Event Related Potentials and Affective Picture Processing in Children with High vs. Low Trait-Anxiety

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Abstract

The present study is one of the first examining the event-related potential (ERP) components of early posterior negativity (EPN) and late positive potential (LPP) following the presentation of negative, neutral, and positive images in children with high vs. low trait-anxiety. We investigated whether differences observed in these ERPs correlate with differences in trait-anxiety. On the basis of existing ERP studies, we hypothesized positive and negative compared with neutral stimuli would be associated with an enhanced EPN and LPP after image presentation. We expected these responses to be larger among children with high trait-anxiety vs. low-trait anxiety. Data suggest that while the ERP component of the LPP suggested enhanced attention to positive and negative images compared to neutral images, the effects were comparable across groups. There was a trend for the EPN suggesting enhanced attention to negative compared to neutral and positive images among high trait anxious children.

Introduction

Previous studies have examined ERPs in anxious adults, but few if any studies have examined ERPs for affective picture processing in children. The late positive potential (LPP) ERP and early posterior negativity (EPN) has been shown to be greater in adults and children after viewing emotional stimuli (Hajcak & Dennis, 2009). These ERP components correspond with the processing of and an increased attention to motivationally salient stimuli. Across studies, the LPP has been quantified using different windows varying from 300-1,000 ms after stimulus presentation (Hajcak, MacNamara, & Olvet, 2010; Hajcak & Olvet, 2008), while the EPN component has been observed to increase in negativity between 150-300 ms after stimulus presentation (Schupp et al. 2003). The present ongoing study is one of the first examining the components of EPN and LPP following viewing of negative, neutral, and positive images in children and if characterized high vs. low trait-anxiety. On the basis of existing ERP studies, we hypothesized the positive and negative images compared with neutral stimuli would be associated with an enhanced LPP and EPN. In addition, we hypothesized that the EPN and LPP would be greater among children with high trait-anxiety vs. low-trait anxiety.

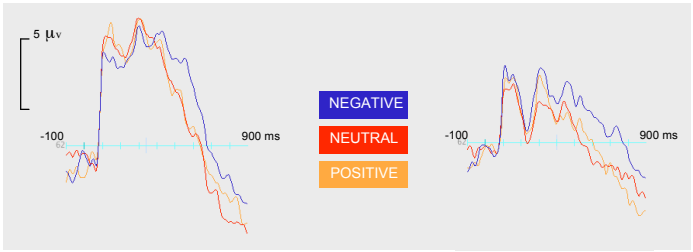
Method

Participants: The sample consisted of twenty-one participants (*N=21)* between the ages of 9-14 from the New Haven, Connecticut area, screened from a two typically developing child cohorts (M. Crowley, PI, L. Mayes, PI). Mothers and children completed the Screen for Child Related Anxiety Disorder (SCARED) and were screened such that the low anxiety group had a total SCARED score ≤ 15 (mother and child report), Mean SCARED =11.92. The high anxious group had total scared scores ≥ 30 (Mean S.C.A.R.E.D. score: 35.25). Eight were characterized with high trait-anxiety and 13 with low trait-anxiety.
Procedure: Each participant sat 24 in. before a 19 in. LCD monitor in a dimly lit (60w bulb) sound attenuated room. Participants viewed 90 age-appropriate images (30 negative, 30 neutral, and 30 positive). They wore a 128 electrode dense array EEG cap to measure ERPs. Images came from the International Affecive Picture System (IAPS) as well as other child appropriate negative images collect at Yale for this study. Data was filtered using a 30Hz low pass and segmented into epochs from 100 ms before to 900 ms after stimuli presentation; corrected artifact trials were then analyzed. All electrodes were referenced to Cz for recording. Impedances remained at or under 40k ohms. The E-prime v.1.2 software package controlled the stimulus presentation.

Results

The LPP effect was statistically significant for image type $F(2,18) = 5.851$ $p<0.01$. No LPP effect for trait-anxiety was found $F(2,18) = 0.126$ (n.s.). A pairwise comparison revealed the mean difference for negative vs. neutral images, $p< 0.005$ and the mean difference for negative vs. positive images were statistically significant, $p< 0.02$; the mean difference for neutral vs. positive images was not statistically significant, $p> 0.05$. An early ERP component effect was observed for early posterior negativity (EPN). The EPN window chosen was 150-300 ms after image presentation, since previous EPN research consisted of this same window (Schupp, Junghöfer, Weike, & Hamm, 2003). The EPN effect for group type was statistically significant $F(2,18)=17.31$, $p < 0.001$. A trend in the effect of image type by trait-anxiety was observed $F(2,18)= 2.917$, $p< 0.08$. A pairwise comparison showed a significant mean difference for EPN for negative vs. neutral and positive images, $p< 0.001$; no difference was observed for neutral vs. positive images $p>0.5$.

Figure 1. Grand Averages at the Electrode Cz in Response to Three Types of Images for Low vs. High Trait-Anxiety Groups



High Anxious **Low Anxious**

Discussion and Future Directions

Our results replicate previous studies showing enhanced attention to emotionally salient images, reflected in the enhanced LPP for unpleasant images. Data suggest a diminished EPN among anxious children overall, and a trend toward greater EPN for negative stimuli among anxious children. Ongoing data collection will allow us to test this effect in a larger sample. We did not see an enhanced LPP for negative images among anxious children. It could be that children are detecting the aversive images and averting their gaze, which could impact later ERP components. Also, the images employed with children are much less aversive and evocative than those used with adults. Work from our group is now manipulating anticipatory anxiety to enhance the processing of affective pictures. For example, Bublatzky et al. (2010) in their investigation of anticipatory anxiety and emotion processing in an adult sample a series of images containing negative, positive, and neutral pictures were presented to the participants after a cue warning of a possible shock before images were shown.

Conclusions

The LPP and EPN ERP components suggested enhanced attention to negative images compared to neutral and positive images, but the results were not statistically significant for trait-anxiety. A trend for the trait anxious group was observed for EPN. These results are consistent with the current literature of emotional pictures having increase LPP size demonstrating an increase in attention. However, while trait-anxiety was not shown to significantly influence the LPPs in children, this discrepancy could be due to the small sample size.

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