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Prosopagnosia: A Case Study Involving Problems in Processing Configural Information

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An ongoing issue in face recognition research is whether holistic face processing relies on the segregation of local discrete facial parts. Evidence in favor of the holistic-plus-parts view stems from a recent study reported by Arguin and Saumier (1999), who show that the priming effects of individual facial parts (i.e., eyes, nose, mouth, or contour) depends on the presence of configural information and that the magnitude of priming augments as the number of facial parts serving as primes increase. The present study demonstrates that these global processing effects are absent in a prosopagnosic patient (A.R.), who shows no priming from single face parts and a linear increase in the magnitude of priming as a function of the number of parts presented. These findings indicate that A.R. is incapable of integrating individual facial parts into a global facial configuration ant that this is likely at the root of her prosopagnosia.

Introduction

Theories of face recognition differ on whether holistic facial information exclusively determines face recognition performance. While some theories assume that face recognition normally occurs holistically without the analysis of discrete facial elements (e.g., Farah, Wilson, Drain, & Tanaka, 1998), others postulate that holistic facial information stems from an analysis of the relations that are perceived among local facial features (e.g., Bradshaw and Wallace, 1971; Sergent, 1984).

In an attempt to contrast the holistic vs holistic-plus-parts accounts of face recognition, Arguin and Saumier (1999) performed a priming study examining the effects of part and holistic facial information in normal face recognition. The study involved having subjects learn arbitrary face–name associations and then name as fast as possible each target face, which was preceded by a prime that matched some of its facial features. The primes were made of the eyes, nose, mouth, or contour of the subsequent target face or of combinations of these parts. Single facial parts were found to prime a target face when presented within the context of a generic face, but failed to prime when presented in isolation, suggesting that the presentation of a single facial part was sufficient to activate facial identity in memory, but only when configural information was present. Furthermore, by varying the number of face part primes, they obtained priming effects that increased exponentially as the number of facial parts presented increased. Thus, the facilitating effect of several facial parts was found to be greater than the sum of the effects of the individual parts, which is consistent with the view that facial parts interact with one another to produce global processing effects. When the primes presented were composed of varying numbers of puzzle-like facial sections that cut across the faces' natural features the magnitude of the priming effect increased as a strictly linear function of the number of face sections in the primes.

In the present study, two of the priming tasks used by Arguin and Saumier were completed by a prosopagnosic subject (A.R.). One of the tasks involved the use of facial primes made of natural facial features shown within the context of a generic

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face. The other experiment involved the use of puzzle-like primes that cut across natural facial features. If A.R.'s face recognition impairment is due to a deficit in processing holistic facial information, then her face recognition performance with primes made of natural facial parts is expected to reveal neither the single part priming effect shown by normal observers nor the exponential increase of priming effects as a function of the number of natural face parts in the prime. In contrast, A.R. should show the same linear increase of priming effects as a function of the number of puzzle-like face sections in the prime as normal observers.

Methods

Case description. At the age of 9 years, A.R. had contracted viral encephalitis that affected her right temporal lobe and a portion of her left inferotemporal region (see Schiavetto, Décarie, Flessas, Geoffroy, & Lassonde, 1996, for a detailed report). Her face recognition problem is revealed by her inability to recognize the faces of classmates, teachers, famous people, or individuals seen a week previously. In addition to her face recognition impairment, A.R. exhibited associative visual agnosia (difficulties in recognizing nonface objects, notably animals, fruits, and vegetables) and color agnosia. None of these deficits was the result of either a visual encoding or a general cognitive deficit, since she performed normally on standardized tests of visual acuity, perceptual matching, spatial localization, language, and verbal intelligence. A.R.'s agnosia for faces, nonface objects, and colors has been demonstrated to be persistent over time (see Schiavetto et al., 1996, for details). A.R. was 19 years of age at the time of testing.

Materials. Two sets of four female faces served as targets in both experiments (see Figs. 1A and 1B). Although Arguin and Saumier (1999) had previously used eight face sets with neurologically intact subjects, preexperimental testing showed that A.R. was most successful at learning four face–name pairs at a time. The faces were digitally modified so as to hide the hair, ears, and neck, and they were scaled

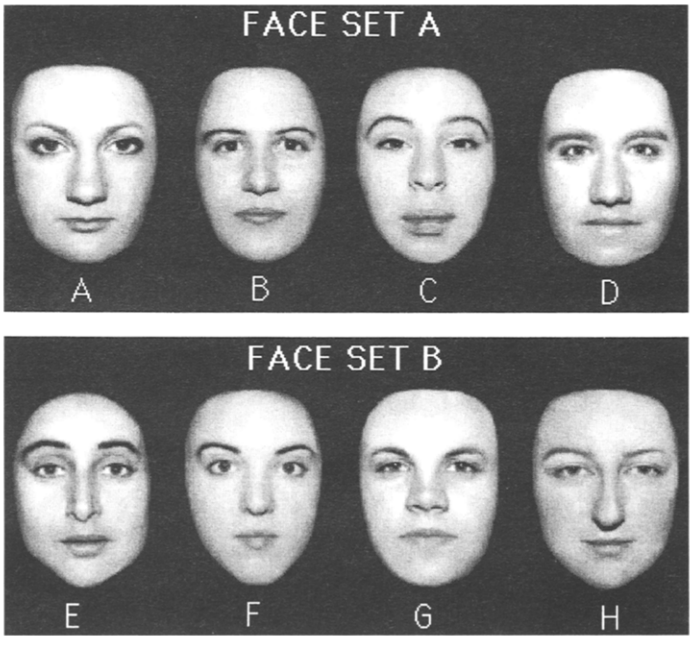

FIG. 1. (A, B) The faces and names (letters) that were used in Experiments 1 and 2.