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Progress Report and Expenditures for:

The Neurophysiology and Attentional Effects of Verbal and Imagery-based Worry

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1) Purpose:

A common component of Generalized Anxiety Disorder (GAD) is chronic worry (Kandel et al., 2013). Several studies have shown that worry is a component of anxiety that can cause a deficit in goal-driven attentional thinking (Leigh & Hirsch, 2011; Williams et al., 2014; Stokes & Hirsh, 2010). Worry is predominately verbal rather than imagery-based, and it is suggested that verbal worry can be blamed for the lack of attentional capability associated with anxiety (Borkovec & Inz, 1990; Stefanopoulou et al., 2014). In fact, verbal worry is thought to perpetuate worry by being less concrete, hindering the problem-solving capabilities of executive function (e.g., attention and working memory) needed to resolve the worry itself (Borkovec & Inz, 1990). Stokes and Hirsh's (2010) study were one of the first to show a possible solution. They found that imagery-based worry may lead to a decrease in negative thought intrusions after treatment compared to verbal worry, suggesting a therapeutic benefit of imagery-based worry training for individuals suffering from anxiety.

The effects of verbal versus imagery-based worry have not yet been studied neurophysiologically. Using electroencephalography (EEG), it has been demonstrated that frontal lobe activation asymmetry (i.e. right versus left hemisphere activity) relates to attentional bias toward threats. Participants with less activation in their right frontal lobe in comparison with the left tend to show more attentional threat bias, demonstrating that the frontal lobe may be a logical place to examine attention. Finding the cognitive, neurophysiological effects of verbal versus imagery-based worry would help bolster future evidence of the effectiveness of therapeutic techniques used to reduce the ill effects of worry.

This study was designed to determine the effects of verbal versus imagery-based worry on attentional capacity and the hemispheric specialization of attentional processes. Because

anxiety can be so debilitating to cognition, and therefore goal-driven behaviors (i.e., work tasks, schoolwork, etc.), it is important to determine which methods decrease worry within anxious individuals. If imagery-based worry helps increase executive function capacity compared to verbal worry, we should expect to see an increase in attentional resource capacity, which would help to ease some of the debilitation associated with anxiety.

2) Outline of Research Design:

Participants

Nineteen male and female undergraduate students enrolled at Winona State University served as participants (18-25 years old). They were recruited through various means including the psychology research sign-up board, in classroom solicitation, and emails. Participants received \$15.00 for completing the project.

Measures

Generalized Anxiety Disorder Questionnaire. The Generalized Anxiety Disorder Questionnaire (GAD-Q-IV) was used as a self-report diagnostic measure for GAD based on the Diagnostic and Statistical Manual-IV (Newman et al., 2002). We modified question five to include a scale from 1-10 with each letter, asking “On a scale of 1-10, how disastrous is this worry?” with (1) *only a little disastrous*, (3) *somewhat disastrous*, (5) *moderately disastrous*, (7) *very disastrous*, and (10) *extremely disastrous*.

Penn State Worry Questionnaire. The Penn State Worry Questionnaire (PSWQ) assessed how likely someone was to engage in worry based on their traits (Meyer et al., 1990).

Drugs and Medications Survey. This survey contained a list of psychogenic drugs (i.e., opiates, SSRIs, caffeine, alcohol, marijuana, etc.) where the participants were asked to indicate

whether or not they have used the drug, at what age did they start using the drug, the date they last used the drug, how often they use the drug in a typical week, and for what purpose they use the drug.

Mood ratings. Two visual analogue scales ranging from 0 to 10 were used to assess mood before and after the intervention. Sadness and anxiety levels are the included “moods”.

N-Back Task (Owen et al., 2005). This task was used to assess general attentional control capacity.

Random Generation Key-Pressing Task (Hayes et al., 2008). This task was used to monitor the attentional control used to inhibit rehearsed tendencies (Stefanopoulou et al., 2014).

Emotional Stroop Task (Avram et al., 2010). This task measured threat-related attentional bias.

Procedure

Participants read the project description and completed the informed consent form before continuing. Then, participants completed the PSWQ and a demographic questionnaire during which an EEG cap fitted with 20 recording electrodes was placed on the participant’s head.

Worry intervention. The worry task consisted of five phases: (1) a baseline breathing focus stage for five minutes, (2) mentation (i.e., verbal or imagery-based) training, (3) a worry period for five minutes while engaged in specified worry, (4) a testing phase, and (5) Progressive Muscle Relaxation (PMR) training and finally the participants were debriefed.

Phase 1- Breathing Focus. Baseline frontal EEG asymmetry was monitored first. Participants were then instructed to focus attention on breathing for five minutes. After the five minutes, participants rated themselves on a mood scale.

Phase 2- Mentation Training. After phase 1, participants were trained in the mentation style (i.e., verbal or imagery-based) for their group. Engaging in verbal mentation was defined as thinking “in words, sentences and questions, as though you are talking to yourself” (Leigh & Hirsch, 2010, p. 420). Engaging in imagery mentation was defined as “generating an image of the situation and tuning in to what you can see, feel, smell, hear, and taste in the image as though you are actually there right now” (Leigh & Hirsch, 2010, p. 419). After practice of the participant’s specific mentation style, participants gave feedback on how well they think they engaged in their mentation style.

Phase 3- Worry Phase. After mentation training, participants were asked to think about a personally relevant topic that produces worry. The topic chosen was a personally relevant topic taken from question 5 of the GAD-IV-Q. The topic chosen for each subject was selected based on a rating between 3-5 (4 is preferable, then 3, then 5 maximum) out of 10 on our “Disaster Scale” for our modified GAD-IV-Q. Participants were instructed to think about that topic silently for five minutes using their assigned mentation style. The experimenter left the room during the five minutes, but a camera was used to monitor if the participant demonstrated any distress. Distress was defined as excessive fidgeting, shaking, shortness of breath, and rapid heart rate. None of the participants exhibited any of these signs.

Phase 4 & 5- Testing Phase and PMR. After the worry phase, the participants were asked the percentage of time they spent worrying and how difficult it was for them to worry. Participants were then instructed to complete the N-Back Test and Random Key-Pressing Task to measure availability of attentional resources, and the Emotional Stroop Task to measure attentional threat bias. Afterwards, the participants rated themselves on the mood scale again. Then, they were given instruction in PMR to help reduce any stress caused by the worry phase.

Psychophysiology. The EEG electro-gel cap was used on the participant to measure neurophysiology during baseline activity and all phases of the worry task. To measure attentional threat bias, the left and right mid-frontal electrodes (i.e., F3 and F4) were used to monitor frontal asymmetry. The participant's heart rate was also monitored. Electrophysiological activity between the electrodes will be analyzed at the end of the study.

3) Progress Report and Future Plans

We started running participants in late March and training two research assistants in April to continue this study into next year. So far, we have obtained data from 19 participants and plan to obtain data from more participants next semester. The PI will be working in correspondence with the faculty advisor and other research assistants to over the summer. We are currently in the process of analyzing the EEG files, which will be a project over the summer and the beginning of September. Here's an example of the type of data that we've obtained thus far:

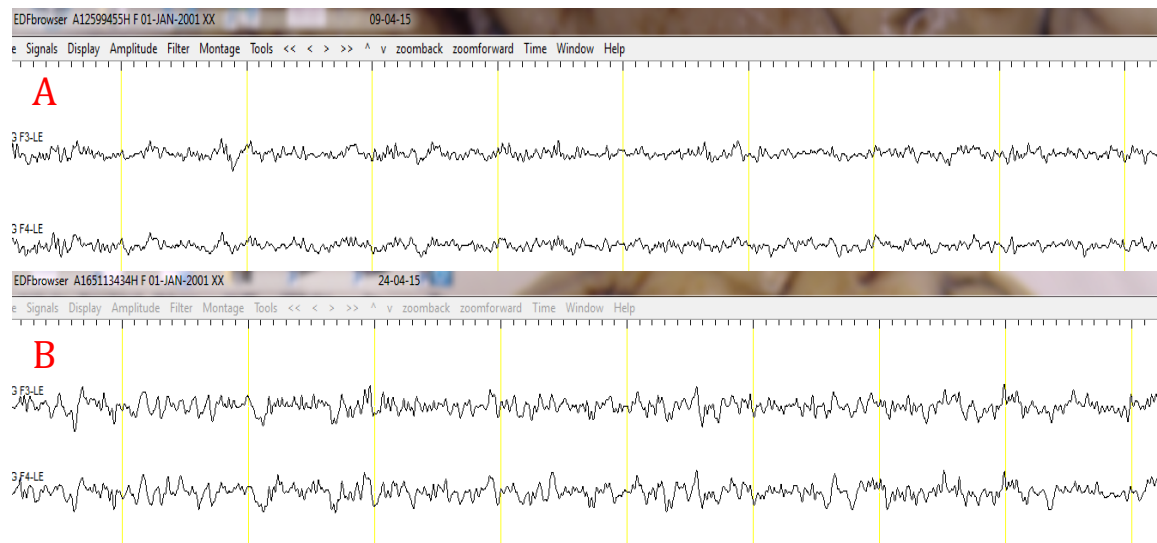


Figure 1. Frontal EEG activity for someone who was positive (A) and negative (B) for Generalized Anxiety Disorder according to the GAD questionnaire during the worry phase of the study.

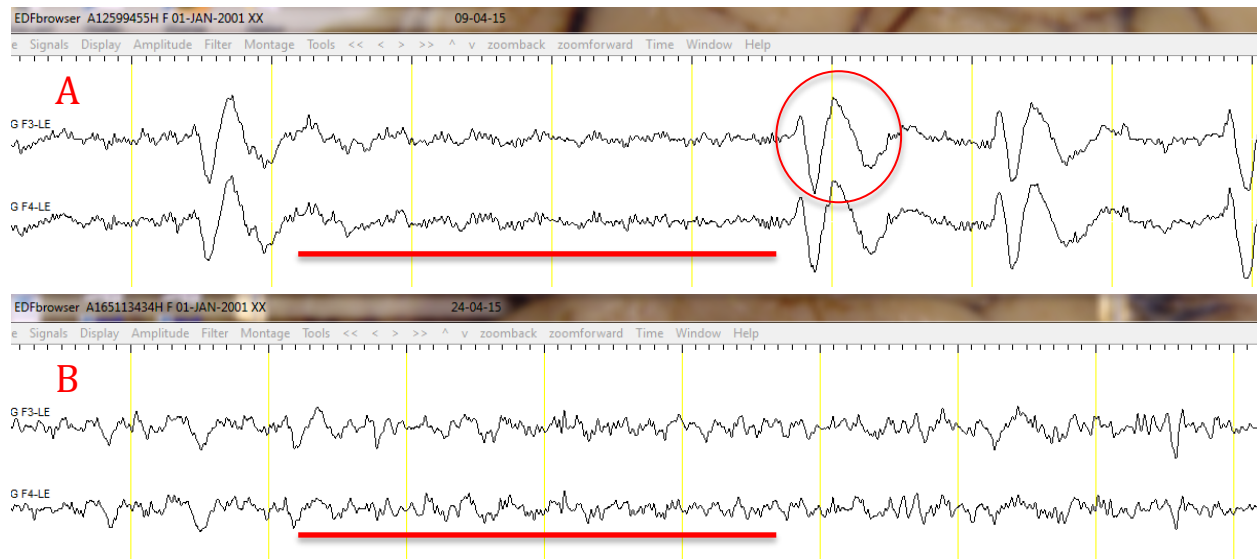


Figure 2. Frontal EEG activity for someone who was positive (A) and negative (B) for Generalized Anxiety Disorder according to the GAD questionnaire during the N-Back task during the second phase. The red lines indicate clear EEG signal, and the circle shows what an eye blink artifact looks like.

Continued on Next Page

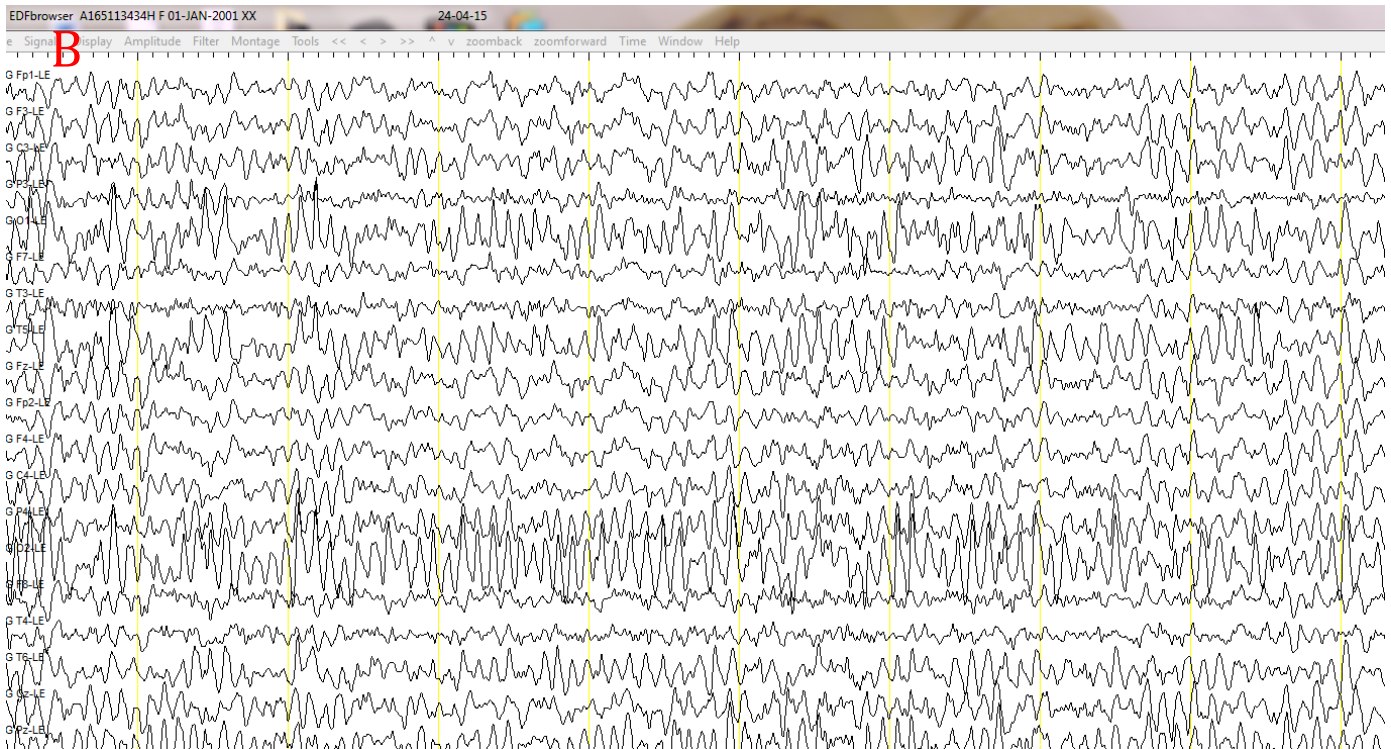
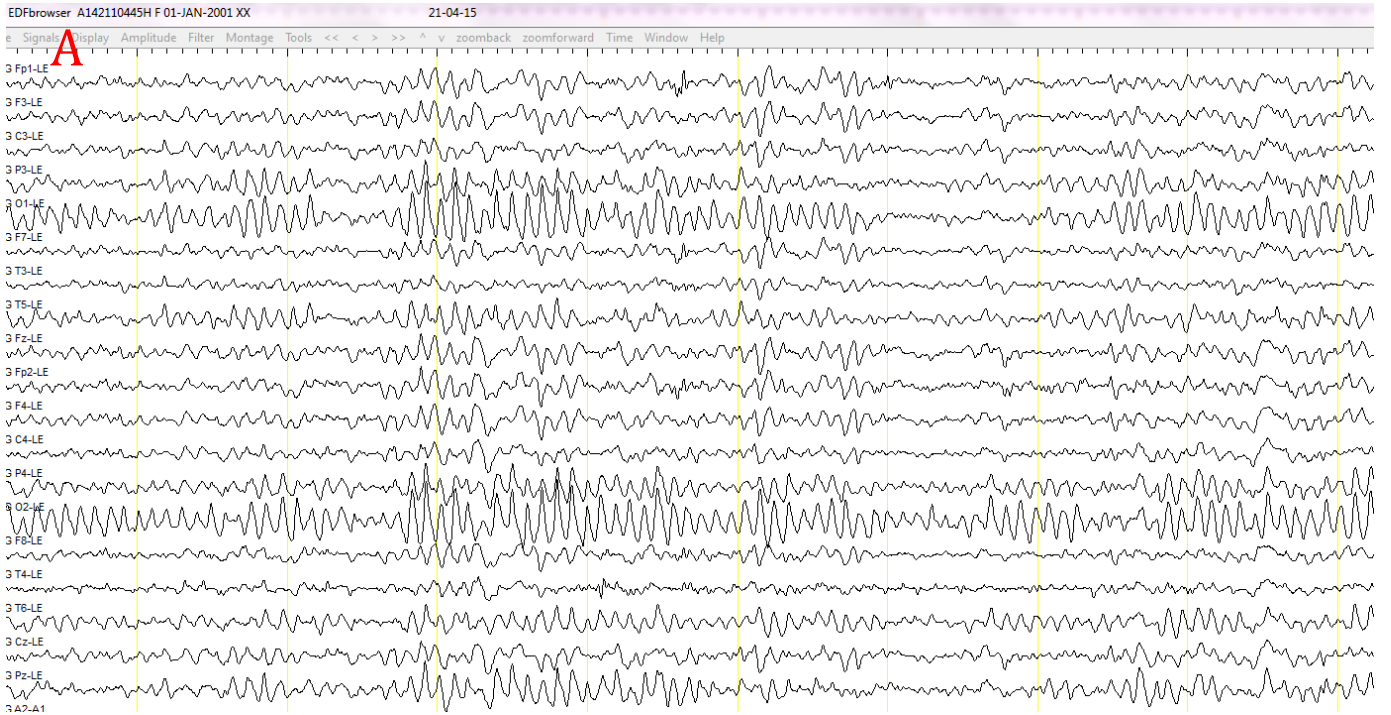


Figure 3. The overall EEG activity of for someone who was positive (A) and negative (B) for Generalized Anxiety Disorder according to the GAD questionnaire during the progressive muscle relaxation task.

7) Finalized Budget Report

Original Budget Request | Cost Center: 213156

Items	Cost Per Item	Number of Items	Total
Participant Payment for 1.5 hour visit	\$15	70	\$1050
EEG Supplies			
Electrogel	\$50	2	\$100
Skin Prep Gel	\$13	4	\$52
Gel Applicators	\$9/bag	3	\$27
Foam Electrode Protectors	\$25	1	\$25
5cc Syringes	\$22	2 packs of 50	\$44
16g Blunted Needles	\$16	4 packs of 50	\$64
Metricide (good for 30 days)	\$24	5	\$120
CDs for Data Storage	\$18	1 pack	\$18
Study Total:			\$1500
Amount Requested for Grant:			\$600

NOTE: Additional funds will be provided by Psychology Department OCED funds and NAI neuroscience funds

FINAL BUDGET REPORT Continued on Next Page

Expenditures Report (\$600) through May 20, 2015:

Items	Cost Per Item	Number of Items	Total
Participant Payment for 1.5 hour visit	\$15	*19	\$285
EEG Supplies			
Ivory Detergent (EEG cleaning)	\$5.75	6	\$34.50
Skin Prep Gel	\$23.10	1	\$23.10
Disposable Sponge Discs	\$20/bag	3	\$60
MetriCide - Quarts size	\$8.95	7	\$62.65
Special Blunted Needles	\$80/pkg. 100	1	\$80
Quick Insert Electrodes	\$9	2	\$18
Electro-Gel	\$12	1	\$12
shipping			\$50.00
TOTAL Spent as of May 20, 2015			\$625.25

*Data collection will resume Fall 2015 using NAI Neuroscience an Department OCED funds.

8) References

Avram, J., Rodica Batles, F., Miclea, M., & Miu, A. C. (2010). Frontal EEG activation asymmetry reflects cognitive biases in anxiety: Evidence from an emotional face Stroop task. *Applied Psychophysiology and Biofeedback*, 35, 285-292.

Borkovec, T. D., & Inz, J. (1990). The nature of worry in generalized anxiety disorder: A predominance of thought activity. *Behaviour Research and Therapy*, 28, 153-158.

- Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion, 7*, 336-353.
- Eysenck, M. W., & Derakshan, N. (2011). New perspectives in attentional control theory. *Personality and Individual Differences, 50*, 955-960.
- Hayes, S., Hirsch, C. R., & Mathews, A. (2008). Restriction of working memory capacity during worry. *Journal of Abnormal Psychology, 117*, 712-717.
- Kandel, E. R., Schwartz, J. H., Jessell, T. M., Siegelbaum, S. A., & Hudspeth, A. J. (2012). *Principles of neural science* (5th ed.). New York, NY. McGraw Hill.
- Klimesch, W., Doppelmayr, M., Russegger, H., Pachinger, T., & Schwaiger, J. (1988). Induced alpha band power changes in the human EEG and attention. *Neuroscience Letters, 244*, 73-76.
- Leigh, E., & Hirsch, C. R. (2011). Worry in imagery and verbal form: Effect on residual working memory capacity. *Behaviour Research and Therapy, 49*, 99-105.
- Meyer, T. J, Miller, M. L., Metzger, R. L., & Borkovec, T. D (1990). Development and Validation of the Penn State Worry Questionnaire. *Behaviour Research and Therapy* 28, 487-495,1990
- Miyake, A., Friedman, N. P., Rettinger, D. A., Shah, P., & Hegarty, M. (2001). How are visuospatial working memory, executive functioning, and spatial abilities related? A latent-variable analysis. *Journal of Experimental Psychology: General, 130*, 621-640.
- Moscovitch, D. A., Santesso, D. L., Miskovic, V., McCabe, R. E., Antony, M. M., & Schmidt, L. A. (2011). Frontal EEG asymmetry and symptom response to cognitive behavioral therapy in patients with social anxiety disorder. *Biological Psychology, 87*, 379-385.

- Newman, M. G., Zuellig, A. R., Kachin, K.E., Constantino, M. J., Przeorksi, A., Erickson, T., & Cashman-McGrath, L. (2002). Preliminary reliability and validity of the Generalized Anxiety Disorder Questionnaire—IV: A revised self-report diagnostic measure of Generalized Anxiety Disorder. *Behavior Therapy, 33*, 215-233.
- Owen, A. M., McMillan, K. M., Laird, A. R., & Bullmore, E. (2005). N-back working memory paradigm: A meta-analysis of normative functional neuroimaging studies. *Human Brain Mapping, 25*, 46-59.
- Pérez-Edgar, K., Kujawa, A., Nelson, S. K., Cole, C., Zapp, D. J. (2013). The relation between electroencephalogram asymmetry and attention biases to threat at baseline and under stress. *Brain and Cognition, 82*, 337-343.
- Putman, P., Verkuil, B., Arias-Garcia, E., Pantazi, I., & van Chie, C. (2014). *Cognitive, Affective, and Behavioral Neuroscience, 14*, 782-791.
- Stefanopoulou, E., Kirsch, C. R., Hayes, S., Adlam, A., & Coker, S. (2014). Are attentional control resources reduced by worry in generalized anxiety disorder?. *Journal of Abnormal Psychology, 123*, 330-335.
- Stöber, J. (1998). Worry, problem elaboration and suppression of imagery: the role of concreteness. *Behaviour Research and Therapy, 36*, 751-756.
- Stokes, C., & Hirsch, C. R. (2010). Engaging in imagery versus verbal processing of worry: Impact on negative intrusions in high worriers. *Behaviour Research and Therapy, 48*, 418-423.
- Williams, M. O., Mathews, A., & Hirsch, C. R. (2014). Verbal worry facilitates attention to threat in high-worriers. *Journal of Behavior Therapy and Experimental Psychiatry, 45*, 8-14