

## Covert Processing of Faces in Prosopagnosia Is Restricted to Facial Expressions: Evidence from Cross-Modal Bias

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We present a single case study of a brain-damaged patient, AD, suffering from visual face and object agnosia, with impaired visual perception and preserved mental imagery. She is severely impaired in all aspects of overt recognition of faces as well as in covert recognition of familiar faces. She shows a complete loss of processing facial expressions in recognition as well as in matching tasks. Nevertheless, when presented with a task where face and voice expressions were presented concurrently, there was a clear impact of face expressions on her ratings of the voice. The cross-modal paradigm used here and validated previously with normal subjects (de Gelder & Vroomen, 1995, 2000), appears as a useful tool in investigating spared covert face processing in a neuropsychological perspective, especially with prosopagnosic patients. These findings are discussed against the background of different models of the covert recognition of face expressions. © 2000 Academic Press

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### INTRODUCTION

The face is the bearer of many messages. There is reason to think of these different aspects of facial information, like gender, familiarity, expression or speech, as functionally separated, with appropriate processing routes corresponding to each type of information (Bruce & Young, 1986). This complexity is reflected in disorders of face recognition (i.e., prosopagnosia). Prosopagnosia is a deficit in face recognition that can be limited to recognition of either previously familiar faces or unfamiliar faces. The deficit often extends to other aspects of face processing besides personal identity, such

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as facial expression (Tranel, Damasio, & Damasio, 1995) and even facial speech (de Gelder, Vroomen, & Bachoud-Levi, 1998a, for recent evidence).

Research over the last decade established that in some prosopagnosic patients, loss of familiar face recognition is not absolute if the methods used are sensitive enough to bring to light residual abilities or so-called covert face processing (i.e., the ability to process faces in the absence of any overt recognition). When face recognition in prosopagnosic patients was tested in a covert mode, behavioral methods showed savings in relearning, better matching performance for previously familiar than for unknown faces (Bruyer, Laterre, Seron, et al., 1983), and priming (de Haan, Young, & Newcombe, 1987). Electrophysiological methods like galvanic skin conductance (Bauer, 1984; Tranel & Damasio, 1987) and evoked potentials (Renault, Signoret, Debruille, et al., 1989) also showed evidence of covert processing. Such evidence for the spared processing of faces in the covert mode has so far only been reported for the recognition of personal identity. Face agnosia is a complex phenomenon and not all cases of overt or explicit loss of identity recognition show evidence for spared covert abilities (Newcombe, Young, & de Haan, 1989). It is not yet clear in which cases an overt deficit combines with a spared covert ability (de Haan, Bauer, & Greve, 1992). Undoubtedly the locus of the impairment and the specific type of face agnosia matter greatly and these two may interact with visual knowledge, memory, and mental imagery for faces in ways that are not yet understood.

As is the case for other covert implicit recognition phenomena that have been reported over the last 2 decades (for overviews see Weiskrantz, 1997; Kohler & Moscovitch, 1997), different kinds of explanations have been offered. Implicit face recognition has been interpreted as evidence for separate systems implementing overt and covert representations (Bauer, 1984). It also has been interpreted as a matter of absence of integration between explicit and implicit representations not allowing for access to consciousness (Tranel & Damasio, 1988). Alternatively, implicit face recognition has been conceptualized in terms of degraded representational quality, which would make it impossible for impoverished representations to become conscious (Farah, O'Reilly, & Vecera, 1993), or as a consequence of processing representations disconnected from later stages in consciousness (Schacter, 1987; see Farah, 1996, for an overview of nonconscious face processing). The account offered by Bauer (1984) seems particularly relevant since it was developed to explain a case of covert processing in a patient suffering from prosopagnosia and from loss of emotional responsivity to visual stimuli (not restricted to faces). But this report concerned personal identity and did not actually investigate whether there was covert recognition of facial expressions in the patient and thus leaves unanswered the question of covert recognition of facial expression or the possible co-occurrence of both kinds of covert recognition.

Covert processing of facial expression in prosopagnosic patients has not been documented so far and this study is the first to present evidence of

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