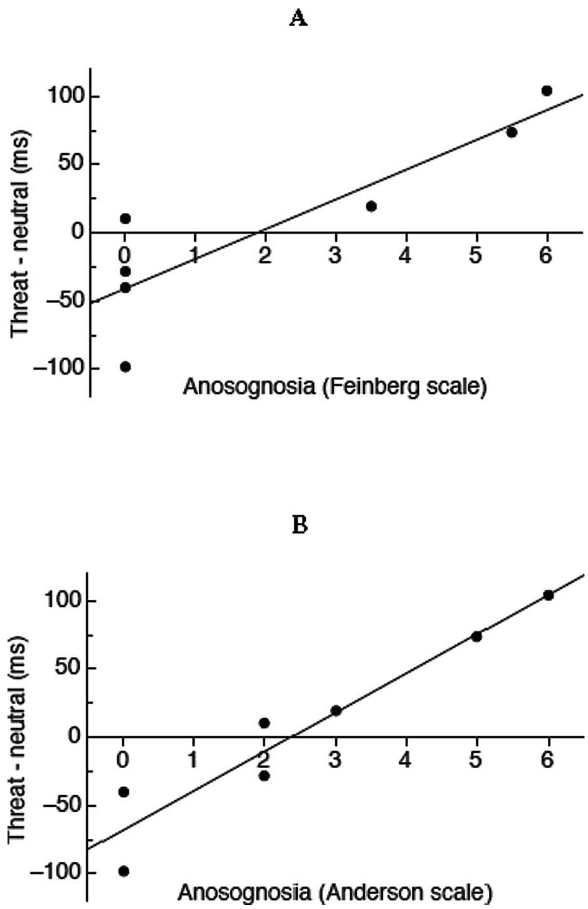

Fig. 3. (A, B) Anosognosia scales and response times on the Dot Probe task: correlation between patients' Difference response times on the Dot Probe Task and each of the anosognosia scales: Feinberg et al.'s (A) and Anderson and Tranel (B).

overall ($r^2(5)$ =.080; p> .05). That is, there appears to be some specific relationship between performance on the target words and the degree of neglect-like behaviour. However, the relationship is not a simple one, as for example there was no correlation between line bisection performance and DRT ($r^2(5)$ = .21; p > 0.5). Thus, our results generally fit with other observations suggesting that anosognosia is frequently associated with neglect symptoms, although dissociations can sometimes be found (e.g., Pia, Neppi-Modona, Ricci, & Berti 2004).

Discussion

The present study used a dot-probe visual attention paradigm (MacLeod et al. 1986) to investigate the effect of emotionally-threatening words related to motor disability on attention, in neurological patients with and without anosognosia. As expected, neurologically-normal controls did not display any attentional bias towards target versus neutral words, suggesting that these target words are not emotionally salient for people who have no motor disability.

However, there was a substantial range of variation in the performance of the neurological patient group, with some patients performing significantly faster for target than neutral words, and *vice versa*. When these patient performances were classified into two groups on the basis of awareness of deficit, non-anosognosics showed substantially reduced latencies (i.e., *facilitation*) for emotionally salient words, while anosognosics showed increased latencies (i.e., *interference*). When we re-analyzed these data with the measurement of anosognosia as a continuous variable, it was clear that the magnitude of the attentional bias was directly proportional to the extent of unawareness of deficit.

A likely explanation for the phenomenon of facilitation in the non-anosognosic group is that they are especially primed to awareness of disability-related words: presumably because thoughts of disability and motor impairment dominate their everyday life. This finding is consistent with the dot-probe performances reported in a number of other studies: for example, psychiatric disorders in which patients are especially primed to the recognition of words related to their medical condition. This effect of hypervigilance for threatening events has been reported in individuals suffering from anxiety (Bradley 1998; Bradley et al. 1999; MacLeod et al. 1986; Mathews & MacLeod 1986; Mogg et al. 1993), as well as depression (Mathews et al. 1996). Thus, the non-anosognosic patients in the present study exhibit a well-established trend towards increased sensitivity to emotionally-threatening words.

A strikingly different effect was found in the anosognosic group. Here patients were *slower* in responding to target words, showing a powerful tendency towards interference, though they were as physically disabled as non-anosognosics. This effect is rather surprising. These patients show reduced awareness of their disability, including some islands of frank denial. On this basis we might expect that their performance should lie somewhere between that of non-anosognosics and the healthy controls. Instead they appear to show the opposite pattern of performance.

It is important to note that the overall response latency of the two patient groups is not significantly different, and that the effect of the attentional capture in anosognosics is based on a *differential* slowing of response times for target versus neutral words, rather than an absolute measure of response speed. It is also notable that the effect seems unlikely to have resulted from any lateralized attentional deficit in these patients, given that all of the stimuli were presented centrally. Thus, these findings do not appear to be an artefact of a sampling bias, but appear to reflect a selective tendency for patients who deny their deficit to show substantial interference effects for deficit related words.

We suggest that the differences between anosognosics and non-anosognosics may be related to repression. In laboratory tasks, it has been found that the repeated avoidance of a concept leads to inhibition of memory for that concept – the phenomenon usually described as repression (Anderson & Green 2001). Anosognosics might well be characterised as showing repression, given that their explicit reports indicate that they are avoiding thoughts related to the deficits of which they should be aware. Previous work has found that response to threatening stimuli can depend upon coping strategy, and that high anxiety and repressive coping can lead to very different attentional sets. Thus, individuals classed as repressors show slowed responses to threatening objects under the same conditions in which highly anxious participants show speeded responses to the same threatening objects (Calvo & Eysenck 2000). In sum, inhibition or avoidance of threatening objects could plausibly interfere with subsequent objects associated with the threat. In our experiments, it could be that the presence of a prime (threatening to an anosognosic) such as 'WALK', biases behaviours that inhibit or avoid processing of the word. Inhibition of the prime's location would then result in delayed processing of the probe appearing next to it.

What is clear, in any event, is that the anosognosic group demonstrated implicit knowledge of their deficit. The more strongly the deficit was denied, the stronger was the inhibitory behavioural significance of words related to the deficit. In sum, the present study demonstrates that anosognosic patients appear to show a degree of interference for disability-related words, which is at odds with the explicit reports of indifference to their motor impairment. This unusual form of attentional awareness in these anosognosics might well be due to some degree of 'implicit' knowledge of their deficit, maintained outside of awareness, by a process akin to repression. These findings are also consistent with other reports of the use of defence mechanisms in anosognosic patients, including the possibility that they can acquire conscious awareness of disability following certain psychological manipulations (Kaplan-Solms & Solms 2000; Ramachandran 1995; Weinstein & Kahn 1953). Notably these episodes of transient awareness often produce feelings of sadness and even tearfulness (Kaplan-Solms & Solms 2000; Turnbull et al. 2002, 2005).

Most importantly, these data support an account of anosognosia which stresses the role of emotion in generating the phenomenon, including the possibility that anosognosia might result from a disruption of a right hemisphere emotion-regulation system (Kaplan-Solms & Solms 2000; Turnbull et al. 2002, 2005), such that these patients are less able to tolerate powerfully aversive ideas. However the phenomenon of anosognosia remains poorly understood: much work remains to be done to test these ideas, and to properly understand this extraordinary class of neuropsychological deficit. Nevertheless, this investigative effort is clearly justified, given that anosognosia speaks to a range of scientifically important issues, including the nature of conscious awareness, and the remarkable issue of self-deception (Trivers 2000).

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Appendix 1. Word lists used in the Dot Probe task

Body parts		Actions		Paralysis		Mobility	
Target	Neutral	Target	Neutral	Target	Neutral	Target	Neutral
Ankle	Belly	Balance	Blink	Crippled	Affordable	Active	Airy
Arm	Chest	Dance	Feel	Deformed	Convenient	Athletic	Damp
Fingers	Eye	Hop	Kiss	Disabled	Cosy	Energetic	Distributed
Foot	Mouth	Jump	Move	Dysfunctional	Delicious	Healthy	Efficient
Hand	Neck	Run	Nod	Handicapped	Intimate	Mobile	Expensive
Knee	Nose	Ski	Shake	Helpless	Mouldy	Normal	Large
Leg	Ribs	Skip	Sniff	Immobile	Mountainous	Physical	Moderate
Toes	Shoulder	Stand	Talk	Impaired	Painted	Powerful	Modern
Wrist	Tongue	Swim	Wink	Paralyzed	Rainy	Strong	Spacious
Elbow	Back	Walk	Touch	Useless	Windy	Vigorous	Terraced