

AFFECTIVE MODULATION OF AUTONOMIC RESPONSES TO NOXIOUS ELECTRIC STIMULATION: VALENCE AND AROUSAL CONTRIBUTE

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INTRODUCTION

In accordance with the motivational priming theory (MPT), recent studies have shown that affective valence modulates nociceptive-specific reactions (nociceptive flexion reflex, pain report) to noxious sural nerve stimulation. Affective valence has also been shown to modulate autonomic responses (skin conductance, short latency heart rate acceleration) to noxious stimuli. Specifically, unpleasant pictures enhance autonomic responses and pleasant pictures inhibit them. MPT suggests that affective intensity (arousal) should also contribute to the modulation of reactions to noxious stimulation, with more intense emotions leading to greater modulation. However, this effect requires demonstration.

The present study examined the independent effects of valence and arousal on autonomic responses to noxious stimuli. IAPS pictures were chosen to independently manipulate affective:

- **Valence** - unpleasant (loss, attack), neutral (household objects, mushrooms), pleasant (food, erotica) and
- **Arousal** - low (neutral), moderate (loss, food), high (attack, erotica)

It was hypothesized that unpleasant pictures that were high in arousal (attack) would enhance heart rate and skin conductance responses, whereas pleasant pictures that were high in arousal (erotica) would inhibit them. Moderately arousing pictures were expected to show little if any modulation.

NOXIOUS ELECTRIC STIMULATION

- Stimulating electrodes were attached to the left ankle over the sural nerve.
- Stimulations were 5 pulses of 1 ms duration at 250 Hz
- Stimulus intensity during picture-viewing was 1.2 x nociceptive flexion reflex threshold
- Delivered randomly during and in between pictures (balanced across picture content)



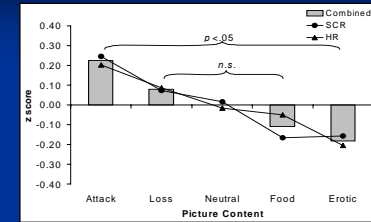
AUTONOMIC RESPONSES: Skin Conductance



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

RESULTS: Autonomic Responses

Valence and arousal contributed to modulation



- Effect of picture content was significant $F=2.77, p=.036, \eta^2=.17$
- Linear trend explained 48% of the variance ($p=.003$)

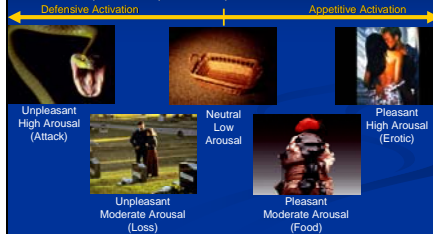
OBJECTIVES

- To examine the independent effects of valence and arousal on autonomic reactions (skin conductance and short-latency heart rate acceleration) to noxious stimuli
- To replicate previous findings suggesting MPT extends to modulation of autonomic reactions

EMOTION-INDUCTION: Picture Viewing

(Center for the Study of Emotion and Attention, 1999)

60 pictures, 12 per content, presented for 6 s or 500 ms



DATA ANALYSES

- Valence and Arousal Analyses: individual 1-way (Picture Content) ANOVAs
- Skin Conductance and Heart Rate Analysis: simultaneously analyzed using 2 (Reaction Type) x 5 (Picture Content) ANOVA
- Greenhouse-Geisser corrections were used to overcome sphericity problems
- *a priori* comparisons made using Fisher's LSD tests
- Partial eta-squared (η^2) reported as a measure of effect size

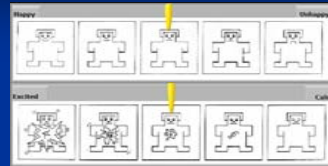
CONCLUSIONS

- Pictures effectively manipulated affective valence and arousal
- Affective valence and arousal independently contributed to the modulation of autonomic responses to noxious stimulation
 - Pleasant pictures generally led to inhibition of responses, whereas unpleasant pictures generally led to enhancement of responses
 - The most arousing pictures led to the greatest modulation
- Emotion has a powerful coordinating effect on autonomic responses to noxious stimulation – explaining 48% of their combined variance

PARTICIPANTS

- 16 healthy students
 - Characteristics: Female (50%), White non-Hispanic (79%), single (93%), employed (50%) with an average age of 23 yrs ($SD=7.54$)
- 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
 - Problems healing
 - Raynaud's disease
 - Medical problems exacerbated by stress
- 3 persons excluded for equipment problems (1 no shock felt, 2 recording errors)

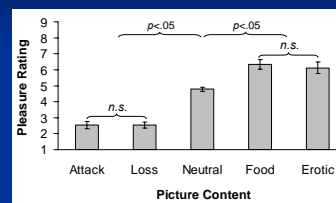
EMOTION-INDUCTION: Manipulation Checks



- Self-Assessment Manikin (Lang, 1980)
 - Valence (Pleasure) Ratings: 1 (unhappy) to 9 (happy)
 - Arousal ratings: 1 (calm) to 9 (excited)
 - Subjective emotional reactions assessed following presentation of each picture

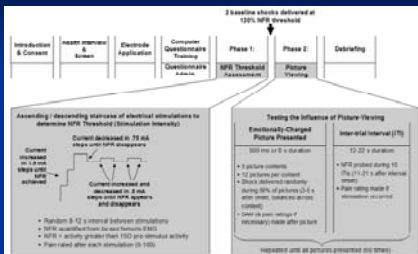
RESULTS: Manipulation Checks

Pictures independently manipulated valence

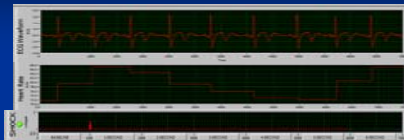


Pleasure (Valence) Ratings. The effect of picture content was significant, $F(4,9)=26.04, p<.001, \eta^2=.92$.

PROCEDURE



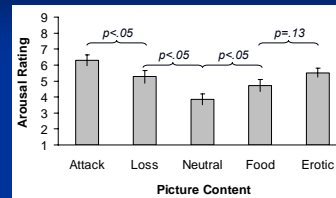
AUTONOMIC RESPONSES: Short-Latency Heart Rate Acceleration



- 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

RESULTS: Manipulation Checks

Pictures independently manipulated arousal



Arousal Ratings. The effect of picture content was significant, $F(4,9)=7.15, p=.007, \eta^2=.76$.