

Background and Significance

- Previous research has shown that visual attention tasks like the Infant Orienting With Attention (IOWA) Task are effective in identifying individual differences in attention in both adults and infants (Ross-Sheehy et al., 2015).
- Additionally, high levels of anxiety and/or stress have been found to affect visual behaviors and cognitive performance (Grillon et al., 2006).
- If performance on a visual attention task is influenced by individual differences in physiological arousal and cognitive functioning, then we might expect performance to vary as a function of stress and/or anxiety.

Methods

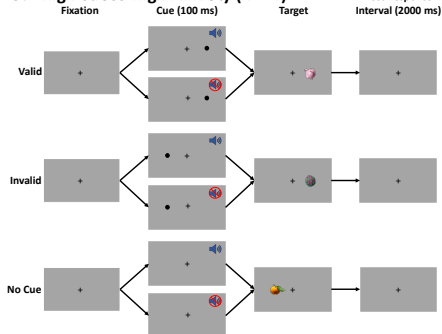
Visual Attention Task:

- Participants (55 adults; 35 females, 20 males) were tested in a modified version of the IOWA Task consisting of valid, invalid, and no cue conditions both with and without tones.
- The task was presented on an EyeLink 1000 plus eye-tracker.
- The subjects reported the location of a target image using a button-press.
- Task measures collected were pupillometry, reaction time (RT), and accuracy.

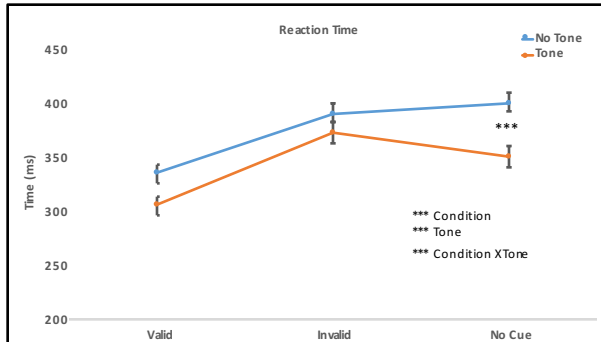
Stress/Anxiety Assessment:

- Participants completed the *Perceived Stress Scale* (Cohen, Kamarck & Mermelstein, 1983) and *Beck Anxiety Inventory* (Beck, Epstein, Brown & Steer, 1988).
- Perceived Stress Scale (PSS) Sample Questions:
 - "In the last month, how often have you been upset because of something that happened unexpectedly?"
 - "In the last month, how often have you felt that you were unable to control the important things in your life?"
- Beck Anxiety Inventory (BAI) Sample Questions:
 - "Indicate how often in the past month you have been bothered by each of the following symptoms: heart pounding/racing, unable to relax, dizzy or lightheaded, shaky/unsteady, etc."
- Scores from the BAI and PSS were used to separate the subjects into three distinct groups:

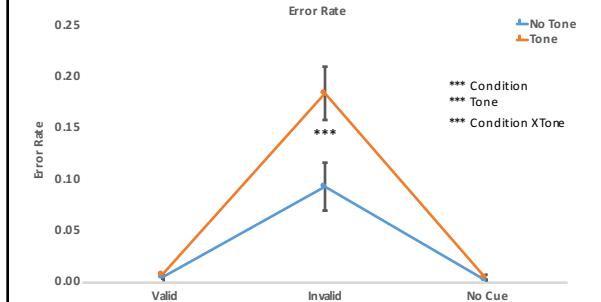
1. Low Stress (n=17)
2. High Stress Low Anxiety (n=24)
3. High Stress High Anxiety (n=14)



Reaction Time and Error Rate

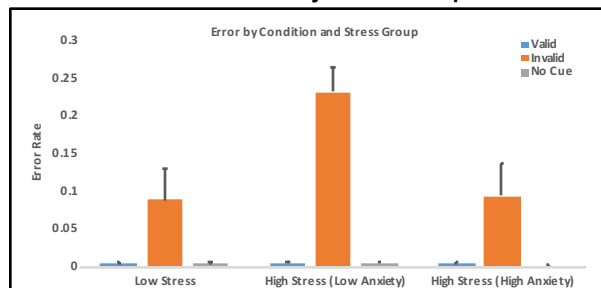


- Overall, participants were **significantly faster for the valid conditions**, $F(2,102)=169.21$, $p<.001$, and **significantly faster for tone conditions**, $F(1,51)=86.52$, $p<.001$.
- However, the effects of the tone were most pronounced for the no cue conditions, $F(2,102)=24.87$, $p<.001$.



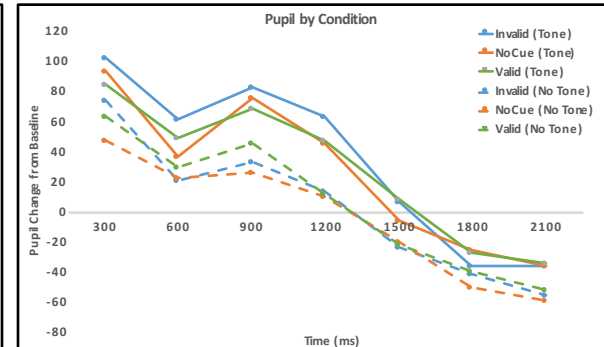
- Overall, **errors were significantly higher for the invalid conditions**, $F(2,102)=31.73$, $p<.001$, and **significantly higher for tone conditions**, $F(1,51)=33.57$, $p<.001$.
- However, the negative effect of the tone was especially pronounced in the invalid conditions, $F(2,102)=33.74$, $p<.001$.

Error Rate by Stress Group

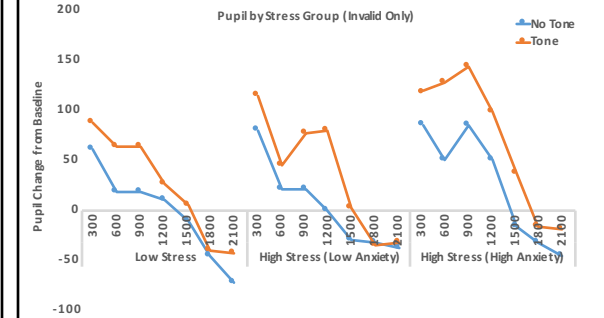


- **The High Stress Low Anxiety group made significantly more errors** than both High Stress High Anxiety and Low Stress groups, $F(2,51)=5.13$, $p=.001$ and this is especially apparent in the Invalid Condition, $F(4,102)=3.29$, $p=.014$.

Pupil Effects



- Overall, **pupil change was significantly greater for tone conditions**, $F(1,52)=28.21$, $p<.001$, but this effect decreased over the 2000ms test interval, $F(6,312)=3.48$, $p=.002$.



- Interestingly, pupil revealed **clear effects of stress group, particularly for the invalid cue condition**, $F(24,624)=1.54$, $p=.049$.
- Both of the High Stress groups showed **prolonged effects of the tone**, and the High Stress **High Anxiety group showed the largest change from baseline**.

Discussion

- Overall, results replicate previous work and demonstrate **robust effects of both spatial and auditory cues on reaction time, error rate, and pupil change**: Participants were slowest and made the most errors in conditions that required *effortful control of attention* (invalid cues), and this increased mental effort was also apparent in pupillometry.
- However, results also reveal that **high levels of stress negatively impacted attentional performance**, particularly for error rates.
- Importantly, however, **the negative effects of stress may be overcome in individuals with relatively high anxiety**. We interpret this finding as **evidence of hypervigilance**, including a heightened state of arousal, and increased allocation of attentional resources to the task.
- Future work will attempt to further isolate the effects of hypervigilance by manipulating stress and anxiety, task difficulty, and the alerting properties of the tone.