Does Culture Affect the Perception of Emotion in Virtual Faces?

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Previous research, which has used images of real human faces and mostly from the same facial expression database [Matsumoto and Ekman 1988], has shown that individuals perceive emotions universally across cultures. We conducted an experiment to determine whether culture affects the perception of emotions rendered on virtual faces. Specifically, we test the *holistic perception hypothesis* that individuals from collectivist cultures, such as East Asians, visually sample information from central regions of the face (near the top of the nose by the eyes), as opposed to sampling from specific features of the face. If the holistic perception hypothesis is true, then individuals will confuse emotional facial expressions that are different in terms of the shape of the mouth facial feature. Our stimuli were computer generated using a face graphical rendering tool, which affords a high level of experimental control for perception researchers.

Emotional psychology research has shown that individuals across various cultures can accurately recognize the same emotions. Cognitive scientists have recently used eye tracking to study facial feature perception. Specifically, the *holistic perception hypothesis* suggests that individuals from collectivist cultures, such as East Asians, visually sample information from central regions of the face (near the top of the nose and the eyes), as opposed to sampling from specific features of the face [Blais et al. 2008; Jack et al. 2009]. If the *holistic perception hypothesis* is true, then East Asian individuals will confuse emotional facial expressions that can be differentiated by looking at the mouth. Our research tests this hypothesis by using computer generated faces.

Method, Results, and Discussion

Participants, Design, Apparatus, Materials, Procedure

Thirty-seven individuals voluntarily participated in the study upon invitation. Twenty were Western Caucasian (15 male/5 female) and 17 were East Asian (13 male/4 female). The Western Caucasian participants were American, and the East Asian participants were recruited from a Chinese university. The latter group of participants did not have life experience with Caucasians. The study used a within-subjects randomized design with two independent variables (Stimulus Face Ethnicity and Emotional Expression). The dependent variable was recognition accuracy. Accuracy was determined based on whether the judged emotional choice made by the observer was the same as the ground truth emotion displayed in a face stimulus.

We used FaceGen to design the emotional facial expressions; it is a statistics based C++ library that generates unique, realistic, 3D faces based on a parametric model of a large biometric database of real humans faces whose shape and texture were captured and transformed into a uniform 3D face space. FaceGen allows modelers to change a 3D face's age, gender, and ethnicity, to name just some of the controls. The main advantage of the tool is that it allows us to control the intensity of emotional facial expressions.

Participants had to choose the emotion each particular face displayed from 7 choices in a forced-choice paradigm. The order that

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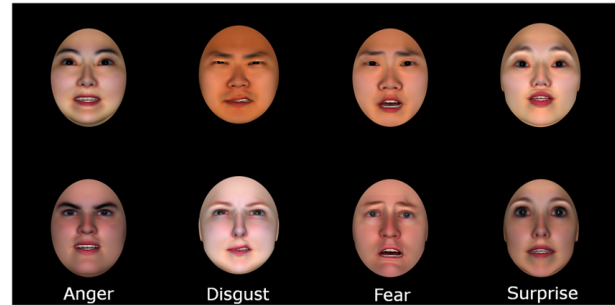
the images were presented was pseudorandom and they appeared in one of the four quadrants on the screen. Images remained until the participant used the mouse to choose the emotional expression that s/he thought the stimulus face expressed.

Confusing Fear and Surprise. The *holistic perception hypothesis* predicts that Asian observers should confuse fear and surprise emotional facial expressions. Planned comparisons showed that, as predicted, Chinese participants were worse at recognizing surprise emotions compared to fearful emotions for both Asian, $t(16) = 2.14, p < .05$, and Caucasian faces, $t(16) = 2.31, p < .05$. This was not the case for American participants as they were only more accurate at recognizing fearful Caucasian expressions compared to surprise Caucasian expressions, $t(19) = 3.5, p < .01$, but not for Asian faces, $t = .3, p = .8$. An inspection of the confusion matrices shows that Asians chose surprise 25% of the time when the correct emotion was fear compared to the 11% demonstrated by American observers.

The results are consistent with the *holistic perception hypothesis* because we find that Chinese participants confuse fear and surprise emotions, which are similar in terms of central features but not the mouth feature. This work has implications for perception researchers interested in controlled stimuli of faces and also designers of 3D avatars for games and other graphics and visualization applications.

Acknowledgements

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