The roles of visual expertise and visual input in the face inversion effect

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Research has shown that inverting faces significantly disrupts the processing of configural information, leading to a *face inversion effect*. Ge and colleagues (2006) recently used a contextual priming technique to show that the top-down activation of a face processing expertise system that is tuned through experience to process upright configural information plays a crucial role in the face inversion effect. Chinese participants were primed with either two face tasks (Real Face Discrimination Task followed by Schematic Face Discrimination Task) or two Chinese character tasks (Real Character Discrimination Task followed by Nonsense Character Discrimination Task) and then tested on Ambiguous Figures that could be perceived as either faces or Chinese characters. All tasks involved exclusively configural discriminations. Chinese characters were chosen as the comparison stimuli because they are highly similar to faces on a number of dimensions except for one. Literate Chinese people have extensive and long-term exposure to both faces and characters, and they have high-level expertise on both in the sense that thousands of both are known at individual level. Also, both faces and characters are usually processed in a canonical upright orientation. However, although featural information is critical for identification of both faces and characters, configural information plays an important role for face processing but not for character processing. In the current study, we used the same technique as that of Ge and colleagues, but under somewhat different conditions. We replicated the finding that the inversion effect was observed in the face-priming condition but not in the character-priming condition. These data provide further evidence to support the contention that the top-down activation of a face processing expertise system that relies on upright configural information for processing plays a crucial role in the face inversion effect.

Ge and colleagues further suggested that the face and character expertise systems are the product of extensive experience with processing a multitude of individual faces and characters, respectively. Because the processing demands are different for faces and characters, the systems are tuned differentially to meet the demands of face or character processing. Thus, the face expertise system is tuned to be highly sensitive to upright configural information, whereas the character expertise system is not.

Why is configural information crucial for face processing but not for characters? One possibility is that the difference is due to different top-down cognitive strategies one has learned to use for processing faces versus characters. Experience may have taught one to rely on configural information for face processing but to rely on featural information for character processing. An alternative possibility is that the difference is a bottom-up phenomenon. The differences in terms of the role of configural information may already exist in the face and character stimuli themselves.

To date, no evidence exists that determine the validity of these two possibilities. It has been long proposed that face processing expertise systems develop through extensive experience with human faces. Although extensive research has shown that with increased experience, children become increasingly less reliant on featural information and more reliant on configural information for face processing, little is known as to why experience should engender such developmental change and what perceptual-cognitive mechanisms are responsible for this change.

To bridge the gap in the literature, we employ a neurocomputational model of face and object recognition that has previously been shown to account for a number of important phenomena in facial expression processing, holistic processing, and visual expertise (e.g., Dailey and Cottrell, 1999). Specifically, we train neural network models of face and Chinese character expertise and test them on the Ambiguous Figure Task from Experiment 1. The face expertise network produced a significant decrease in discriminating Ambiguous Figures involving configural discriminations when they were inverted, whereas the character expertise network did not. Taken together, these results support 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 recruited.