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Introduction

Background

- Post-Traumatic Stress Disorder (PTSD) is thought to involve unusually strong associative memories between the intense fear felt during a traumatic experience and other environmental cues present at the time of the trauma. Our study uses an animal model to investigate social contact, one of the factors that can impact fear responses, to learn more about possible risk factors or interventions that may be relevant to humans who experience PTSD.
- Multiple studies have demonstrated a benefit of social support on stress in humans following a traumatic event. Recent research in rodents has also shown that memories of fearful experiences, expressed as freezing and passive avoidance of fear-related cues, are reduced if subjects are exposed to fear-inducing stimuli in the company of conspecifics (Lee & Noh, 2016). However, humans and animals also demonstrate a high capacity for observational learning, which could result in fear transmission from one to another. For example, fear of a particular stimulus can be communicated between rodents that have both been exposed to the same aversive event (Kim, Kim, Covey, & Kim, 2010). These studies demonstrate social transmission of fear between conspecifics.

Previous Approach and Initial Results

- To elucidate the conditions under which social buffering or facilitation of fear may occur, we tested whether the degree of fear expressed by a social companion impacted the level of fear demonstrated by young male chicks. We initially predicted that the presence of a companion would reduce the fear demonstrated by a chick in response to an audiovisual predator stimulus, known as social buffering of fear.
- Initial results actually showed the opposite effect. Chicks that experienced predator stimuli in the presence of another chick remained immobile longer than those who experienced the predator alone. It seemed as though chicks were mirroring the fear expressed by their companion.

Current study

- To more thoroughly investigate whether social transmission of fear is occurring between chicks in this study, we used controlled video stimuli and experimental manipulation of the level of fear expressed by companion. (See Figure 1)

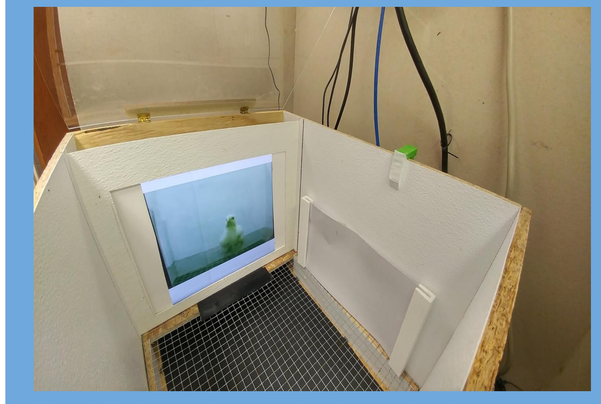

Figure 1. Testing box with companion video used in this study

Methods

Subjects and Housing

- 48 male Cornish chicks were hatched at Hoovers Hatchery (Rudd, Iowa) and immediately transported to Augustana College (Rock Island, Illinois).
- Upon arrival (PHD1), chicks were weighed and housed in groups of 4-5 per home cage. Each home cage contained a communal water and food source. The colony room was regulated between 29-32°C and was on a 12 hour light/dark cycle.
- Chicks had 24 hour access to food and water until PHD6, after which point food was removed at 8p each evening and returned after habituation or testing procedures the following day.

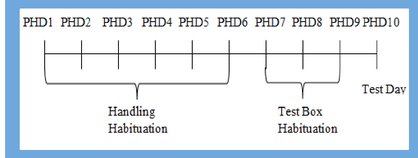

Figure 2. Experimental timeline

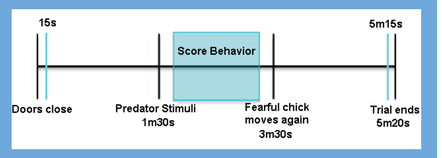

Figure 3. Timing of test day procedures

Habituation

- Chicks were weighed daily by experiments to habituate them to handling. On PHD7-9 chicks were habituated to the testing apparatus. (See Figure 2)
- During text box habituation, the chicks were weighed and transported in pairs to the testing apparatus. They were placed into the test box for 5 minutes and 20 seconds. On PHD7, a silent video of an empty chamber played. On PHD 8&9, a silent video of the non-fearful companion chick played.
- None of the chicks were exposed to the predator stimulus during habituation.
- Chicks were then returned to their home-cages and given access to food.

Test Day

- Chicks were again weighed, transported in pairs, and placed in the testing apparatus for 5 minutes 20 seconds. (See Figure 3)
- Two independent variables were manipulated: the presence v. absence of audiovisual predator stimuli and the presence of a fearful or non-fearful companion video. This created four conditions (See Figure 4)
- Behavior was video recorded for later analysis using Smart 3.0 (Panlab) software.

Stimuli

- Videos of the fearful or non-fearful chick companion were playing as chicks were placed into the chamber. The fearful companion video depicted a silent chick that walked around the chamber. At 1m30s, the chick began demonstrating clear freezing behavior (crouched position with the absences of movement) for two minutes. At 3m30s, the chick in the video resumed walking until the end of the trial. The non-fearful companion video depicted a silent chick that walked around the chamber (demonstrating no freezing) for the duration of the trial.
- Predator exposure (timed to coincide with the onset of fear behavior in the fearful companion video, or at the 1m30s timepoint of the non-fearful companion video) consisted of a predator shaped shadow (see Figure 5) passed overhead paired with a 2s owl screech. Chicks in the no predator group were just exposed their assigned video with no additional stimuli.

Experimental Conditions	
FC (n=23)	Fearful Companion, No Predator
FP (n=24)	Fearful Companion, Predator
NC (n=22)	Non-Fearful Companion, No Predator
NP (n=24)	Non-Fearful Companion, Predator

Figure 4. Experimental conditions

Figure 5. Predator-shaped shadow

Research Question & Hypotheses

Prediction #1: We predict that chicks exposed to the predator cues will demonstrate more fear behavior than those not exposed to predator cues.

Main Research Question:
Will chicks mirror levels of fear demonstrated by their companions?

Prediction #2: We predict that chicks in the predator condition will demonstrate the most fear when in the presence of a fearful companion video and less fear when in the presence of a non-fearful companion video.

Results

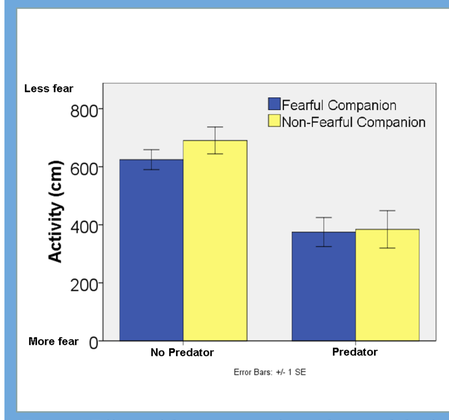

Figure 6. Effects of the presence of a predator and the fear level of a video companion on fear behavior.

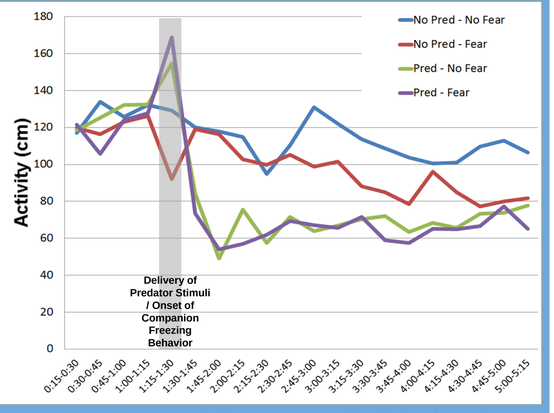

Figure 7. Line graph depicting activity level of each condition over time (15s bins)

- Results of a 2x2 Factorial ANOVA indicate that there was a significant main effect of the predator stimulus, $F(1, 89) = 28.11$, $p<.0001$. As predicted, chicks in the predator condition displayed more fear, demonstrated by a reduction in activity. (See Figure 6)
- Mean levels of fear in each condition were modulated in the predicted directions by levels of companion fear (see Figure 7), however, there was no significant effect of the fear level in the companion videos, nor a significant interaction.
- Predator + Fearful companion (M=374); Predator + Non-fearful companion (M=384); No predator + Fearful companion (M=624); No predator + Non-fearful companion (M=691)

Discussion

- Although in the direction of our prediction, the video stimuli did not significantly impact chicks' fear behavior in response to predator stimuli.
- The social transmission or mitigation of fear may be stronger through an actual conspecific compared to video stimuli. Additionally, social bonding among chicks in each homecage could have occurred outside of being tested. This could have created an amount of baseline buffer to the stimuli during testing.
- Future directions for this experiment will include optimizing salience of video stimuli to better depict a natural environment, and maximizing the levels of "fear" and "non-fear" expressed by video chicks in each condition.

References

Kim E.J., Kim E.S., Covey E., Kim J.J. (2010) Social transmission of fear in rats: the role of 22-kHz ultrasonic distress vocalization. *PLoS ONE, 5*(12): e15077.

Lee, H. & Noh, J. (2016). Pair exposure with conspecific during fear conditioning induces the link between freezing and passive avoidance behaviors in rats. *Neuroscience Research, 108*, 40-45.