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Unconscious Familiarity and Local Context Effects on Low-Level Face Processing: A Reconstruction Hypothesis

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A common view in face recognition research holds that there is a stored representation specific to each known face. It is also posited that semantic or memory-based information cannot influence low-level face processing. The two experiments reported in this article investigate the nature of this representation and the flow of face information processing. Participants had to search for a particular primed face among other faces. In Experiment 1, the search was done in a context where distractors had either a different degree of fame or the same degree of fame. In Experiment 2, the target face was primed either with semantic information or without any information. Both experiments demonstrated that increasing the display set size lengthened face detection time. However, the lengthening was a function of face fame. The search context also had an effect on the slope of the famous face detection. The results are explained in terms of the idea that face representations are reconstructed and that high- and low-level information are integrated into the processing. The integration process is not a conscious one.

Key Words: context; face recognition; bottom-up process; top-down process; memory; face perception; familiarity; visual search; consciousness.

INTRODUCTION

In daily life, we often deal with situations containing multiple faces, both known and unknown. When looking for a friend in a railway station or in a crowd, we are able to recognize quite accurately and rapidly the person, no matter how many people are in the crowd and how similar their faces are. How is this possible? What mechanisms underlying the recognition process allow us to perceive known persons? Why is it that we cannot look at a familiar face and decide not to recognize it? In an attempt to answer these questions, more and more attention is being devoted to face recognition, now a research area of its own. Many of the studies in this field rely on the idea of the domain specificity of face processing (Kanwisher, 1997, 1998; Nachson, 1995) or they look at the information that was processed for face representation (Burton, Bruce, & Dench, 1993; Rhodes, 1988; Sergent, 1984, 1989; Tanaka & Farah, 1993). Research on the processes underlying face recognition have highlighted a number of issues concerning conscious and unconscious processing in face recognition.

One issue concerns the nature of face representations in memory. More specifically, what descriptive information accounts for face representation, categorization, and recognition? The second issue concerns the influence of the visual search context

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in the processing of a face. In particular, does the presence of the famous or unknown distractors faces that make up the context disrupt the search for a target that is a unknown or famous face? This issue have raised some important implications for the cognitive architecture of the face recognition system, especially in the debate about how closely perception is linked to memory and cognition (Pylyshyn, 1999). Two conceptions can be distinguished: one sees knowledge as influencing perceptual processing (Gregory, 1970, 1975; Ramachandran, 1990) and the other suggests that information processing is data-driven (Fodor, 1983; Marr, 1982; for review see Pylyshyn, 1999).

HOW ARE FACES REPRESENTED?

Some answers to the question of the nature of face representations might be found in the most popular model of face processing. Two decades ago, Bruce and Young (1986) proposed a general framework for face recognition that yielded a sequential and hierarchical organization for the different processing stages. Recognition of a face is said to be based on an abstractive unit containing several structural descriptions of each known face (Bruce & Young, 1986; A. W. Ellis, Young, & Hay, 1987; H. D. Ellis, 1986; Hay & Young, 1982). At the low level of face processing, a perceptual analysis of facial features is done by the structural encoding component, and the result of this analysis is stored in a ''face recognition unit'' (FRU). This component provides information in the form of expression-independent descriptions to the recognition units. The face recognition unit stores the visual descriptions that allow a particular face to be discriminated from other known or unknown faces (Burton, Young, Bruce, Johnston, & A. W. Ellis, 1991, p. 130). The authors claim that this last ''classification system. . . . contains stored structural codes describing one of the known faces to a person'' (p. 311). A FRU becomes active when any view of the appropriate face is presented. It is important to note that in this model, the feeling of familiarity is thought to be generated at the FRU level. When a face is seen, the activation strength of the recognition unit informs the cognitive system about the degree of resemblance between the stored structural description and the input provided by the structural encoding component (Bruce & Young, 1986, pp. 311–312). The FRU also allows for access to semantic information about the individual (occupation and so on), which is stored in the ''personal identity node'' (PIN). The PIN may become active as a result of input other than a face because it is assumed that there are other routes to access the PIN, such as channels that process someone's voice or written or heard name (Burton et al., 1991). The PIN is the level where the person is classified, while the FRU is the level where the face is classified (Burton et al., 1991, p. 130). The latest stage is ''name generation,'' which is activated after the appropriate PIN.

An implementation of Bruce and Young's (1986) original model was proposed with interactive activation and a competitive architecture, but with two modifications (Burton, Bruce, & Johnston, 1990). First, the function of the PIN was made clearer by stating that it gives access to semantic information rather than containing it. Familiarity decisions could then be taken at the PIN level. Second a ''semantic information unit'' (SIU) system was created to store particular semantic information about known people. This implementation also stipulates that a face recognition unit is generated