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Face Inversion Disrupts Holistic Processing of Duchenne Emotions during Binocular Rivalry

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Abstract

While holistic processing is best known for the visualization of a face as a whole, its contribution to emotion perception continues to be debated. Moreover, whether intense emotions are processed differently, how this influences conscious perception, and what this may imply about the evolution of the human social brain have yet to be explored. More than a century ago, Duchenne de Boulogne suggested that wrinkles around the eyes serve as a marker for intense and genuine emotions. We hypothesized that Duchenne wrinkles are holistically encoded by the brain to preferably perceive intense and discriminate genuine facial expressions. Binocular rivalry (BR), or the competing percept during the simultaneous presentation of two monocular images, has been increasingly used to test the perceptual strength of stimuli. The longer a stimulus is perceived (larger dominance duration), the greater its perceptual strength—probably due to a stronger neural representation of that stimulus. Three natural-looking, 3-D face identities of similar skin tone and gender, each expressing five emotions (Duchenne/intense happy, happy, neutral, sad, and Duchenne/intense sad), were computer-generated and presented in a BR paradigm to 30 human participants to assess the perceptual strength of intense emotions. Duchenne facial expressions were consistently seen for significantly longer durations ($p < 1.455 \times 10^{-5}$, Wilcoxon signed-rank test). Importantly, this effect disappeared when face stimuli were inverted, likely disrupting holistic processing ($p > 0.1451$, Wilcoxon signed-rank test). Our results indicate that intense Duchenne emotions are automatically more salient—not due to the local eye-wrinkles feature, but due to the holistic processing of the Duchenne emotion. This may suggest a core role of the Duchenne feature in the evolution of a

neural mechanism to promptly distinguish intense, genuine emotions in order to effectively shape human social behavior.

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