Is Facial Expression Processing Holistic?

Most studies examine holistic processing with respect to facial identity, but at least one study has also looked at holistic processing of facial expressions (Calder, Young, Keane, & Dean, 2000). This work used what Gauthier & Bukach (2007) call the partial design, which has been widely used to investigate holistic processing (Young, Hellawell, & Hay, 1987). Holistic processing of facial stimuli is generally measured with composite face paradigms, where chimeric faces are constructed from the top and bottom halves of different “source” faces. Subjects are asked to identify face halves of chimeric faces or to judge whether two halves of a pair of chimeric faces are the same or different. Misalignment of the top and bottom halves generally leads to an increase in the subjects’ accuracy and/or a decrease in reaction time relative to the aligned condition, demonstrating that faces are processed holistically. The partial composite paradigm is known to exhibit bias effects (Richler, Cheung, & Gauthier, 2011).

The complete composite paradigm (CCP) is an improvement upon the partial design (Gauthier & Bukach, 2007). The CCP eliminates the effects of response bias (for example, a preference towards answering “same” in comparisons of misaligned stimuli). In previous work, we developed a model of face processing called EMPATH (Dailey, Cottrell, Padgett, & Adolphs, 2002), and here we report experiments using EMPATH with simulations based on the CCP. The model simulates early visual processing using Gabor filtering at multiple scales and orientations, followed by applying Principal Components Analysis to the output of the Gabor filters (Dailey et al., 2002). A linear classifier (perceptron) is used to classify the faces. Our results predict that a facial expression recognition experiment with humans based on the CCP will indicate holistic processing.

Subsequently, we also found that our model accounts for experimental results in Tanaka et al. (2012). Tanaka et al. argued that facial expression processing is holistic when there is a clash between parts of a facial expression (e.g. angry-happy composite), but was analytic or parts-based when there is little or no conflict between the parts (e.g. normal happy face). They interpreted their findings as providing evidence for an earlier processing stage where a face is rapidly assessed for parts that clash in order to determine the subsequent pathway to be used. However, we achieved similar results with our model which (i) has one processing pathway for all stimuli, (ii) does not have an earlier stage for quick appraisals, and (iii) is not trained to combine decisions on parts of a stimulus into an overall decision. Our results suggest that one holistic processing pathway is sufficient to account for their data.

Composite face effect. “Smiling” eyes in the neutral-happy composite face on the left stop “smiling” upon misalignment.