Efficient assessment of Emotional Bias using Item Response Theory and Decision Tree Computerised Adaptive Testing

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SUBMISSION DETAILS

What is the Methodological Question Being Addressed? Can the Emotional Bias Task be abbreviated to allow more efficient testing of emotional processing?

Introduction Emotional processing bias has been proposed to be a core feature of mood disorders, particularly depression, and has been proposed to be both responsive to antidepressant treatment and a predictor of long-term outcomes. Here we describe analysis of an established test of facial Emotional Bias processing (EBT) using modern psychometrics, and the derivation of an abbreviated adaptive form of the task suitable for high-frequency usage.

Methods 737 adults (>18 yrs) were assessed using a web-based version of EBT. In this task participants are briefly presented with 45 facial expressions from a 15-step morph sequence from happy to sad and are asked judge which emotion they saw. The bias point indicates when a participant is equally likely to endorse either emotion. Data from this normative sample were analysed using Item Response Theory (IRT), producing two parameters for each emotion morph (difficulty and discrimination), predicting participant latent emotional bias (theta). These parameters were then used to generate synthetic trial-by-trial responses from 10,000 participants. These synthetic data were used in turn to generate a decision regression tree (DRT), where binary happy / sad response at each trial predicts the continuous theta outcome, thus modelling the underlying emotional bias trait. Each node represents a choice of morph to present at that trial, dependent on prior responses, and each leaf represents a final a predicted theta. We compared full length EBT performance to both modelled adaptive EBT (a-EBT) performance, as well on an implementation of the a-EBT in 73 adults (>18 yrs).

Results Performance on the EBT in the normative sample was normally distributed and centred on a mean bias of 8.5, representing a slight positive bias. Both IRT difficulty and the discrimination were highest for most ambiguous emotional expressions (morphs 5 to 10) and declined where emotions are unambiguous. The DRT had an average depth of 10.27 (range 6 –19), representing the mean number of trials for each participant in an adaptive form of the task. When modelling a-EBT performance, we found a strong correlation between modelled a-EBT bias and full-length EBT bias point ($r = 0.97$ ($p < 0.001$). When actual performance on the a-EBT task was compared with performance in the full-length task, the correlation was more modest, with an r of 0.46 ($p < 0.01$), compared to the test-retest reliability of the EBT which is approximately 0.6.

Conclusion We have used IRT analysis of the CANTAB EBT in a normative sample to derive a DRT-based adaptive version of the task. This abbreviated, adaptive form is considerably briefer than current version, which may have utility in high -frequency testing scenarios. Future work will examine performance in the context of repeated administrations in psychiatric trials.

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Guidelines I have read and understand the Poster Guidelines

Disclosures if applicable All authors are employees of Cambridge Cognition, which commercialises the Emotional Bias Test and CANTAB.

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