

# INTRODUCTION

Repeated pairing an unconditioned aversive stimulus (UCS) with a previously neutral stimulus (conditioned stimulus, CS) imbues the CS with the ability to elicit negative emotion (conditioned fear). Studies have shown that conditioned fear inhibits pain responses (eg, Flor et al., 2002; Ross & Randich, 1985). However, it is unknown whether the conditioned fear and pain relationship can be moderated. For example, preparedness theory suggests that some stimuli are more readily associated with an UCS and lead to more rapid development of a conditioned response. Specifically, pictures depicting facial expressions of fear are readily associated with a shock US and lead to greater conditioned fear responses than happy expressions (eg, Ohman & Dimberg, 1978).

# OBJECTIVES

- To examine the influence of conditioned fear on pain threshold
- To determine whether preparedness will affect the conditioned fear and pain relationship

# PARTICIPANTS

- **50 healthy undergraduate students**
  - 20 male and 30 female
- **Participants were excluded for:**
  - < 18 years of age
  - Current acute illness
  - Cardiovascular, neurological, and/or circulatory problems
  - Recent use of analgesic, antidepressant, anxiolytic, or antihypertensive medication
  - Recent psychological trauma
  - Problems healing
  - Raynaud's disease
  - Medical problems exacerbated by stress

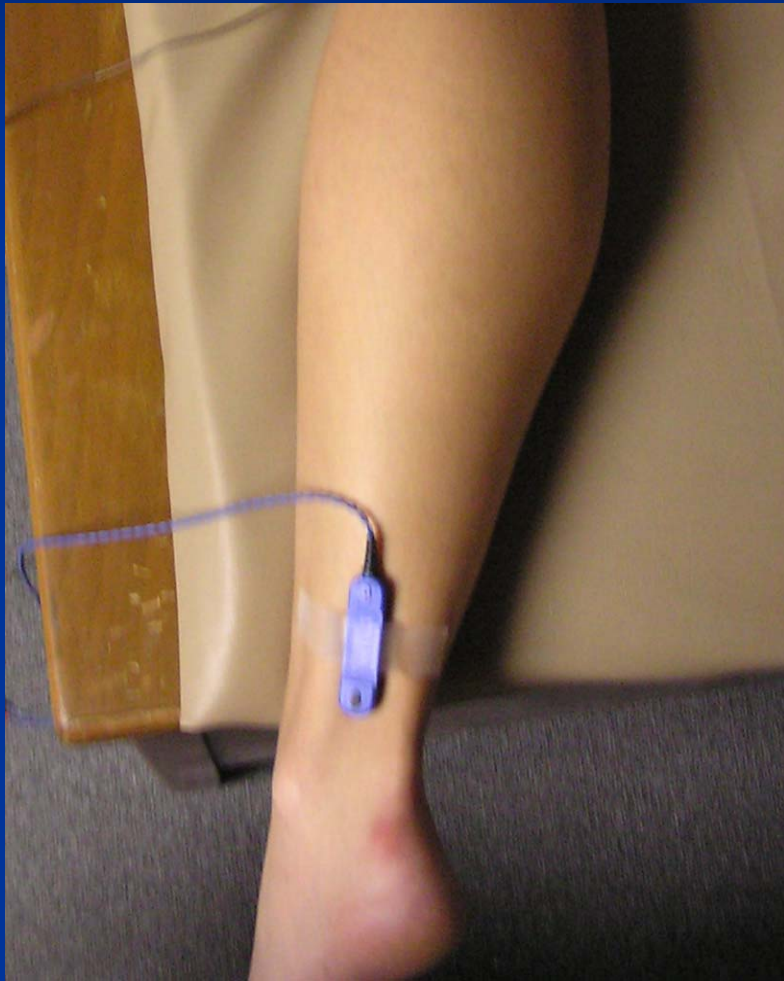
# CONDITIONED STIMULI (CS)



Montreal Set of Facial Displays of Emotion (Beaupre, Cheung, & Hess, 2000)

- Half of the participants had the fear face as the CS+ and the happy face as the CS- (pictures shown are exemplars of those used)
- Half of the participants had the happy face as the CS+ and the fear face as the CS-
- Pictures were presented for 10-s with a random inter-trial interval (ITI) of 35 to 75-s during habituation and extinction and 35 to 50-s during acquisition
- Pictures were presented 3 times each during habituation and 4 times during acquisition and extinction

# UNCONDITIONED STIMULUS (UCS)



- Electric stimulation (5mA) delivered to left retromalleolar pathway of the sural nerve
  - Average rating of 53 on 0 to 100 scale where 50=painful
- Electric stimulations were delivered at the offset of the CS+ during the acquisition phase (total of 4 stimulations)
- Each stimulation was 150 ms train of rectangular wave pulses of 1 msec duration and 3 msec interstimulus interval

# RADIANT HEAT PAIN THRESHOLDS

- Computer-controlled, bottom-illuminated, radiant heat device
- Finger placed in groove
- Instructions: “Remove finger as soon as heat becomes painful”
- Pain threshold = finger withdrawal latency (in seconds)
- Index, middle, and ring fingers were rotated to minimize sensitization<sup>1</sup>



<sup>1</sup>Rhudy & Meagher, 2003, *Pain*

# PROCEDURE

Baseline Pain Tests

## Habituation

Present conditioned stimuli to allow habituation

Three presentations each

- Happy face
- Fear face

Pain tested during two of each picture.

## Acquisition

Pair conditioned stimulus with aversive, fear-provoking, unconditioned stimulus

Four presentations each

- Happy face
- Fear face

Half of participants receive shock (UCS) during fear face and half during happy face.

Pain tested during one interval.

## Extinction

Present conditioned stimulus alone to examine conditioned response

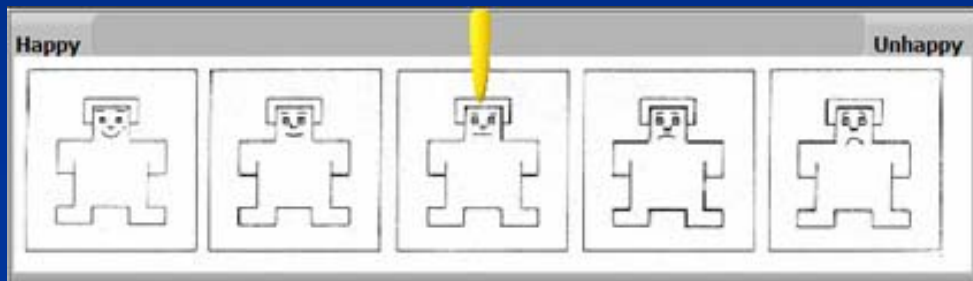
Four presentations each without UCS

- Happy face
- Fear face

Pain tested during two of each picture.

Pain tested during one interval.

# MANIPULATION CHECKS FOR CONDITIONING



## Valence Ratings

- Self-Assessment Manikin (SAM)  
1 (unhappy) to 9 (happy)
- Administered following each picture during habituation, and following the experiment
- Used to assess evaluative conditioning

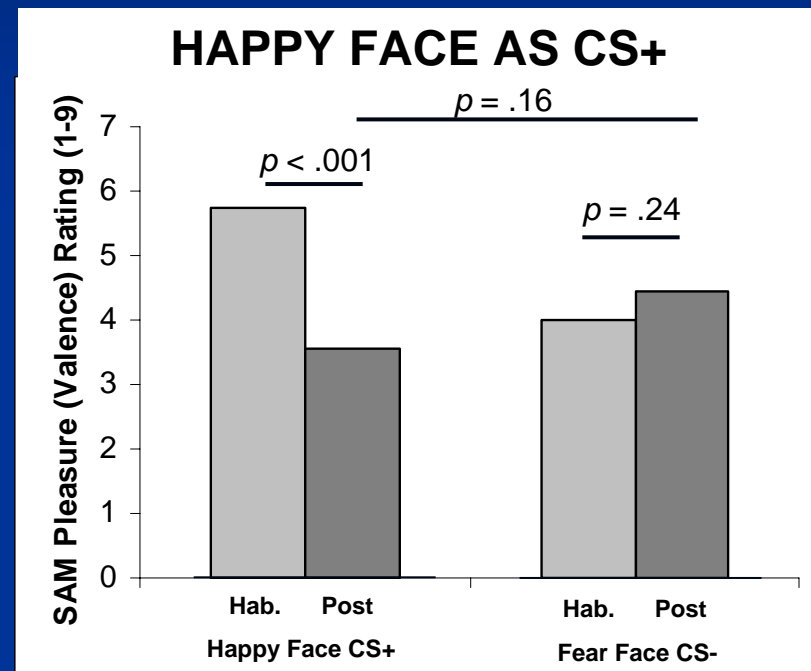
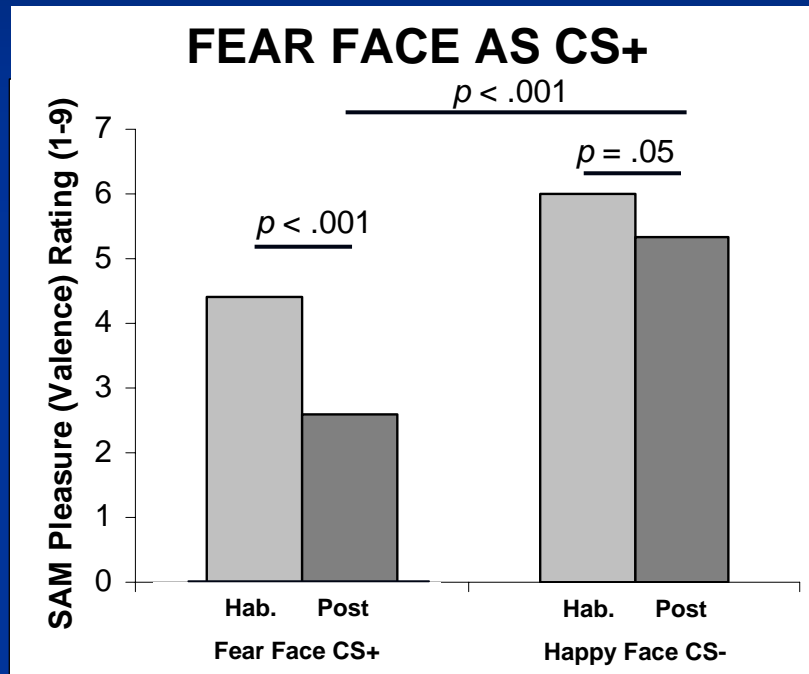
## Skin Conductance

- Measure of sympathetic arousal (sweating)
- Sensors attached to the palmar surface of the right hand fingers
- Used to assess conditioned sympathetic arousal



# RESULTS: MANIPULATION CHECKS (Acquisition)

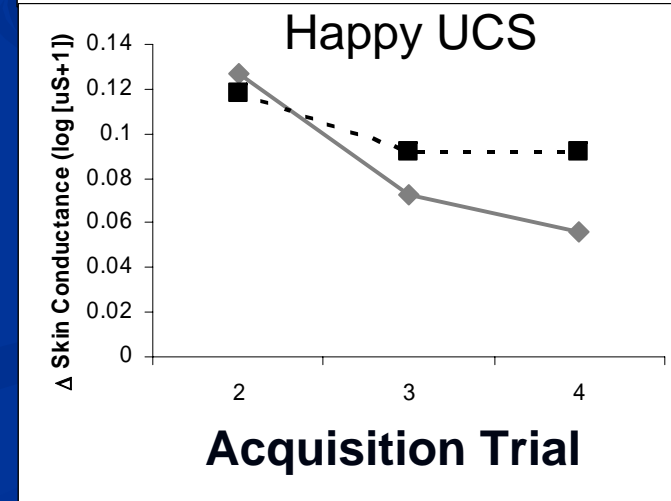
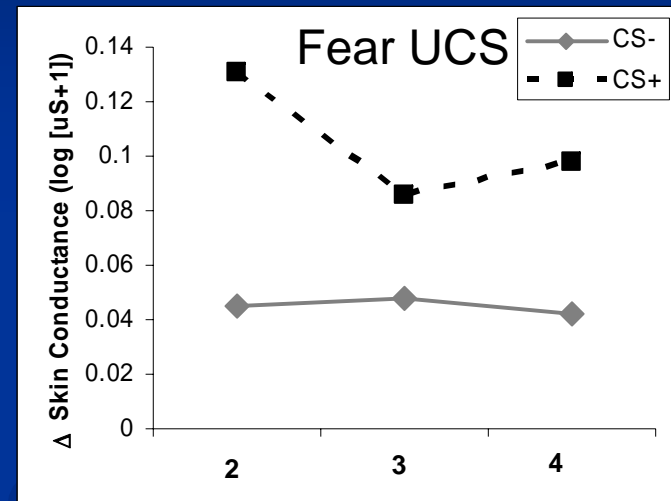
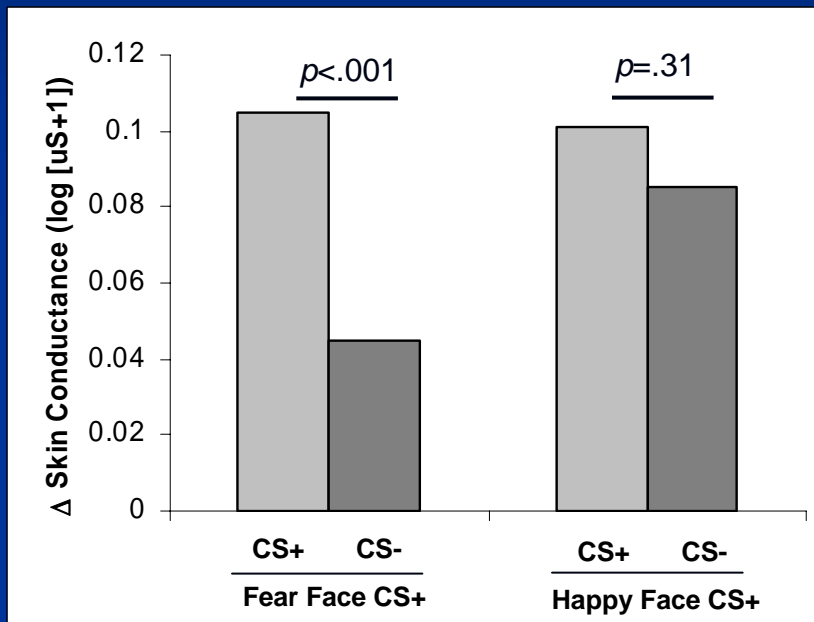
## Preparedness influenced evaluative conditioning



- CS+ was rated more unpleasant after fear conditioning regardless of the face that served as the CS+
- CS- ratings were not generally affected by conditioning, although there was a slight decrease in the group with the fear face CS+
- Differential evaluative conditioning was not present for the group with the happy face CS+

# RESULTS: MANIPULATION CHECKS (Acquisition)

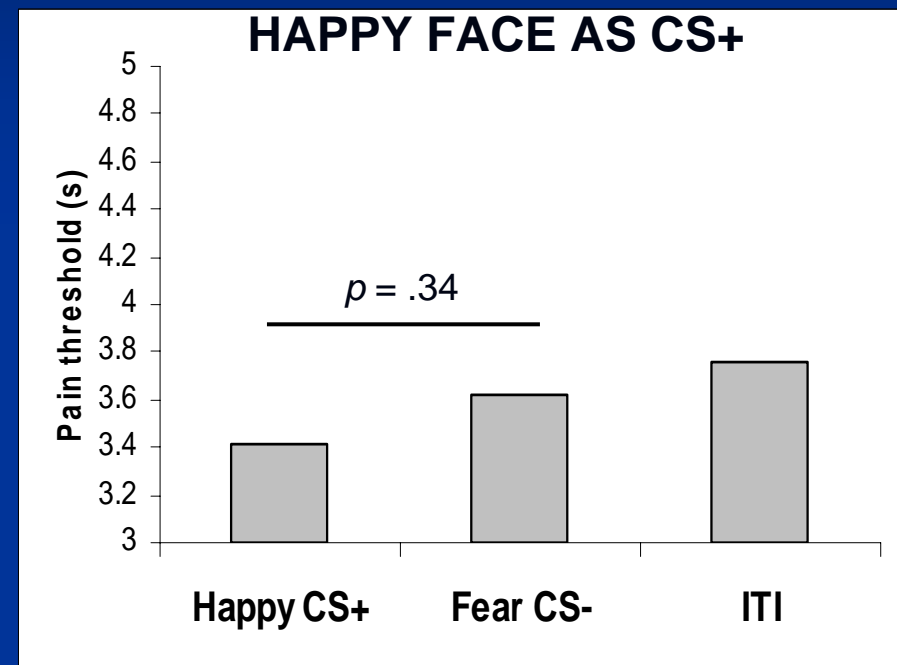
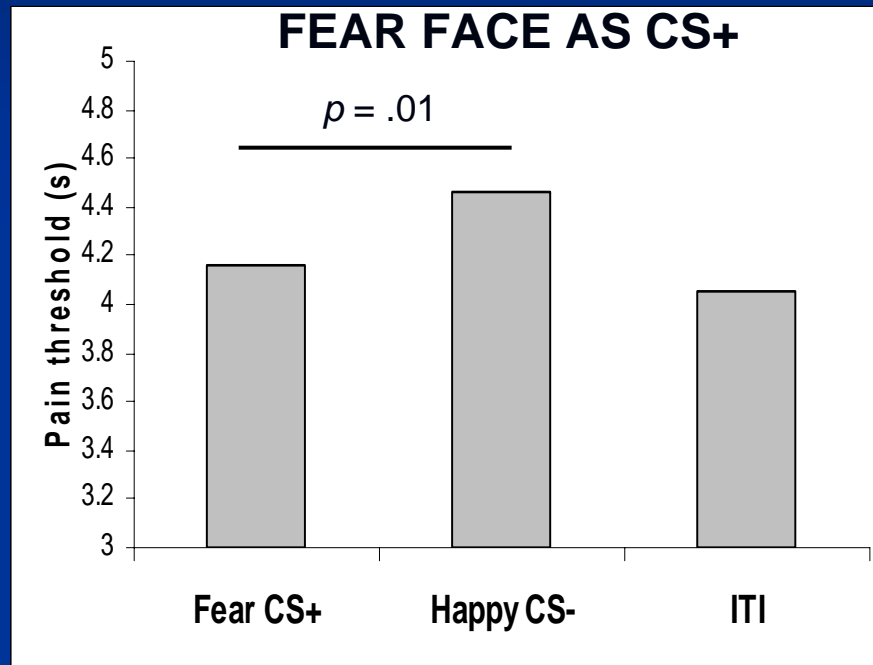
## Preparedness influenced conditioned SCR



- After repeated CS+/UCS pairings, the CS+ elicited greater skin conductance than the CS- for people shocked during the fear face, but not those shocked during the happy face

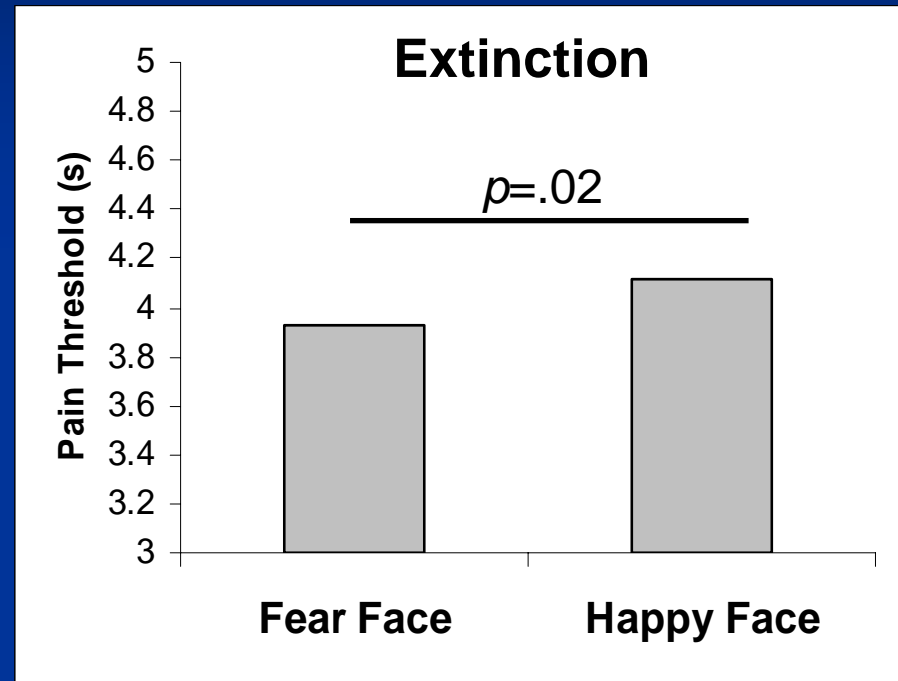
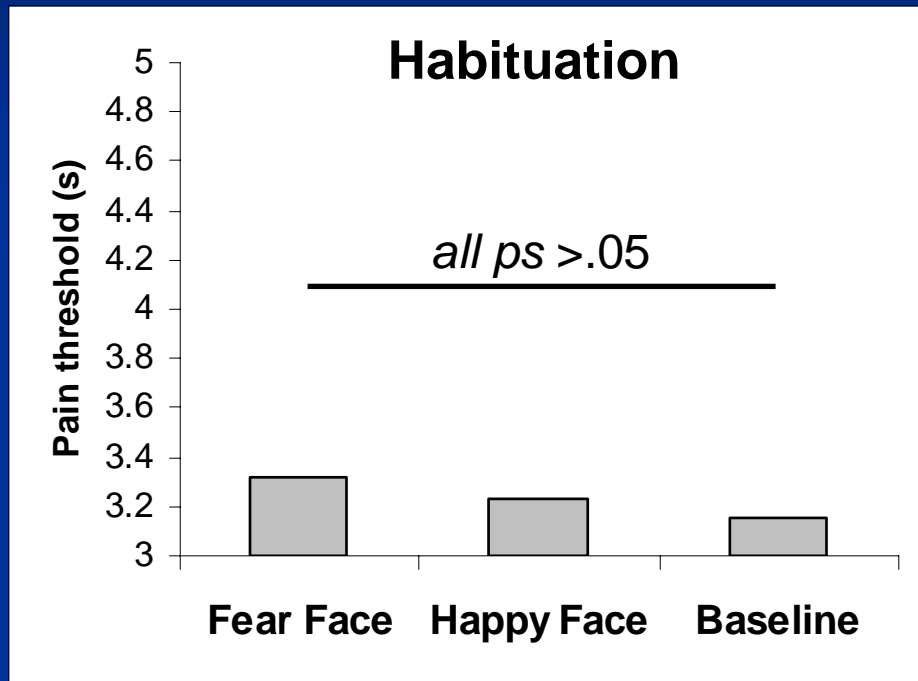
# RESULTS: PAIN THRESHOLD (Extinction)

## Preparedness influenced conditioned pain modulation



- Conditioned fear led to lower pain thresholds during the CS+ compared to the CS-, but only when the fear expression was the CS+ (left graph)
- Conditioned fear had no significant effect on pain when the happy expression was the CS+ (right graph)

# RESULTS: FACES & PAIN THRESHOLD (Habituation & Extinction)



Ignoring the CS+ / CS- distinction, participants generally had lower pain thresholds during the fear face compared to the happy face during extinction, an effect that was not present during habituation.

# CONCLUSIONS

- Preparedness influenced the acquisition of conditioned arousal and evaluative conditioning
  - Only participants with the fear expression CS+ demonstrated differential conditioned arousal and differential evaluative conditioning
- Using fear vs. happy expressions as the CS+ differentially influenced pain thresholds
  - People for whom the fear expression was the CS+ evidenced lower pain thresholds (hyperalgesia) during the CS+ relative to the CS-
  - People for whom the happy expression was the CS+ did not show significant modulation of pain thresholds

# CONCLUSIONS

- Preparedness may alter the impact of conditioned fear on pain threshold measures
- Pain thresholds were lower during fear vs. happy expressions during extinction, although during habituation there were no differences