Neural correlates of anxiety risk in a diverse sample of undergraduates

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Background

- Error monitoring is considered a critical aspect of self-regulation—it allows individuals to detect errors and alter behavior accordingly (Gehring et al., 2012)
- Error monitoring may be adaptive in the context of normative anxiety (Barlow, 2002)
- However, alterations in neural responses to error are considered one mechanism by which pathological anxiety may develop
- The error-related negativity (ERN) is a negative voltage deflection in the event-related brain potential that peaks within 100ms of an error response (Gehring et al., 1993; Falkenstein et al., 1991)
- The ERN is thought to be a reflection of individual variance in threat sensitivity
- Detection and salience of threat may in turn modulate fear regulation
- Exaggerated neural response to error could manifest behaviorally as excessive concern about one's performance, a characteristic of pathological anxiety.

Research Aims

- The goal of the present study is to examine the association between the ERN and anxiety in a diverse sample of undergraduate students
- Because Latino individuals are shown to be at greater risk for developing anxiety (U.S. Department of Health and Human Services, 2001), racial/ethnic differences will also be explored

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Methods

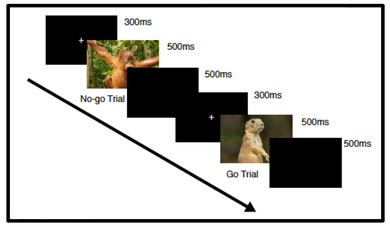
Sample Characteristics
- Participants were 42 undergraduate students (78% female; M_{age}= 20.12)
- The sample was 50.0% Asian, 28.6% Latino, and 21.4% non-Latino White

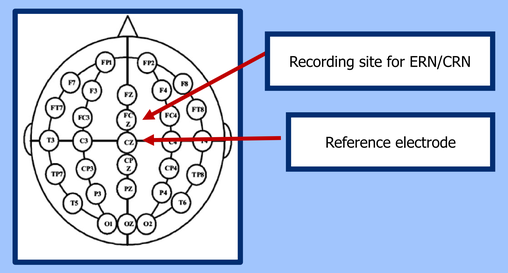
Procedures
- Four computerized tasks were administered, during which electrophysiological data was collected
- A battery of questionnaires was administered

Self-Report and ERP Measures
- Anxiety was measured using the Anxiety Subscale of the Brief Symptom Inventory (BSI; Derogatis, 1982)
- A go/no-go task called the "Zoo Game" (Grammer et al., 2014) was used to elicit the ERN
- The Zoo Game is comprised of 8 blocks of 40 trials, with 75% go trials and 25% no-go trials

ERP Recording and Scoring
- Electrocortical activity was recorded using 32 Ag/AgCl scalp electrodes using the Brain Products ActiCap attached to a ActiChamp amplifier
- The electrooculogram generated from blinks was recorded using two Ag/AgCl electrodes placed below each eye
- Data were recorded referenced to Cz
- The ERN was quantified using mean amplitude measures relative to a baseline of 200ms prior to a response along four midline channels
- Mean amplitude of the ERN was derived from incorrect trials in a window of 0-100ms immediately following an error response
- Mean amplitude of the correct-related negativity (CRN) was derived using the same parameters as the ERN but following correct responses
- As an alternative to subtraction-based difference scores, residualized ERN and CRN values were created by saving the variance left over in a regression equation predicting CRN from ERN and ERN from CRN
- Mean-centered ERN and CRN values were also created to examine if the relationship between ERN and anxiety was conditional upon the level of the CRN

Zoo Game





Results

Independent Samples t-Tests
- Latinos, regardless of gender, demonstrated significantly larger ERN amplitude (p = .001)
- Latina females showed larger ERN amplitude than White and Asian females (p = .012)

Correlations between ERPs and Anxiety
- $ERN_{residual}$ significantly correlated with anxiety (r = .482, p = .015), controlling for age, gender, and ethnicity
- $CRN_{residual}$ significantly correlated with anxiety (r = -.445, p = .026), controlling for age, gender, and ethnicity

Regression Model Predicting Anxiety from ERPs
- The interaction between mean centered ERN and CRN was nonsignificant
- There was a significant main effect of $ERN_{centered}$ (β = .559, p = .040) as well as $CRN_{centered}$ (β = -.420, p = .045)

Discussion

- Results indicate that neural response to error is enhanced among Latino undergraduates, especially females
- Only one other study to date has identified a racial/ethnic disparity in ERN magnitude (Hill et al., In Press)
- Larger (i.e., more negative) ERN was associated with greater risk for anxiety in both correlational and regression analyses
- A significant association was also detected between CRN and anxiety, a finding that has been disputed by previous research (Moser et al., 2013)
- More recent publications that utilize alternatives to subtraction based approaches to quantifying ERPs have revealed an association between CRN and clinical outcomes (Meyer et al., 2017)
- Findings from the present study were in line with other research that suggests that a smaller (i.e., more positive) CRN is related to increased anxiety risk (Meyer et al., 2017)
- Collectively, the present study demonstrates a link between both ERN and CRN with anxiety, and further, that Latino undergraduates may be particularly vulnerable

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