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Can Deficits in Mental Imagery occur without Visual Agnosia?

Yes—as individual cases show—they can. In a recent study, Moro et al. [1] investigated cognitive abilities of two brain damaged patients who showed significant impairment in visual imagery but not in visual perception. This is particularly interesting since “seeing with the mind’s eye” appears to share basic representational and neural features with visual perception.

In this essay it will be shortly outlined what Moro et al. did, what results they obtained and what conclusions they draw. Finally, some comments on limitations of the present study and possible further research will be given.

The two patients (Patient 1 female, Patient 2 male) matched relatively well for age, handedness, education and brain pathology. They underwent standardized neuropsychological measures for cognitive functions such as language, visuo-perceptual abilities, memory and imagery (visual and non-visual). The assessments tool the form of questionnaires, interrogations and imagination and drawing tasks. To identify pathological results, patients’ performance was compared to that of five healthy (age- and education-matched) control subjects. Provided clinical MRI radiological prints were used to reconstruct a 3D realization of patients’ brains. Subsequently, manual voxel segmentation was applied to identify damaged areas.

Analysis of the MRI prints revealed a lesion of the inferior and middle left temporal gyri in Patient 1. In Patient 2, the left temporo-occipital, left medial parietal and superior parietal lobe, and similar but smaller region of the right parietal lobe were damaged. However, V1 was intact in both patients. Cognitive abilities were within normal range for both patients; except for visual imagery tasks (cf. [1], table 2). This matched observed difficulties in patients’ drawings from memory and their reported problems with describing shapes of imagined objects.¹

From the above results, Moro et al. conclude that the “striking impairment of visual imagery in these patients can be accounted for by the evidence that the left inferior temporal gyrus (BA 37) was damaged in both of them” ([1], p. 115). Thus, the left temporal lobe is of crucial importance in mental visual imagery.

¹Interestingly, they were still able to give a functional description of the object in question. Whether this might be explained in terms of hemispheric asymmetry shall be discussed elsewhere.

Furthermore, visual imagery deficits occur independently from deficits in visual perception and even if V1 is intact.

Note that this conclusion is compatible with an earlier study by Goebel et al. [2] who found that mental visual imagery induces little activation, if at all, in primary visual cortex. The efficiency increases within the hierarchy of cortical areas and might—at the very top—even exceed visual stimulation.

Now that Moro et al.'s procedure toward their conclusion has been sketched, some remarks are to be given: First, the study draws evidence from only two patients. With respect to their very special pathological condition this seems reasonable. On the other hand, we cannot categorically say that the two case studies are *sufficiently* similar. Among the most salient differences between subjects are their sex and their rating on the GSC (Patient 1: 5, Patient 2: 3). Second, Moro et al. do not report who the MRI prints provided and how old these had been at the time the experiments were conducted. Time can be a crucial factor given that the brain is a highly re-organizing structure, parts of which make new connections to re-implement functionality after severe injury. Third, no control group with equivalent lesions to the right hemisphere has been provided. It is still possible that for proper visual mental imagery both inferior temporal gyri are necessary. Fourth, it could be useful to study reverse cases, i.e. patients with visual agnosia but preserved mental visual imagery abilities. Do such cases exist? And would this indicate a functional independence of higher from lower visual areas? Finally, studying patients absolutely incapable of mental visual imagery would be interesting to find out whether (and if, how) a complete loss of this capacity interacts with visual perception.

References

- [1] V. Moro et al. (2008). Selective deficit of mental visual imagery with intact primary visual cortex and visual perception. *Cortex*, 44(2), 109-118.
- [2] R. Goebel et al. (1998). The constructive nature of vision: direct evidence from functional magnetic resonance imaging studies of apparent motion and motion imagery. *European Journal of Neuroscience*, 10, 1563-1573.