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Research report

A selective deficit in the appreciation and recognition of brightness: Brightness agnosia?

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ABSTRACT

We report a patient with extensive brain damage in the right hemisphere who demonstrated a severe impairment in the appreciation of brightness. Acuity, contrast sensitivity as well as luminance discrimination were normal, suggesting her brightness impairment is not a mere consequence of low-level sensory impairments. The patient was not able to indicate the darker or the lighter of two grey squares, even though she was able to see that they differed. In addition, she could not indicate whether the lights in a room were switched on or off, nor was she able to differentiate between normal greyscale images and inverted greyscale images. As the patient recognised objects, colours, and shapes correctly, the impairment is specific for brightness. As low-level, sensory processing is normal, this specific deficit in the recognition and appreciation of brightness appears to be of a higher, cognitive level, the level of semantic knowledge. This appears to be the first report of 'brightness agnosia'.

1. Introduction

The concept of a higher-order modality-specific recognition deficit was first suggested by Lissauer (1890), and it was Freud (1891) who subsequently coined the term (object-) agnosia. Further studies suggested even more selective deficits, such as agnosia for faces or prosopagnosia (Bodamer, 1947) and colour agnosia (e.g., Klein and Stack, 1953). Agnosia (a-gnosis, ''non-knowledge'', or loss of knowledge) is generally defined as the loss of ability to recognise for example objects, faces, shapes or colours, despite intact visual perception and memory (Bauer and Demery, 2003). These impairments do not have their origins in impairments of detection or discrimination of primary visual cues, such as luminance contrast, colour, acuity, and orientation, but are considered impairments of (detailed) visual knowledge. Beyond the very earliest stages for visual processing, different visual primitives (e.g., shape, luminance, colour, and motion) appear to be processed in distinct areas of the brain, and damage to these areas of the brain can lead to different kinds of visual deficits. Of the different visual primitives, shape agnosia (Campion and Latto, 1985; Milner et al., 1991) and colour agnosia (Davidoff, 1991, 1996; Steeves et al., 2004; van Zandvoort et al., 2007) have been especially well studied and well described.

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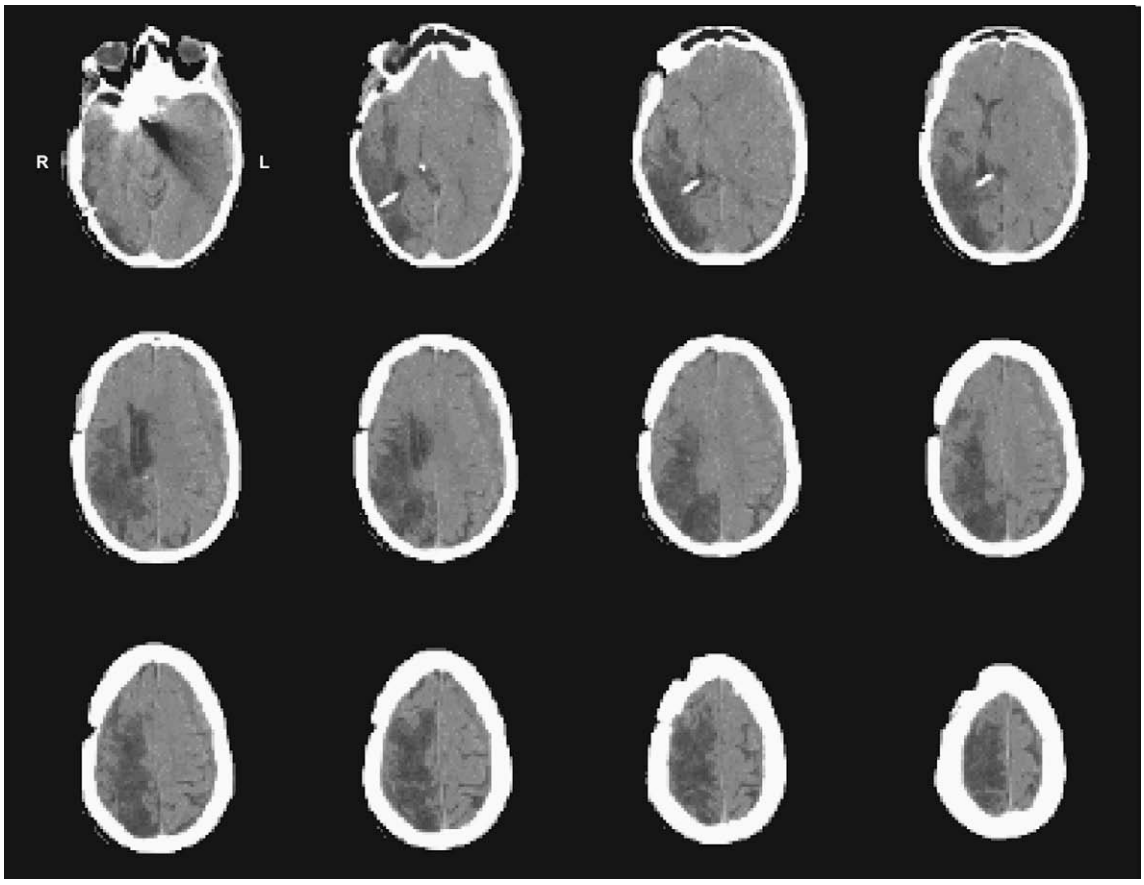

Fig. 1 – CT scan (2005) showing clip artifacts in the right frontal region, a ventricular peritoneal drain from the right lateral ventricle, a large cortical infarct in the right hemisphere, and a SDH in the left hemisphere.

The patient we report here has a selective impairment in recognising brightness[1] and darkness, in absence of low-level sensory-perceptual deficits. To the best of our knowledge, no case of ''brightness agnosia'' has been reported in literature so far. The aim of the present study was to describe this patient and to examine several aspects of bright- and darkness recognition and discrimination in more detail. Throughout the paper, we have used the comparison to colour agnosia in a descriptive manner.

2. Case report

LZ is a 66-year-old right-handed female, who suffered a subarachnoid haemorrhage (SAH) in September 2000. The ruptured aneurysm was successfully clipped, but one day after surgery, she developed severe vasospasms, which resulted in a large infarct of the right hemisphere involving the parietal, temporal, and occipital lobes with extensions into the frontal region. Retrospection of early neuropsychological reports suggested severe left-sided neglect and left-sided hemiparesis. In 2005, her husband noticed that she had language problems and she was admitted to a hospital where a subdural haematoma (SDH) was detected over the left hemisphere. The language disorder disappeared following evacuation of the SDH via a burr hole (see Fig. 1).

By the time she was examined in our laboratory for the first time (July 2006; after the left hemisphere SDH), she showed normal language and memory functioning [Boston Naming Test 34th percentile (average performance); Rey Auditory Verbal Learning Test (RAVLT) immediate recall: 10th decile (above average performance); RAVLT delayed recall: 7th decile (average performance); RAVLT recognition: 10th decile (above average performance)], and moderate left-sided visual neglect (BIT Line Bisection: 3/9; Star Cancellation: 47/54; Letter Cancellation: 35/40; Line Cancellation: 30/36; Representation Drawing: 2/3; Figure and Shape Copying: 1/4).

LZ's husband told us that she had additional problems appreciating whether lights were switched on or off since the SAH in 2000. The first time he became aware of this was when she was admitted to a rehabilitation centre in 2001. He noticed that when he left her in the evening and switched off the light for her to go to sleep, she switched it back on again. When he quizzed her about this, she claimed to have switched the light off to go to sleep. As a more recent example, he told us that, one night, he had asked her what time it was, as she has an alarm clock next to her bed. Even though the lights were still on, she replied that she could not tell him the time as it was dark and

[1] In this paper, we use the term *brightness* for 'perceived luminance' and the term *lightness* for 'perceived reflectance' (Jando et al., 2003).