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The roles of visual expertise and visual input in the face inversion effect: Behavioral and neurocomputational evidence

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Abstract

Research has shown that inverting faces significantly disrupts the processing of configural information, leading to a *face inversion effect*. We recently used a contextual priming technique to show that the presence or absence of the face inversion effect can be determined via the top–down activation of face versus non-face processing systems [Ge, L., Wang, Z., McCleery, J., & Lee, K. (2006). Activation of face expertise and the inversion effect. *Psychological Science, 17*(1), 12–16]. In the current study, we replicate these findings using the same technique but under different conditions. We then extend these findings through the application of a neural network model of face and Chinese character expertise systems. Results provide support for the hypothesis that a specialized face expertise system develops through extensive training of the visual system with upright faces, and that top–down mechanisms are capable of influencing when this face expertise system is engaged.

Keywords: Face processing; Chinese characters; Neural network models; Neurocomputational models; Visual expertise; Visual discrimination; Configural processing; Featural processing

1. Introduction

Research has shown that inverting faces significantly disrupts the processing of configural information, leading to a *face inversion effect* (e.g., Searcy & Bartlett, 1996). The psychophysical result of this disruption of configural information is that inverting faces impairs discrimination performance more than does inverting non-face objects. Additionally, inverting faces during feature-based discriminations does not impair performance, but inverting faces during a configural discrimination task does (e.g., Farah, Tanaka, & Drain, 1995; Freire, Lee, & Symons, 2000, but see Yovel & Kanwisher, 2004). Therefore, the evidence to date suggests that face processing involves a specialized type of configural processing, which may be associated with high levels of visual discrimination expertise (see e.g., Gauthier & Tarr, 1997). However, little is known about the direct relationships of visual expertise, configural processing, and the face inversion effect.

We recently found psychophysical evidence that the presence or absence of the face inversion effect can be determined via the top–down activation of face versus non-face processing systems (Ge et al., 2006). In this previous experiment, we primed Chinese participants with either

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