



Acquired prosopagnosia as a face-specific disorder: Ruling out the general visual similarity account

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ABSTRACT

Prosopagnosia is classically defined as a disorder of visual recognition specific to faces, following brain damage. However, according to a long-standing alternative view, these patients would rather be generally impaired in recognizing objects belonging to visually homogenous categories, including faces. We tested this alternative hypothesis stringently with a well-documented brain-damaged prosopagnosic patient (PS) in three delayed forced-choice recognition experiments in which visual similarity between a target and its distractor was manipulated parametrically: novel 3D geometric shapes, morphed pictures of common objects, and morphed photographs of a highly homogenous familiar category (cars). In all experiments, PS showed normal performance and speed, and there was no evidence of a steeper increase of error rates and RTs with increasing levels of visual similarity, compared to controls. These data rule out an account of acquired prosopagnosia in terms of a more general impairment in recognizing objects from visually homogenous categories. An additional experiment with morphed faces confirmed that PS was specifically impaired at individual face recognition. However, in stark contrast to the alternative view of prosopagnosia, PS was relatively more impaired at the easiest levels of discrimination, i.e. when individual faces differ clearly in global shape rather than when faces were highly similar and had to be discriminated based on fine-grained details. Overall, these observations as well as a review of previous evidence, lead us to conclude that this alternative view of prosopagnosia does not hold. Rather, it seems that brain damage in adulthood may lead to selective recognition impairment for faces, perhaps the only category of visual stimuli for which holistic/configural perception is not only potentially at play, but is strictly necessary to individualize members of the category efficiently.

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1. Introduction

Can recognition of faces be selectively impaired following brain damage, leaving object recognition abilities intact? This question has been of interest to neurologists, cognitive neuropsychologists and cognitive neuroscientists in general at least ever since Bodamer (1947) coined the term “prosopagnosia” to refer to “*the selective disruption of the perception of faces, one’s own face as well as those of others, which are seen but not recognized as faces belonging to a particular owner*” (Bodamer, 1947, English translation by Ellis & Florence, 1990, p. 83). Providing evidence for a face-specific disorder following brain damage is important because it would apparently support the view that faces are processed specifically, and thus that at least

some aspects of face processing could be studied in relative isolation with respect to general visual object recognition.

In his definition of prosopagnosia, Bodamer (1947) further stated that “the disorder appears in varying strengths and together with the most different forms of agnosia, but can be separated from these from the outset” (Ellis & Florence, 1990, p. 83). Yet, despite the accumulation of cases of acquired prosopagnosia reported over the years, this important issue of domain-specificity remains largely unclear and debated (e.g., Barton, 2008; Blanc-Garin, 1984; Damasio, Damasio, & Van Hoesen, 1982; Farah, Levinson, & Klein, 1995; Gauthier, Behrmann, & Tarr, 1999; McNeil & Warrington, 1993; Riddoch, Johnstone, Bracewell, Boutsen, & Humphreys, 2008). One major reason for this lack of clarification is that, unfortunately, most cases of prosopagnosia¹ reported in the literature have not

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¹ Here the term prosopagnosia will refer to the classical neurological syndrome of acquired prosopagnosia (AP), without any reference to cases of congenital or developmental prosopagnosia, i.e. the lifelong impairment in processing faces with-

Table 1
A summary of the findings for the 13 “pure prosopagnosic” patients reported in the literature.

Authors	Case	Lesion	Objects	Faces
De Renzi (1986)	Patient 4	Right parahippocampal gyrus, lingual gyrus, fusiform gyrus, calcarine fissure, cuneus	- Figure-ground discrimination: intact - Visual closure: intact - Overlapping figures: intact - Object naming: intact	- BFRT (short form): impaired (18/27) - Memory of new faces: impaired
De Renzi, Faglioni, Grossi, and Nichelli (1991)	VA	Right temporal lobe	- Visual closure: intact - Object naming (usual & unusual view): intact - Coin discrimination: intact - Recognition of personal belongings: intact - Makes of cars naming: intact	- BFRT (short form): intact (21/27, no RTs) - Familiarity judgment: impaired - Famous faces designation: impaired
De Renzi, Perani, Carlesimo, Silveri, and Fazio (1994)	OR	Right temporal lobe involving T3, T5 & T6; right parietal lobe involving P1 & P2	- Object naming: intact - Recognition of animals, fruits, vegetables (usual & unusual views): intact - Italian coins discrimination: intact	- Matching of unknown faces: impaired - Familiarity judgment: impaired - Famous faces designation: impaired
Takahashi et al. (1995)	Case 3	Right temporo-occipital lobe, involving fusiform & lingual gyri	- Visual segmentation: intact - Gestalt completion test: intact - Kanizsa triangles: intact - Real object naming: intact	- BFRT (Japanese version): intact (42/54, no RTs) - Same/different judgment: intact - Memory of new faces: impaired - Familiar faces recognition: impaired
Schweinberger, Klos, and Sommer (1995) and Henke, Schweinberger, Grigo, Klos, and Sommer (1998)	MT	Right temporo-parietal lobe, also extending in frontal & occipital areas	- Visual segmentation: intact - Visual closure: intact - Object naming (line drawings): intact - Animals naming: intact - Similar objects naming (fruits and vegetables; symbols of German industrial brands; cars brands): intact	- BFRT: impaired (37/54, very slow) - Memory of new faces: impaired - Famous faces recognition: impaired
Buxbaum, Glosser, and Coslett (1996)	WB	Bilateral occipital lobes	- Object naming (real objects; drawings): intact - Memory for homogeneous category of objects (glasses, different views): intact - Perceptual categorization: intact	- BFRT: impaired (20/54) - Memory of new faces (different views): impaired - Famous faces recognition: impaired
De Renzi and di Pellegrino (1998)	Anna	Bilateral posterior cingulate gyrus, infra- & supracalcarine areas, mesial part of the superior parietal lobe	- Visual segmentation: intact - Visual closure: intact - Object naming (colour photographs; drawings; Snodgrass & Vanderwart): intact - Memory for homogeneous category of objects (glasses, different views): intact	- BFRT (short): intact (21/27, no RTs) - Memory of new faces (same view): intact - Memory of new faces (different views): impaired - Famous faces designation: impaired - Familiarity judgment: impaired - Famous faces recognition: impaired
Wada and Yamamoto (2001)		Right infero-occipital lobe, involving fusiform gyrus and lateral occipital region	- Low-level visual processing (line length, counting dots, shapes, line orientation): intact - Visual segmentation: intact - Recognition of letters and symbols: intact - Object naming (real objects; pictures; line drawings; usual/unusual views): intact - Famous places naming: intact - Animal face naming: intact	- Matching unfamiliar faces: impaired - Memory of new faces: impaired - Familiarity judgment on famous faces: impaired - Famous faces recognition: impaired - Familiarity judgment on familiar faces: impaired - Familiar faces recognition: impaired
Rossion et al. (2003), Schiltz et al. (2006), Busigny and Rossion (in press)	PS	Right infero-occipital lobe and middle temporal gyrus; left mid-ventral gyrus & posterior cerebellum	- Low-level visual processing (BORB): intact - Object decision: intact - Object naming (Colored Snodgrass & Vanderwart): intact - Between- & within category discrimination: intact - Homogeneous categories (multi-parts novel objects, cars): intact	- BFRT: impaired (27/54, very slow) - WRMT: impaired - Matching unfamiliar faces (same view; different views): impaired - Familiarity judgment: impaired - Famous faces recognition: impaired

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