# UNIVERSITY of **TULSA**

## THE INFLUENCE OF BEHAVIORAL ACTIVATION AND BEHAVIORAL INHIBITION ON AFFECTIVE MODULATION OF NOCICEPTION Carl P. Lattimore, Amy E. Williams, Klanci M. McCabe, & Jamie L. Rhudy Department of Psychology, The University of Tulsa, 600 South College Ave, Tulsa, OK 74104

### Introduction

Appetitive and defensive activation by picture-viewing modulates nociceptive reactions to noxious stimulation. Unpleasant pictures elicit negative emotions and enhance nociception, whereas pleasant pictures elicit positive emotions and inhibit nociception. Behavioral activation involves tendencies toward positive experience and feeling, whereas behavioral inhibition involves tendencies toward negative experience and punishment. Thus, individual sensitivity to behavioral inhibition or behavioral activation may moderate the emotional modulation of nociception. Indeed, prior research suggests behavioral inhibition and behavioral activation moderate emotional modulation of the startle reflex. In the present study, 53 participants completed the BIS/BAS scales, and then viewed pleasant, neutral, and unpleasant pictures during which noxious electric stimulations were administered to their sural nerve.

## Objective

• To determine if individual differences in behavioral inhibition and behavioral activation moderate emotional modulation of nociception

## **Participants**

- 53 Healthy Students
- Characteristics: 15 Men, 38 Women; White non-Hispanic (76%), single (87%), and unemployed (60%), average age = 22 yrs (SD=5.64)
- Exclusion Criteria:
  - < 18 years of age</li>
  - Current acute illness
  - Cardiovascular, neurological, and/or circulatory problems
  - Recent use of analgesic, antidepressant, anxiolytic, or anti-hypertensive medication
  - Recent psychological trauma
  - Specific phobia of snakes or spiders
  - Raynaud's disease



**Picture-Viewing: Emotion Induction** The International Affective Picture System (IAPS; Center for the Study of Emotion and Attention, 1999)



Unpleasant

(Attack)







Pleasant (Erotic)

- ■24 pictures presented in pseudorandom order across participants
- 8 pictures per valence
- Pictures presented for 6 s
- Noxious stimulations to sural nerve Intensity = 120% NFR threshold
- Delivered 3-5 s following picture onset during 50% of pictures (balanced across valence) and 6 inter-picture intervals Pain ratings made following each stimulation

## **Emotion-Induction: Manipulation Checks**



•Self-Assessment Manikin (Bradley & Lang, 1994) Valence (Pleasure) Ratings: 1 (unhappy) to 9 (happy) •Arousal ratings: 1 (calm) to 9 (excited)

#### **Measurement of Subjective Pain**

•NFR recording electrodes - left biceps femoris muscle

Stimulating electrodes - over left sural nerve





Pain Ratings made after each stimulation



- •NFR is a spinally-mediated protective withdrawal reflex elicited by Aδ fiber activation, and NFR magnitude correlates with pain ratings (Sandrini et al, 2005).
- •**NFR magnitude** = mean of biceps femoris EMG in 90-150 ms post-stimulus interval minus mean of 60 ms pre-stimulus interval.

#### **Heart Rate Acceleration**



- •Electrocardiogram (ECG) recorded from left and right forearms
- •ECG was converted offline to heart rate in beats per minute from interbeat interval •HR Acceleration defined as the maximum increase in the 1-5 s post-stimulation
- window

#### **Skin Conductance Response**



Measure of sympathetic arousal

- •Sensors attached to palmar surface of index and middle fingers
- •SCR defined as maximum increase in 1-4 s post-stimulation window

#### **The BIS/BAS Scales**

- Behavioral inhibition and behavioral activation were assessed using the BIS/BAS scales (Carver and White, 1994)
- Normative sample data: N=732 (374 women and 358 men), BIS M=19.99 SD=3.79, BAS Reward Responsiveness M=17.59 SD=2.14, BAS Drive *M*=12.05 SD=2.36, BAS Fun Seeking *M*=12.43 SD=2.26
- Present sample data: N=53 (38 women and 15 men), BIS M=21.13 SD=3.04, BAS Reward Responsiveness M=17.66 SD=1.49, BAS Drive *M*=10.85 *SD*=2.15, BAS Fun Seeking *M*=12.17 *SD*=2.15 • For the present study, BAS subscales were averaged into a single
- BAS scale



#### **Data Analysis**

- Nociceptive reactions (pain ratings, NFR, HR acceleration, SCR) were converted to z-scores and averaged by picture valence
- •3 (Picture Valence) x 4 (Nociceptive Reactions) repeated measures ANOVAs were conducted. BIS or BAS was entered as a covariate to test Covariate x Picture Valence interaction
- •For illustrative purposes, Covariate x Picture Valence interactions were graphed by creating 3 groups from BIS or BAS tertiles
- •BIS and BAS did not moderate subjective reactions to pictures, *F*s<1, *p*s>.38

#### **Results: Nociceptive Reactions and BIS**



- There was a significant BIS x Picture Valence interaction. F(2,50) = 3.39, p = 0.04
- Persons with low scores on the BIS scale did not show displeasureinduced facilitation

#### **Results: Nociceptive Reactions and BAS**



- The BAS x Picture Valence interaction was not significant, F(2,50) = 0.49, p = 0.61
- Individual sensitivity on BAS did not moderate the relationship between picture ratings and nociceptive reactions

#### Conclusions

Contrary to expectations, sensitivity to BIS and BAS did not moderate subjective emotional reactions (valence, arousal) to picture viewing. Nonetheless, individual differences in behavioral inhibition moderated affective modulation of nociceptive reactions. Participants with low BIS scores did not show nociceptive facilitation following defensive activation (negative emotion). Sensitivity to BAS did not moderate affective modulation of nociception. The data suggests that individual differences in motivational disposition may play a role in affective modulation of nociception.