

Pain-Evoked Autonomic Reactions: Assessing the Influence of Emotion and Habituation

Ellen L. Terry, B.A., Emily J. Bartley, M.S., Mary C. Chandler, B.A., Kara L. Kerr, & Jamie L. Rhudy, Ph.D.
 Department of Psychology, The University of Tulsa, 800 South Tucker Drive, Tulsa, OK 74104

Introduction

We have argued that pain-evoked autonomic (ANS) responses (e.g., heart rate [HR], skin conductance response [SCR]) provide important and unique information about pain processing and pain regulation. Consistent with this, our laboratory has shown that pain-evoked HR and SCR are modulated by emotion in a pattern similar to pain ratings. In those studies, participants were exposed to pictures that varied in emotional valence (unpleasant, neutral, pleasant) during which noxious electrocutaneous stimuli were delivered. When pain responses were averaged by picture valence, results suggest responses were augmented by unpleasant pictures and inhibited by pleasant pictures. However, it is important to demonstrate that the interpretation of pain-evoked ANS responses is not confounded by response habituation.

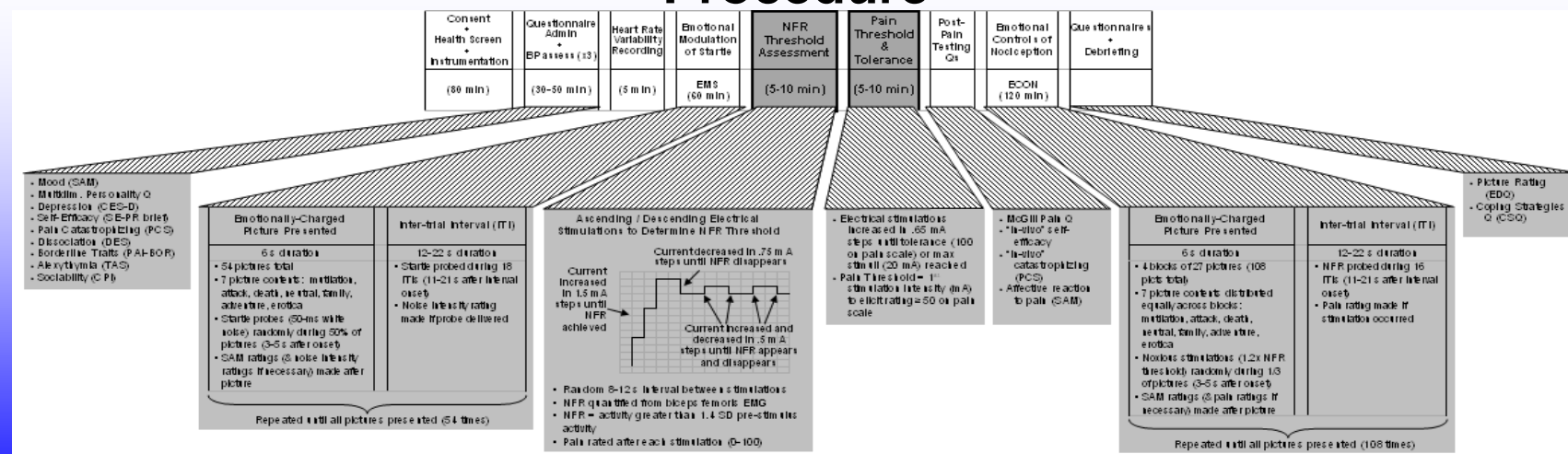
Objective

The present study was designed to demonstrate that the interpretation of pain-evoked ANS responses is not confounded by response habituation.

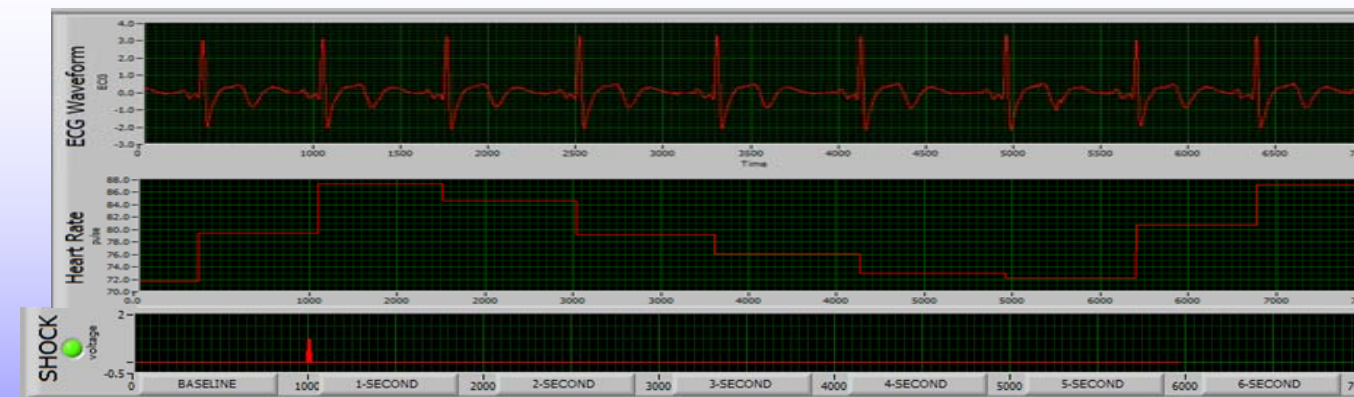
Participants

114 Healthy Participants
 Characteristics: 48 Men, 66 Women; White non-Hispanic (77%), single (58%), employed (76%), average yrs education = 15 yrs ($SD=2.52$), average age = 34 yrs ($SD=14.91$)
Exclusion Criteria:
 < 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
 Specific phobia of snakes or spiders (picture-viewing)
 Any chronic pain
 Raynaud's disease

Procedure



Pain-Evoked Heart Rate (HR) 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 1-6 s post-stimulation window

Picture-Viewing: Emotion Induction

The International Affective Picture System (IAPS; Center for the Study of Emotion and Attention, 2006)



108 pictures presented in pseudorandom order
 4 blocks of 27 pictures
 36 pictures per valence (9 per block)
 Pictures presented for 6 s (12-22 s ITI)

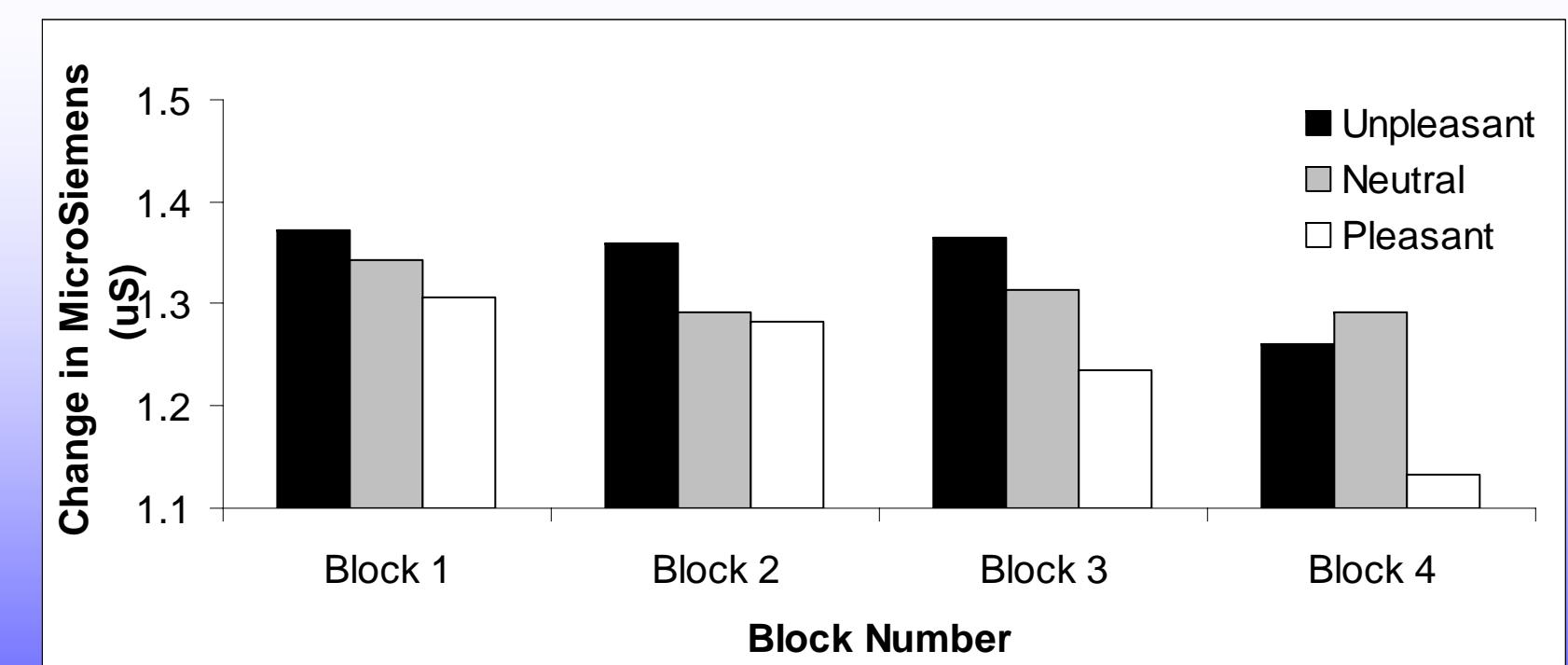
Noxious stimulations to sural nerve
 Intensity = 1.2x NFR threshold
 Delivered 3-5 s following picture onset during 1/3 of pictures (balanced across valence and block) and 16 inter-picture intervals

Data Analysis

SCR and HR were averaged by Picture Valence and Picture Block, then analyzed using a 3 (Picture Valence) x 4 (Picture Block) repeated measures ANOVA

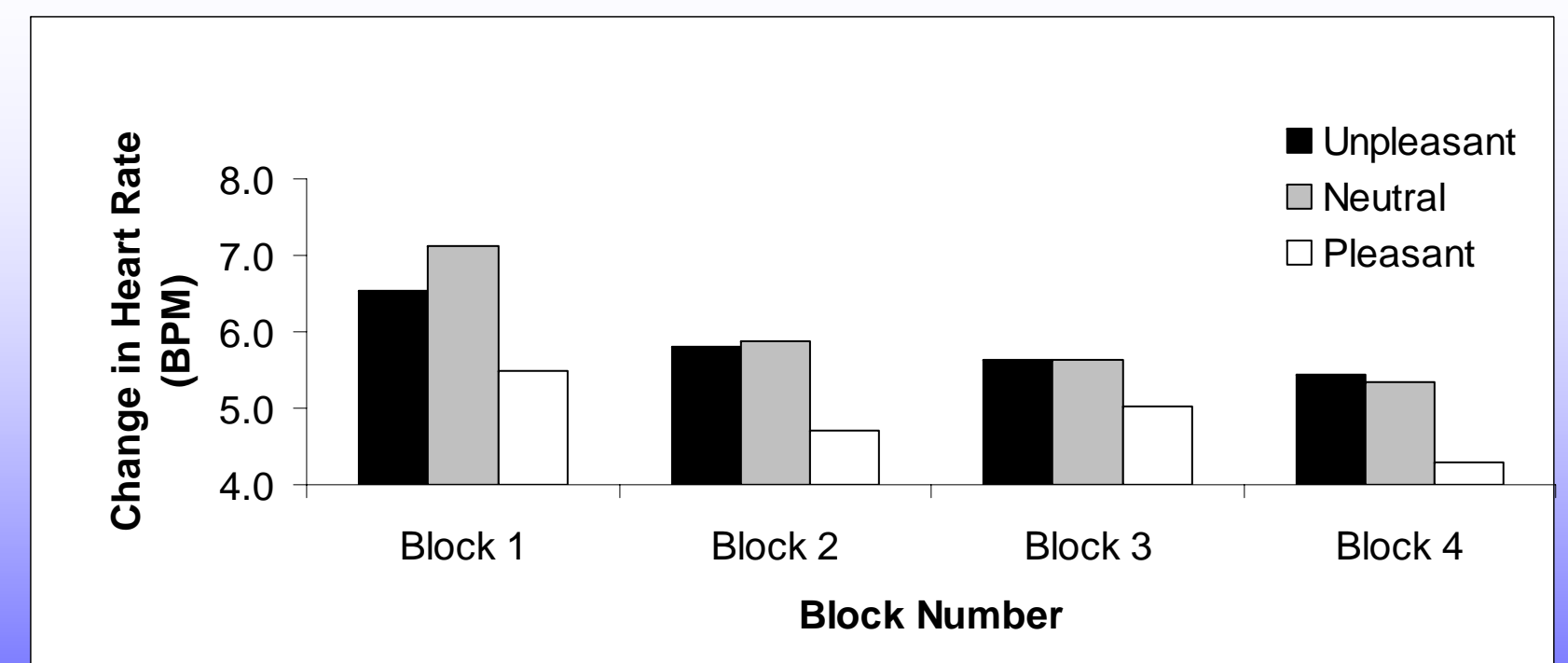
- Multivariate statistics (Wilk's Lambda) were interpreted to overcome sphericity problems
- Analyses were conducted separately for HR and SCR
- Linear and quadratic trends were examined as follow-up tests for Picture Valence and Bonferroni mean comparisons were used to compare means of the main effect of Picture Block

Results: Pain-Evoked Skin Conductance Response



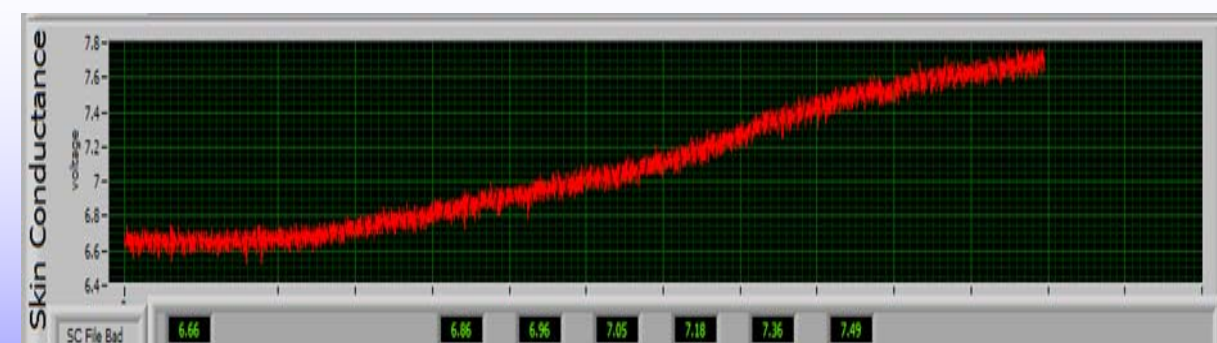
- Pain-evoked SCR was modulated by emotion: pleasant pictures inhibited SCR relative to unpleasant pictures
- SCR did not habituate across picture blocks and habituation did not influence emotional modulation of SCR

Results: Pain-Evoked Heart Rate Response



- Pain-evoked HR was modulated by emotion: pleasant pictures inhibited HR relative to unpleasant pictures
- HR habituated across picture blocks, but habituation did not influence emotional modulation

Pain-Evoked Skin Conductance Response (SCR)



- Physiological measure of sympathetic arousal
- Sensors attached to palmar surface of index and middle fingers
- SCR defined as maximum increase in 1-4 s post-stimulus window

Conclusions

- When pain responses were averaged by picture valence, results suggest responses were augmented by unpleasant pictures and inhibited by pleasant pictures
- HR habituated across picture blocks, but SCR did not habituate
- Both HR and SCR were modulated by picture valence, suggesting emotion modulates pain-evoked ANS responses, but the effect of picture valence was not moderated by habituation.
- In the present paradigm, response habituation does not appear to confound the interpretation of pain-evoked ANS responses