

1-5 The effects of brain damage on attention

Before the advent of ‘brain mapping’, such as by fMRI, it was nevertheless possible to discover something of the part played by different regions of the brain, by observing the problems resulting from brain damage (such as following a stroke). One such area is the parietal lobe. Damage to a single lobe (there is one on either side) leads to what is called **sensory neglect**, or sometimes simply neglect. A patient is likely completely to ignore the doctor if s/he stands on the neglected side (the side opposite to the site of the damage). When eating, the patient will probably leave any food that is on the ‘wrong’ side of the plate, and if asked to draw a flower will put petals on only one side. The problem is not simply blindness to all that lies on the neglected side. A patient asked to draw a whole vase of flowers may draw only those hanging over the ‘preserved’ side, but with each individual flower itself only half complete. It appears sometimes to be half the *object* which is neglected, rather than half the field of view. Figure 1 shows a typical attempt, by a patient with visual neglect, to draw a clock face.

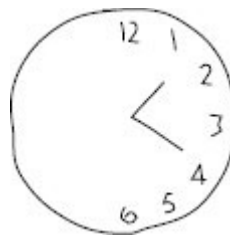


Figure 1 The typical appearance of a clockface, as drawn by a patient with visual neglect.

That neglect may be associated with the object rather than the scene was demonstrated formally by Driver and Halligan (1991). They showed patients pairs of pictures that looked rather like silhouettes of chess pieces. Patients had to say whether the two pictures were the same or different. Where there *were* differences, they comprised an addition to one side, near the top of the figure (as if the chess queen had something attached to one ear!). When the addition was on the neglected side patients were unable to detect the difference. Suppose the ‘problem’ side was the left. The question is whether the patient has difficulty with processing information to the left of the page, or to the left of the object. Driver and Halligan tested this by tilting the pictures to the right (see Figure 2), so that the one-sided feature, although still on the left of the figure, was now in the right half of the page. Still the patients experienced difficulty: neglect was object-related.

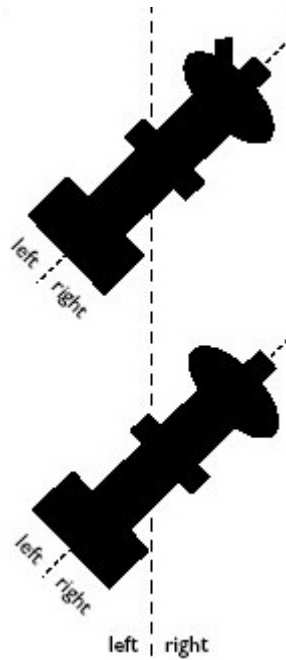


Figure 2 Same or different? The feature that distinguishes the two figures is to the left of the object, but on the right of the page.

We have been describing attention as a mechanism for assembling the subcomponents of items in a scene, so it is not difficult to conceptualise a fault leading to some components being omitted. This account sees attention as an essential element of the perceptual process, helping to organise incoming information. However, neglect is not limited to objects that are physically present. Bisiach and Luzzatti (1978) asked their patient to imagine standing in the cathedral square of the Italian city where he grew up. He was to imagine looking towards the cathedral and to describe all that was in the square. He did this very well, except that he failed to mention any of the buildings down the left-hand side of the square (his brain injury was on the right). He was then asked to imagine standing on the cathedral steps, looking back towards his previous viewpoint. Again, he only reported details from the right. However, with the change of view, this meant that he was now describing previously ignored buildings! Clearly his memory was intact, but in some way not entirely accessible. Equally clearly, attentive processes are involved in the assembly of remembered material as well as of physically present stimuli.

An even more extreme form of neglect is encountered in a condition known as Balint's syndrome. It occurs when a patient is unfortunate enough to suffer damage to both parietal lobes, which results in it being extremely difficult to shift attention from one object to another. Thus, when trying to light a cigarette, the patient may find that his attention has been 'captured' by the flame, to the extent that he can no longer see the cigarette. One patient complained, 'When I see your spectacles I cannot see your face.' This is reminiscent of the experience of pilots using a head-up display (HUD), where focusing on flight information displayed in the HUD makes the outside scene feel less 'visible'. Surprising as it may sound,

it seems necessary to deduce from these effects that we *all* experience the world as a series of objects. However, unless our attentive process has been damaged, we can shift the attention so rapidly from one object to another that we perceive them all as being present simultaneously. Exactly what constitutes an object depends upon the situation; Balint patients are revealing here, because they see only one object at a time. Baylis et al. (1994) described a patient who could not report the letters making up an isolated word. Viewed in this way, each letter was a small object and it was not possible to switch attention from one to the next. However, the patient could read the whole word, since for this purpose it was a single object.

Early visual processing takes place in two major pathways in the brain, known as the ventral and dorsal streams; the parietal region is part of the dorsal pathway. Damage to the ventral stream results in different kinds of integration problems; patients are aware of all aspects of a scene, but to the patient they remain segmented into small elements. For example, an individual shown a photograph of a paint-brush described seeing a wooden stick and a black object (the bristles) which he could not recognise. Humphreys (2001) suggests that the varieties of different problems are evidence that the binding together of different features takes place in several different stages and brain locations.

