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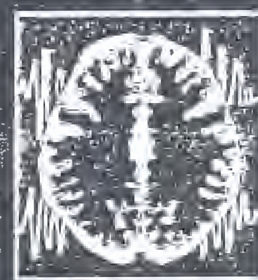

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W-4. A Case Study of a Strong Perceptual Deficit without Agnosia: Evidence against Sequential Perception and Memory?

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This paper reports the case of P.G., a patient who is not agnosic despite massive failure in low level visual perceptual processing tests dealing with spatial or shape information. P.G.'s preserved abilities to identify objects is difficult to be accounted for in the framework of standard models of visual identification which presume that construction of a structural code by perception is necessary in order to access memory. Our data argues against this hypothesis of sequential processing of perception and memory, and indicates that knowledge influences our way of "seeing" from the first stages of the so called perceptual processing.

Poster Description

Visual object identification is usually seen as the result of several hierarchical processes. The first one, perceptual processing, is generally conceived as a series of sequential and bottom-up operations (see Humphreys and Riddoch, 1987; Treisman, 1986). The early stages detect the elementary visual features, while the next code the relations between them in order to build a description of the object's shape. Moreover, some models (e.g., Kosslyn, Flynn, Amsterdam & Wang, 1990) distinguish between two types of processing applied to visual input: Those processing shape properties (ventral system) and those responsible for processing spatial properties (dorsal system).

Theoretically, the two systems must function conjointly in order to build an object's perceptual representation, which can then be matched with a stored structural representation, which in turn activates semantic memory.

The case of P.G. seems likely to question this theoretical option.

(I) Case Description

P.G. (27 years old) sustained a head trauma with a three weeks coma. The initial clinical picture was very severe, and dominated by cortical blindness. To date, T2 weighted MRI shows bifrontal lesions, diffuse lesions of the white matter, and a more obvious cortical–subcortical right parieto-occipital lesion. P.G. still exhibits important motor defects (inability to write or draw), an optic ataxia in the left field, an alexia and important visual impairments. These cannot be accounted for by elementary sensory perturbations, as the last neuro-ophtalmological examination only shows a partial left homonymous hemianopia: Central vision is perfect; visual acuity and ocular movement control are normal and P.G. does not show any ocular ataxia.

(II) Experimental Study

(a) Spatial information processing. P.G.'s pattern of relative perturbations and preservations agrees with the dissociation described by Kosslyn between metric and categorical coordinate processing. P.G.'s performance is impaired in most of the tests assessing spatial processing: the reproduction of an orientation is impossible, as well as the tracing and the description of a line. His performance is at chance level in judging which of two squares contains a dot which is exactly in the center (VOSP, Warrington and James, 1991, subtest 6) and far below the norm in tasks requiring to estimate the parallelism of lines or the position of a gap in a contour (BORB, Riddoch and Humphreys, 1993, subtests 4–5).

These results could then lead to believe that P.G. suffers from a global disorganization of spatial information processing. However, a more fine-grained approach shows that, in the above-mentioned tests, P.G.'s answers are correct if the two items are very different or if the difference can be described verbally (e.g.: one circle broken at the top, the other at the bottom). What's more, he is always able to judge whether a point is inside or outside a circle, above or below a line. The data are, therefore, compatible with a selective preservation of categorical spatial information processing.

(b) Shape processing. Despite the integrity of his visual *sensory* capacities (figure-ground discrimination, VOSP screening test: 19/20), P.G. is largely impaired in all tasks which tap shape processing: he is unable to compare the length of lines, or the size of circles (BORB, subtests 2–3), to identify fragmented letters (VOSP, subtest 1), and his performance is practically at chance level in all shape discrimination tests, even using the simplest forms (e.g.: discrimination between a rectangle and an elongated form or between two very different potato-like shapes).

His impairment arises at a very elementary level: in target detection tasks (cf. Treisman; Donnelly, Humphreys & Riddoch, 1991) P.G.'s results indicate that he totally fails to detect feature conjunctions and that even primitive features detection is slow compared to normal. Finally, P.G.'s results in standard global precedence tasks (cf. Navon, 1977) clearly show a lack of global shape processing.

(c) Visual object identification. The severe perceptual deficits described above contrast sharply with P.G.'s virtually normal object identification abilities. This patient is not agnosic, since he recognizes objects in everyday life and has only a slight deficit for pictures, independent of item size but correlated with the realism of the stimulus (Real objects: 30/30, Photographs: 32/32, realistic drawings: 127/152, Snodgrass stimuli: 196/258, Silhouettes: 0/20).

What's more, even his perceptual discrmination abilities become satisfactory when concerning objects, be they totally different, or different examplars of the same object. When asked to judge two realistic drawings of dolphins, for example, as being same or different, P.G. scores 17/22, whereas his performance is at chance level in the same task using controlled unknown forms matched on perceptual complexity. It seems then that knowledge of the items to be processed has a serious influence on P.G.'s perceptual capacities.

Discussion

The main point of interest here appears to be the contrast between P.G.'s perceptual deficits and the absence of visual agnosia. P.G.'s perceptual deficits are massive and involve early visual processing. Thus, they are likely to prevent him from building an integrated structural representation. However, they don't disrupt either identification or comparison of known object. This argues against the sequential nature of visual object identification, such as it is usually described, with perception building a structural code which is necessary for subsequent memory access.

This data favours the hypothesis that memory can directly compensate for perceptual deficits. This is compatible with the principle of completion in PDP models: a system which has been adapted to perceive some objects when all the perceptual processes worked, needs less cues for these same objects, and can complete the low level perceptual dimension, which is now missing, by memory. This completion follows a similarity principle: the more the object to be identified is similar to an object that has already been processed, the better the completion.

Applied to P.G.'s case, this explanation would simply imply that he sees "badly" any new shape, and "well" any known object on the basis of information which is as deficient in both cases.

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