The Effect of Idiographic Worry on Emotional Processing

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Abstract: Emotional processing to internal threat is increasingly being studied as a way to evaluate the effect of worry on attention. The current study seeks to use event related potentials (ERPs), specifically the Late-Positive Potential (LPP), to determine how an idiographic worry episode effects the amount of neural resources individuals use to emotionally process internally produced threat. Participants will engage in thought manipulations intended to provoke either worry or positive emotion towards several daily topics while viewing a cue for each topic. Then the visual cues for each topic will be displayed on a computer screen and an electroencephalogram will be collected to obtain the LPP Potential to assess the amount of emotional processing the participants engage in. We anticipate the worry manipulation group will exhibit higher levels of emotional processing. These results would suggest that worry causes individuals to use more neural resources to emotionally process threat. This increase in threat processing could disrupt the balance between stimulus and goal driven attention systems resulting in impaired attentional control.

Keywords: Emotional Processing, Event-Related Potentials, Idiographic Worry, Late-Positive Potential

Introduction

Generalized Anxiety Disorder (GAD) is a common mental disorder that is characterized by excessive and perpetual worry that interferes with daily life (American Psychological Association 2013). Specifically, worry is a verbal-linguistic pattern of fearful thoughts relating to future events (Freeston et al. 1996). Current cognitive models suggest that the primary mechanism of worry is avoidance (Borkovec 1994; Newman et al. 2011). The Cognitive Avoidance Theory of Worry (CATW) suggests that worry is negatively reinforced because it is used to avoid the negative emotions of anticipated events (Borkovec et al. 1990). Specifically, worry is believed to suppress fearful mental images and the negative physiological responses that arise from them. However, subsequent research has found that high worriers tend to exhibit higher levels of negative emotions at baseline when compared to healthy controls (Peasley-Milkus et al. 2000; Stapinski et al. 2010). The Contrast Avoidance Model of Worry (CAMW) accounts for this variability, suggesting that worriers do maintain a negative emotional state when engaging in worry (Newman et al. 2011), and that worry is negatively reinforced by avoidance. However, CAMW specifies that maintaining the negative emotional state associated with worry decreases the likelihood of experiencing sudden negative emotional "contrasts" when threatening events occur.

While the emotional reinforcements of worry can provide significant insight into the underlying causes of this aversive mental state, there are a number of other factors that are negatively affected by worry and, therefore, can exacerbate symptoms. Attentional control, for example, is believed to be negatively affected by the presence of worry. More specifically, the Attentional Control Theory (ACT; Eysenck et al. 2007; Eysenck et al. 2011) states that worry promotes stimulus driven attention systems over goal driven

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attention systems, which increases an individual's attention to threat stimuli and decreases their ability to engage in goal directed behavior.

One way to study the effect of worry on attention is to measure the amount of neural resources the individual is devoting to processing threat, or the amount of emotional processing the individual is engaging in. Emotional processing is often measured utilizing ERPs because of their high temporal resolution. Specifically, the Late-Positive Potential (LPP) amplitude is typically greater after the presentation of both pleasant and unpleasant stimuli when compared to neutral stimuli (Diedrich et al. 1997; Dillon et al. 2006). Because of this, the LPP is believed to reflect an increased devotion of attentional resources to emotional processing (Schupp et al. 2000). The LPP begins at approximately 200-300 ms post stimulus onset and reaches its maximum between 700-1000 ms at the Pz electrode (Cuthbert et al. 2000).

In the past, studies have found conflicting data regarding the effect of worry on the LPP, with some suggesting that worry increases the LPP amplitude (Moser et al. 2014), and others indicating no group differences in emotional processing between worriers and controls (White et al. 2017; Grant et al. 2015). As a result, the relationship between worry and emotional processing is not yet clear.

Previous studies have attempted to investigate the relationship between worry and emotional processing by instructing participants to view threatening images (Moser et al. 2014; White et al. 2017). However, worry is a verbal-linguistic rather than imagery-based cognitive process. Because of this, studies provoking or assessing the worry process through images may overlook the cognitive nuance of worry as it typically exists in a real world setting, and do not evaluate the immediate consequences of an individual's worry. The present study seeks to measure the effect of worry on emotional processing by instigating a worried state with a structured interview about a wide variety of everyday topics. We hypothesize that an induction of idiographic worry will result in increased LPP amplitude compared to an induction of positive cognitions, and therefore indicate a higher level of emotional processing.

Methods

Participants:

A total of forty participants will be recruited from Oklahoma State University via an online recruitment system. Based on earlier studies conducted in this lab, we expect that the sample will consist of primarily Caucasian female participants and that age will range between 18 and 22 years.

Materials:

Penn State Worry Questionnaire (PSWQ; Meyer et al. 1990). The PSWQ is a 16-item self-report questionnaire intended to quantify the amount and severity of worry an individual is predisposed to display. Items are on a Likert scale with responses to each question ranging from 1 (not at all typical of me) to 5 (very typical of me). High scores on this questionnaire indicate that an individual has high levels of worry while low scores indicate low levels of worry.

Thought Induction (modified from procedures by Vasey and Borkovec, 1992). Participants will be randomly assigned to one of two groups. The first group will be subjected to a worry thought manipulation while the second group will be given a positive thought manipulation. In the worry group, the participant will be asked questions about a wide variety of everyday topics (School, Finances, Relationships, Family, The Future, Errands, and Health) in a manner that is intended to provoke idiographic worry. All of these topics will be discussed with each participant in a randomized order to ensure that carry over effects from previous topics will not significantly affect results. To begin, participants will be asked to provide an example of something that worries them about a given topic. After they provide an answer, participants are asked to describe aspects that worry them about whatever their first response

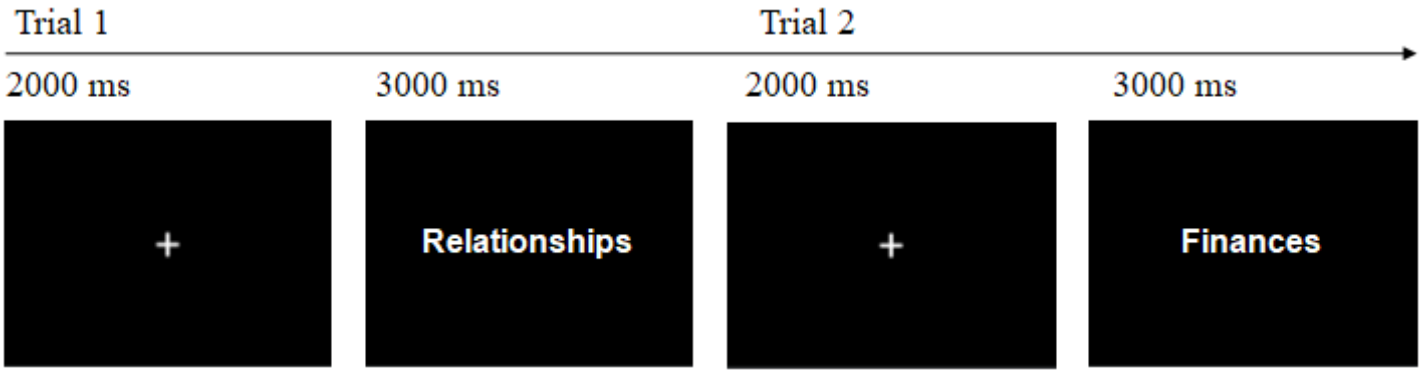


Figure 1: Sample trials from Viewing Task

was. This process is continued until a participant either refuses to provide an answer or repeats the same answer three consecutive times. This process will be repeated for all seven topics for each participant.

In the positive group, participants will be asked about the same topics, but in a way intended to evoke positive emotion. In this group, participants will be asked to provide an example of something positive about a given topic, and then describe the specific aspect about whatever was positive about whatever their first response was. Again, this process will continue until participants refuse to provide an answer or provide the same answer 3 times in a row. During each thought induction, a verbal cue associated with each topic will be presented on a computer screen.

Viewing Task. For the viewing task (see Figure 1), participants will be told "For this task you will be asked to view a series of word cues. You will first see a fixation cross (+) on the screen. Next, you will see a cue. Please think about the content you described to the experimenter. You will have a chance to practice first." Participants will view 3 neutral word cues to ensure that they understand the instructions, and these cues will not appear later in the study. After each practice cue they view, the experimenter will assess to ensure they viewed the portion inside the circle, by asking "What did thoughts did you bring to mind?" Next participants will be offered an opportunity to ask questions and will be instructed that the task will begin: "The study will begin now. You will view several words just like you did during the practice. Please let the experimenter know when you are ready to begin."

During the task, there will be 119 trials total, 17 per word cue. A trial will consist of a fixation cross presented for 2000 ms, followed by the word cue for 3000 ms (Figure 1). Studies using the LPP have used as few as 12 trials (Moran et al. 2013). Therefore, there will be sufficient trials to evaluate the LPP for each condition if no more than 25% of trials are rejected.

Electrophysiological Data:

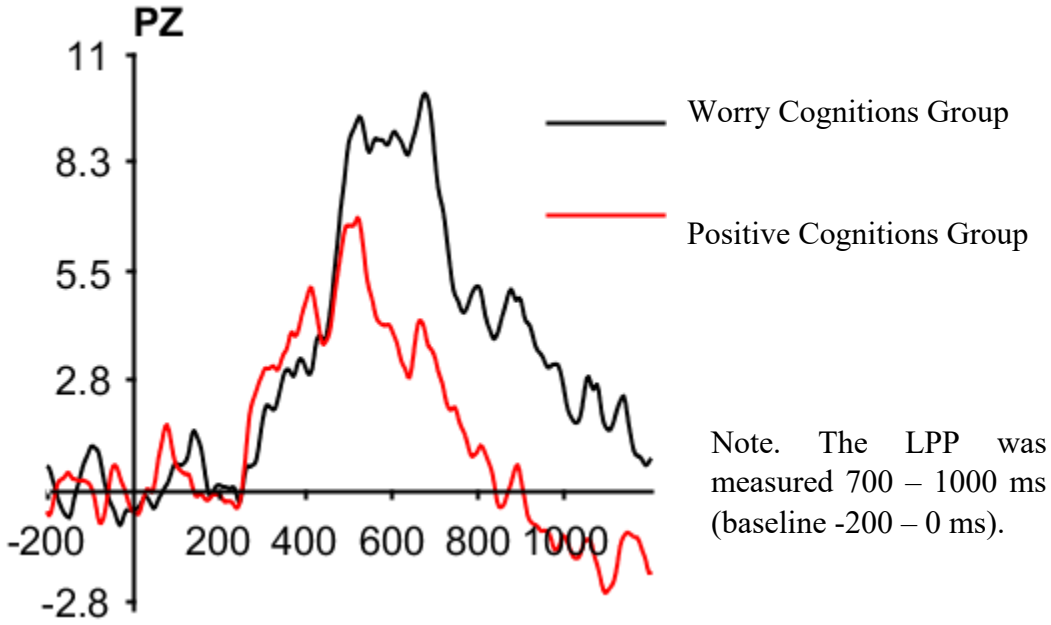
Electroencephalography (EEG) and electrooculography (EOG) will be recorded using a BioSemi ActiveTwo System (Biosemi, Amsterdam, Netherlands). Data will be recorded using 32 Ag/AgCl electrodes (Fp1, Fp2, AF3, AF4, Fz, F3, F4, F7, F8, FC1, FC2, FC5, FC6, Cz, C3, C4, T7, T8, CP1, CP2, CP5, CP6, Pz, P3, P4, P7, P8, PO3, PO4, Oz, O1, and O2) mounted in an elastic cap in the standard 10/20 system and referenced online using the Common Mode Sensor and Driven Right Leg electrodes. The EEG also will be re-referenced offline to the average of two electrodes, which will be placed on the left and right mastoids (Luck 2014). Vertical EOG will be measured using an electrode placed approximately 1 cm under the left eye in line with the pupil. In order to measure horizontal EOG, two other electrodes will be placed near the outer canthi of the left and right eye.

Data will be sampled at 256 Hz and filtered offline using a .01-.30Hz band-pass filter (Luck,

2014). Data will be processed using EEGLAB version 14 (Delorme and Makeig 2004) and ERPLAB version 7.0.0 (Lopez-Calderon and Luck 2014). ERPLAB automated routines will be used to detect and reject artifacts. Independent components analysis will be used to detect blinks and saccades. A 200 ms window will move through the data in 50 ms increments to detect changes in the voltage due to artifact including flat lining, movement or other noise. Trials with artifacts in the baseline or measurement window will be excluded and participants whose data has more than 25% of trials rejected will not be included in analyses (Luck 2014). Based on previous research (Grant et al., 2015; Judah et al., 2016), the LPP will be measured at the Pz electrode site. Research employing a similar paradigm used a 200 ms baseline window prior to the image onset (Dunning and Hajcak 2009; Hajcak et al. 2009). Based on prior research, the LPP will be defined as the average activity in the 700 – 1000 ms.

Procedures:

Upon entering the lab, participants will first be given informed consent along with a short description of the study. They will then be seated in a chair approximately 70 cm from a 24'' Dell LCD monitor and asked to complete the PSWQ. After completion of the questionnaires, the participant will be attached to EEG electrodes to collect electrophysiological data during the study. After the participant is properly attached to the EEG electrodes and oriented to the computer screen, the study will begin. Then the participant will be presented with a fixation cross on the computer screen for five minutes while baseline data is collected. After the baseline measurement, the participant will then be subjected to one of the predetermined thought manipulations, while EEG data are continuously collected. After the manipulations, the viewing task will begin, while EEG are collected. After the viewing task is completed, the electrodes and cap will be removed from the participant. The participant will then be debriefed and released from the study.



Note. The LPP was measured 700 – 1000 ms (baseline -200 – 0 ms).

Figure 2: Expected LPP waveform

Progress to Date

By then end of the Spring 2019 semester, we have collected data from 50 participants, with roughly half of the participants being given the worry manipulation and the other half being given the positive manipulation. This study only requires a sample size of around 40 participants. As is typical with EEG research, we expect we will lose some data due to technical difficulties with the EEG electrodes, human error in data collection, and other unforeseen complications. EEG data cleaning and processing is in progress and should we lose more than 10 subjects due to these issues, we plan to continue data collection into this

summer and possibly next semester if required. Once all of the data has been collected, we will conduct a 2 group (Worry, Positive) ANOVA on the LPP amplitude with a PSWQ covariate (see Figure 2 for expected LPP differences).

Discussion

If the hypothesis is supported, the LPP amplitude will be higher for the Worry Group compared to the Positive Group. This means that the individuals subjected to the worry thought manipulation were engaging in more emotional processing toward the otherwise neutral verbal cues than the group given the positive thought manipulation. These results would suggest that worry results in higher emotional processing of threat. Similar results have been found in other studies using differences in trait worry to investigate emotional processing of threatening images (Burkhouse et al. 2015). However, these studies do not use verbal-linguistic thought manipulations to induce a worried episode as is done in this study. Further research would need to be conducted to investigate the effect that differences in trait worry could have on emotional processing and attentional control when ideographic worry is induced.

If being in a worried state causes individuals to spend more of their neural resources processing threat, then it is possible that the worry is also disrupting the balance between stimulus and goal driven attention systems, resulting in decreased attentional control capabilities as outlined by ACT (Eysenck et al. 2007). This also would suggest that poor attentional control could result in problems with engaging in goal directed activity. Such behavioral deficits would likely have a detrimental effect on people with GAD or other forms of chronic worry. Because of this, it is important to continue to study the relationships between worry, emotional processing and attentional control. Result from this study and others in this field could be used to modify existing therapies for GAD and other psychological disorders relating to chronic worry.

In particular, therapies could be modified to include an increased emphasis on developing adaptive emotional processing strategies and attentional control capabilities. For example, this could include an increased focus on reappraisal and cognitive challenging techniques. Such interventions could serve to mitigate the detrimental effects that worry has on emotional processing of threat stimuli. This could, in turn, improve goal-driven attention systems and the ability of worrisome individuals to engage in goal directed activity.

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