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Supplementary Material

Article Title: Facial Emotion Recognition Performance Differentiates Between Behavioral Variant Frontotemporal Dementia and Major Depressive Disorder

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List of Supplementary Material for the article

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SUPPLEMENTARY MATERIAL

METHODS:

Neuropsychological assessment. Patients were administered the German version of the "Consortium to Establish a Registry for Alzheimer's Disease – Neuropsychological Assessment Battery" (CERAD-NAB) as well as three additional tests of executive function and mental speed (Trail Making Tests A and B, Phonemic Fluency) (CERAD-NAB Plus).[1] In all patients, the degree of depression was measured by the Hamilton Depression Rating Scale (HAMD-21;[2]) and the Geriatric Depression Scale (GDS-15;[3]), whereas the degree of rumination was assessed by the German version of the Response Style Questionnaire (RSQ-D) 10-item rumination subscale.[4] In bvFTD and AD dementia patients, behavioral symptoms were assessed by the Frontal Behavioral Inventory (FBI;[5]). Dementia severity was assessed by the Clinical Dementia Rating (CDR;[6]) and the Frontotemporal Dementia Rating Scale (FRS;[7]).

Participants:

Patients with bvFTD and AD dementia were recruited from five Swiss memory clinics and the outpatient memory clinic of the Technische Universität München, Germany. The diagnosis was derived by a multidisciplinary team consisting of neurologists, neuropsychologists, and psychiatrists, who performed comprehensive neuropsychological and neuroimaging assessments. Exclusion criteria were less than 7 years of education, history of current drug or alcohol abuse according to DSM-IV,[8] psychiatric disorders according to DSM-IV,[8] head trauma (with loss of consciousness > 30 min), systemic disorders or brain diseases that could result in neuropsychological deficits, chronic pain thought to interfere with neuropsychological testing, general anesthesia within the last 3 months, and a Mini Mental State Examination (MMSE) Score < 20. Medication of bvFTD patients included selective serotonin reuptake inhibitors (SSRIs; *n*=8), serotonin-norepinephrine-dopamine reuptake inhibitors (SNDRIs; *n*=1), tetracyclic antidepressants (*n*=1), atypical neuroleptics (*n*=6), and

benzodiazepines (*n*=1). Medication of AD dementia patients included SSRIs (*n*=2), serotonin-norepinephrine reuptake inhibitors (SNRIs; *n*=1), tricyclic antidepressants (*n*=1), and benzodiazepines (*n*=1).

MDD patients were recruited from the in-patient clinic of the Psychiatric Clinics of the University of Basel, Switzerland. Additional exclusion criteria for MDD patients were ≤ 15 on the Hamilton Depression Scale (HAMD-21;[2]), and/or ≤ 5 on the Geriatric Depression Scale (GDS-15;[3]). Comorbid Axis I diagnoses of DSM-IV[8] were acceptable as long as the current depressive episode was primary (one patient had an additional alcohol-dependency, one patient had a generalized anxiety disorder, and one patient had a mixed personality disorder with narcissistic and emotionally unstable traits). Medication of MDD patients included SSRIs (*n*=10), SNRIs (*n*=10), tricyclic (*n*=1) and tetracyclic (*n*=7) antidepressants, agomelatine (*n*=1), atypical neuroleptics (*n*=10), benzodiazepines (*n*=13), antiepileptics [pregabalin (*n*=3) and valproic acid (*n*=2)], and lithium (*n*=4).

HP were recruited from the participant pool of the Memory Clinic Basel, Switzerland. They were considered cognitively normal if they scored more than 6 points on the combined MMSE and Clock Drawing Test.[9] Exclusion criteria have been described previously.[10]

Procedure:

Prior to the experimental session, participants completed an adapted version of the emotion word knowledge questionnaire[11] to ensure their understanding of each of the six basic emotion terms. For example, to test their knowledge of sadness, participants were asked "How would you feel if your good friend dies?"

Facial emotion stimuli are in greyscale and the hairline is masked. A male (model JJ) and female (model MO) model was selected from the Facial Expressions of Emotion – Stimuli and Tests (FEEST).[12] These models show a reasonably standardized pose and lighting and are reported to be of consistent quality for each emotion.[12]

References:

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SUPPLEMENTARY MATERIAL

Figure legends

Supplementary eFigure 1. The experimental design of the congruent and incongruent emotion intensity rating task. Each stimulus was presented six times consecutively and had to be rated regarding all six basic emotions on an intensity rating scale ranging from (1) *no emotion* to (7) *maximum emotion*.

Supplementary eFigure 2. Estimates of means and 95%-CI of intensity rating scores across conditions and rating options in patients with Alzheimer's disease (AD) dementia using linear mixed-effects models.

Supplementary eFigure 3. Mean intensity ratings of congruent composite scores between groups. Error bars depict 95%- confidence intervals (Tukey's multiple comparisons between groups). *$p < .05$ **$p < .01$, ***$p < .001$ compared to HP.

Abbreviations: ET_Con = Congruent Emotion Total score, NET_Con = Congruent Negative Emotion Total score, HP = healthy participants, bvFTD = behavioral variant frontotemporal dementia, MDD = major depressive disorder, AD dementia = Alzheimer's disease dementia

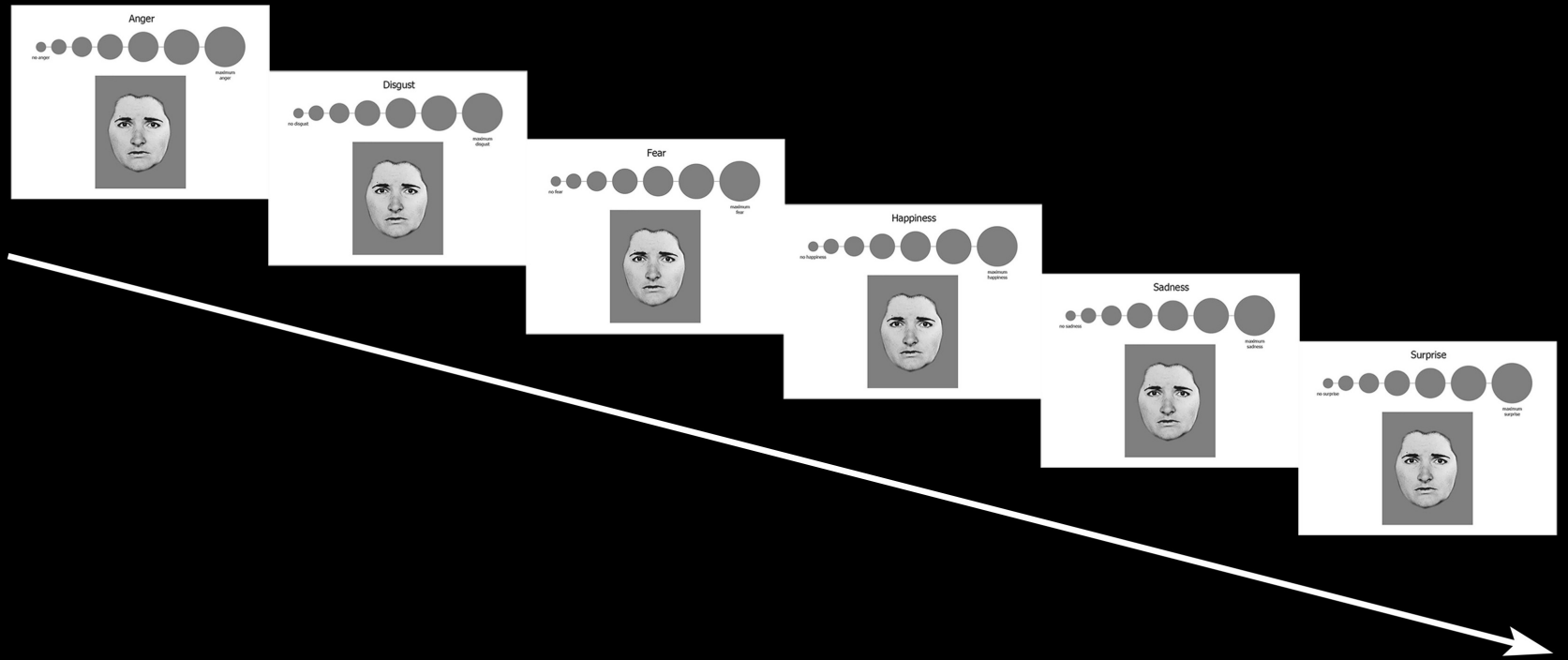
Supplementary eFigure 4. Mean intensity ratings of incongruent composite scores between groups. Error bars depict 95%- confidence intervals (Tukey's multiple comparisons between groups). **$p < .01$, ***$p < .001$ compared to HP.

Abbreviations: ET_Incon = Incongruent Emotion Total score, NET_Incon = Incongruent Negative Emotion Total score, HP = healthy participants, bvFTD = behavioral variant frontotemporal dementia, MDD = major depressive disorder, AD dementia = Alzheimer's disease dementia.

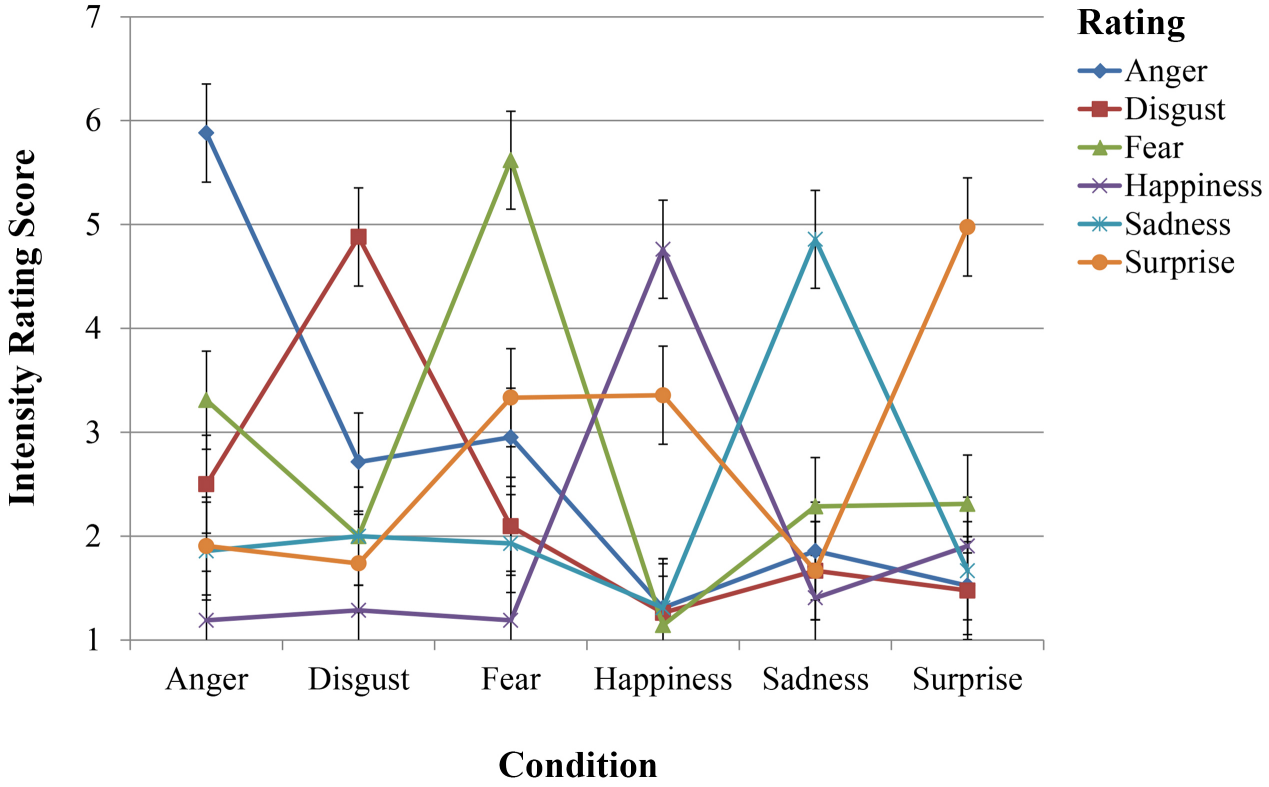
Supplementary eFigure 5. Mean intensity ratings of contrast composite scores between groups. Error bars depict 95%- CI (Tukey's multiple comparisons between groups). ** $p < .01$, *** $p < .001$ compared to HP.

Abbreviations: ET_Contrast = Contrast Emotion Total score, NET_Contrast = Contrast Negative Emotion Total score, HP = healthy participants, bvFTD = behavioral variant frontotemporal dementia, MDD = major depressive disorder, AD dementia = Alzheimer's disease dementia.

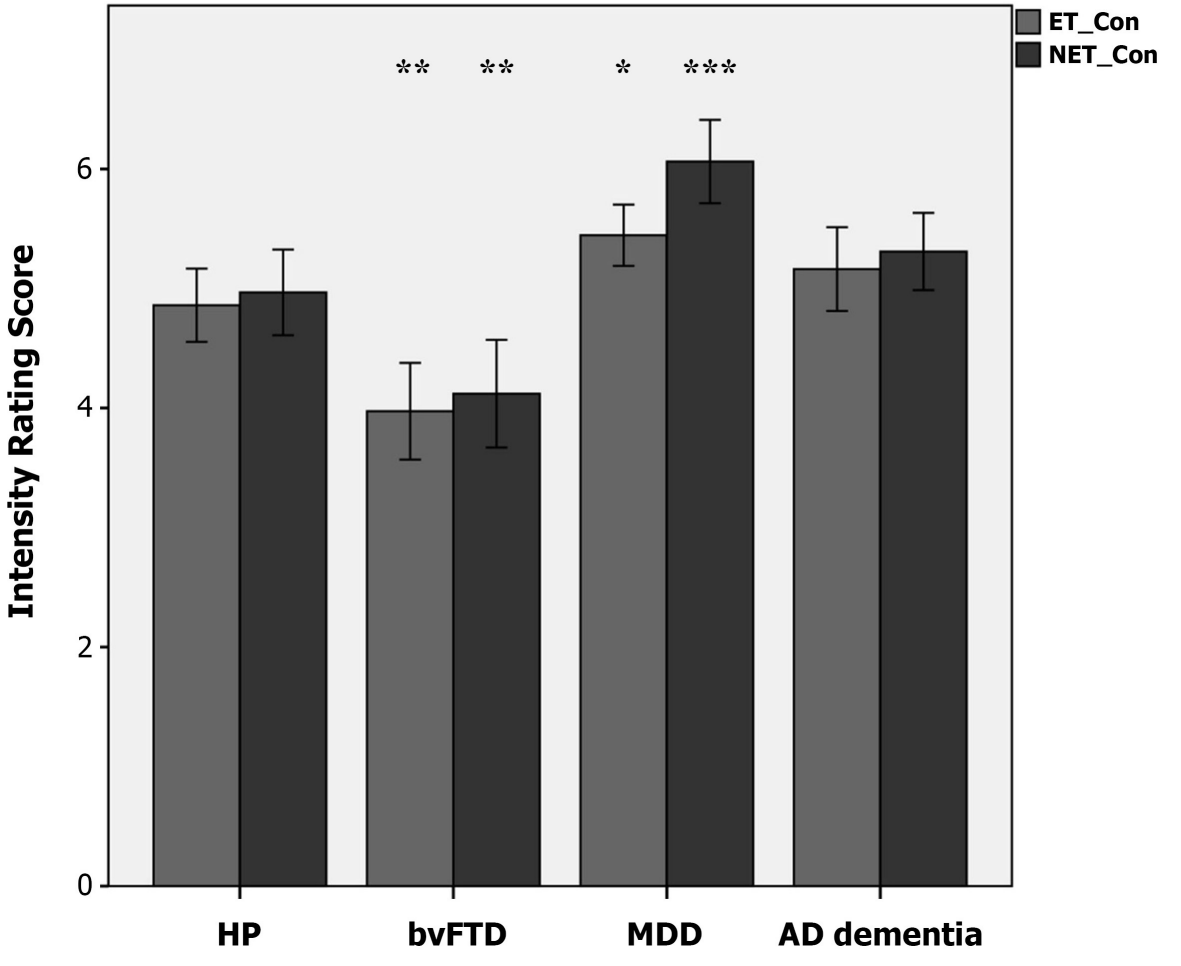
eFigure 1. The Experimental Design of the Congruent and Incongruent Emotion Intensity Rating Task



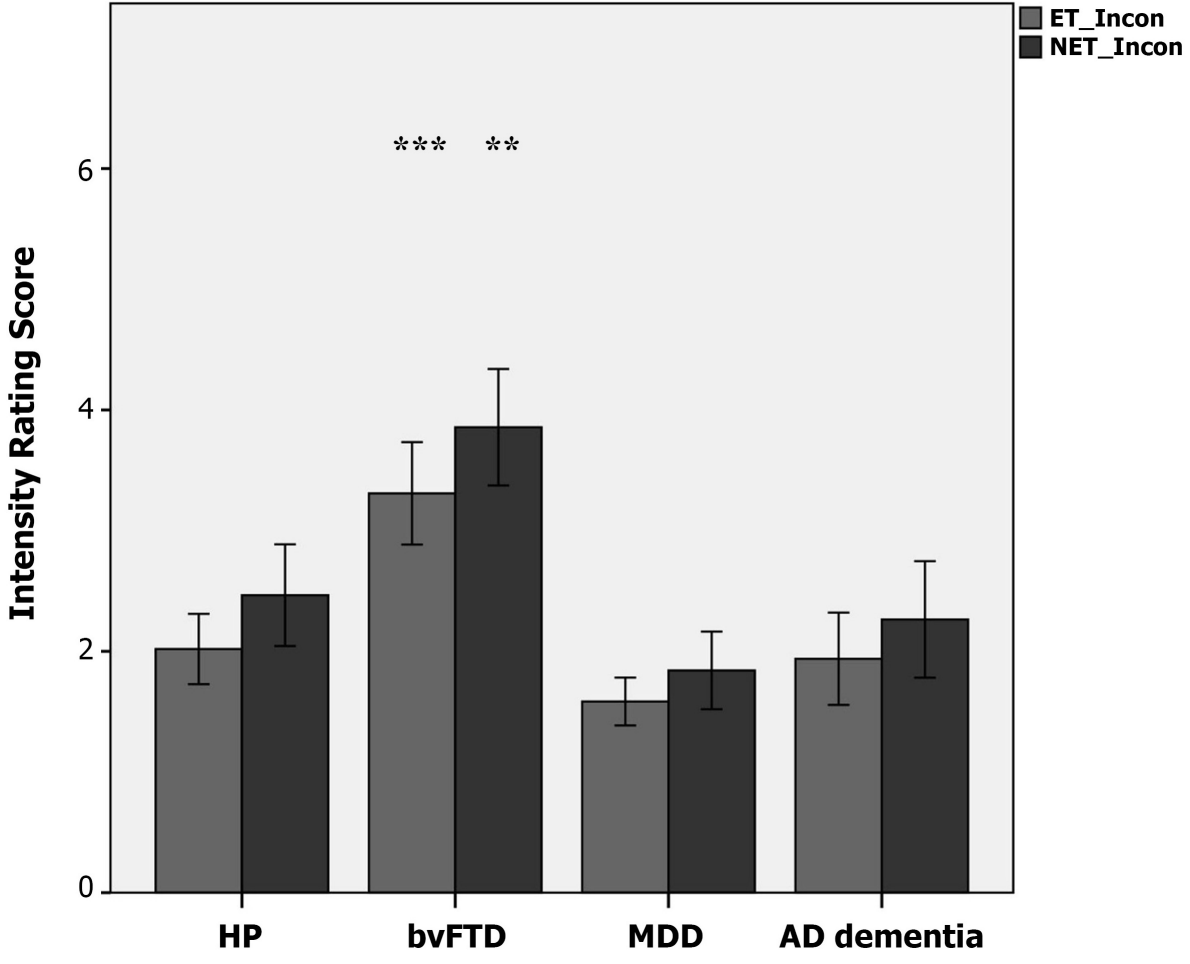
eFigure 2. Estimates of Means and 95% CI of Intensity Rating Scores Across Conditions and Rating Options in Patients With Alzheimer's Disease (AD) Dementia Using Linear Mixed-Effects Models



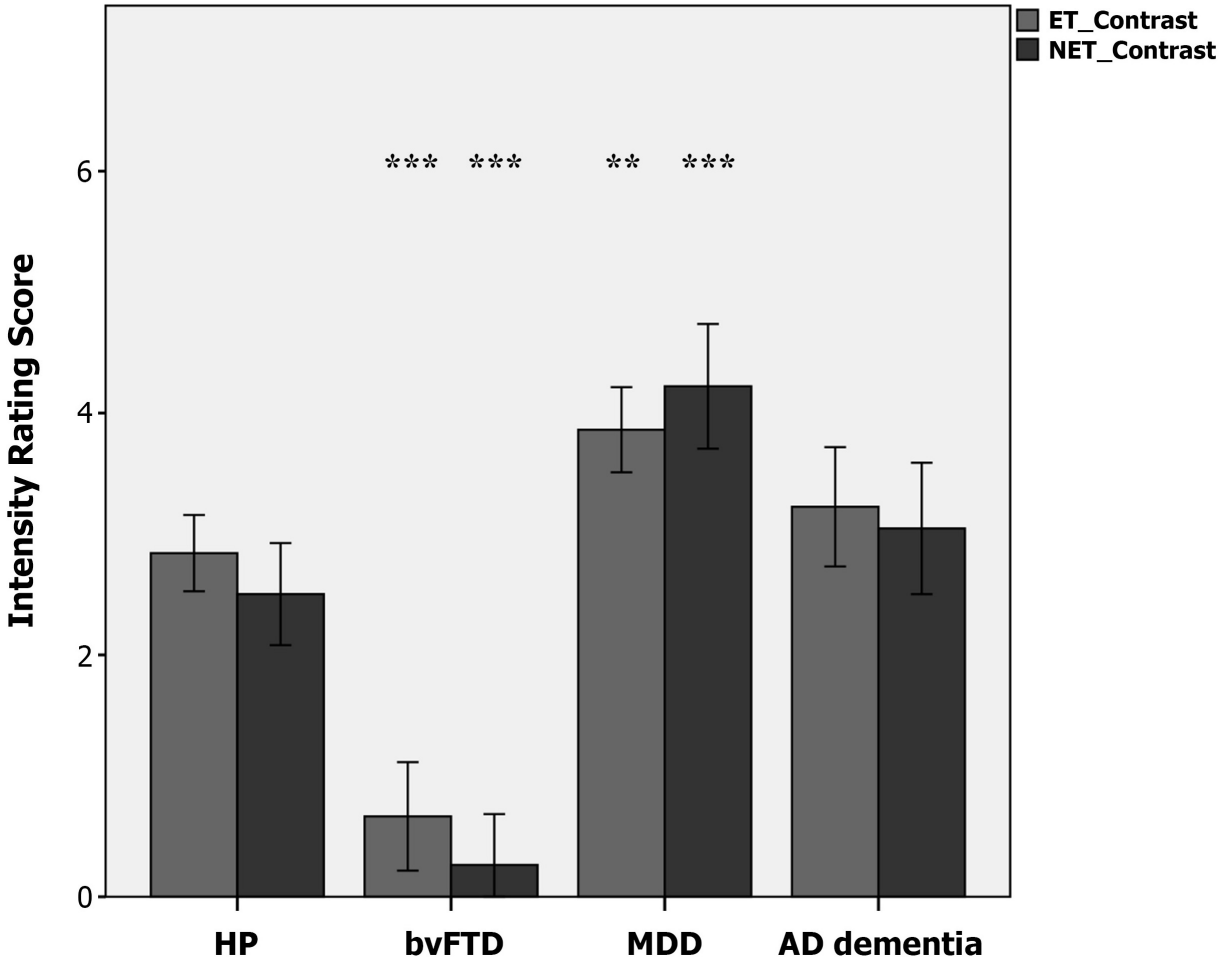
eFigure 3. Mean Intensity Ratings of Congruent Composite Scores Between Groups



eFigure 4. Mean Intensity Ratings of Incongruent Composite Scores Between Groups



eFigure 5. Mean Intensity Ratings of Contrast Composite Scores Between Groups



SUPPLEMENTARY MATERIAL

Test-retest reliabilities of each composite score in healthy participants (*n*=28):

ET_Con: *r* = .75 (95%-CI: 0.53-0.88)

NET_Con: *r* = .80 (95%-CI: 0.61-0.90)

ET_Incon: *r* = .84 (95%-CI: 0.68-0.93)

NET_Incon: *r* = .88 (95%-CI: 0.75-0.94)

ET_Contrast: *r* = .84 (95%-CI: 0.68-0.92)

NET_Contrast: *r* = .86 (95%-CI: 0.72-0.94)