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Differentiating neural sensitivity and bias during face-emotion processing in youth: A computational approach

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Abstract

Background: The ability to interpret face-emotion displays is critical for adaptive social interactions. Using a novel variant of a computational model and fMRI data, we examined behavioral and neural associations between two metrics of face-emotion labeling (sensitivity and bias) and age and psychopathology in youth.

Methods: In two studies, healthy controls (Study 1: $n=46$, M age=19.99, $SD=7.34$, 8-36) and patients (Study 2: $n=92$, M age=13.74, $SD=2.56$, 8-19) with disruptive mood dysregulation disorder (DMDD), attention-deficit/hyperactivity disorder (ADHD) or anxiety disorder completed an explicit face-emotion labeling fMRI task including happy to angry morphed face-emotions. A drift diffusion model was applied to choice and reaction time distributions to examine sensitivity and bias in interpreting face-emotions. Model fit and reliability of parameters were assessed on separate adult data ($n=38$). Linear and quadratic slopes modeled brain activity associated with dimensions of face-emotion valence and ambiguity during interpretation.

Results: Behaviorally, age associated with sensitivity in controls, while psychiatric diagnosis (DMDD, ADHD) associated with bias. Both age and diagnosis related to differential neural responses to ambiguity in lateral frontal regions. Associations between sensitivity and bias metrics and activation patterns indicated that systems encoding face-emotion valence and ambiguity both contribute to the ability to discriminate face-emotions.

Conclusions: The current study provides evidence for age-related differences and clinical associations with distinct metrics of face-emotion processing in youth.

Keywords: face-emotion labeling; computational modeling; development; affective psychopathology; cognitive bias; fMRI