BEATING HEARTS AND SWEATY PALMS: MEAN SKIN CONDUCTANCE RESPONSE DURING FEAR CONDITIONING IS LARGER FOR THOSE WITH LOWER RESTING RESPIRATORY SINUS ARRHYTHMIA

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Introduction

Thayer and Brosschot (2005) suggest that individuals with greater heart rate variability (HRV), an index of cardiac vagal control, should recover more quickly from emotional or physiologically demanding situations. The present study sought to examine the relationship between cardiac vagal control, as indexed by respiratory sinus arrhythmia (RSA), and subsequent sympathetic arousal during fear conditioning, as indexed by skin conductance response (SCR).

Method Overview

The experiment has three phases:

- Day 1 (habituation and training).
- Day 2 (conditioning trials).
- Day 3 (unconditioned presentation).

Habituation: As can be seen in Figure 2, in contrast to Thayer and Brosschot’s (2005) theory’s predictions, the Low RSA group had a trend toward a greater negative slope over the course of the trials, as compared to the High RSA group (F(1,74)=3.68, p=.059).

Conditioning: The High RSA group had a flatter slope across trials than the Low RSA group (F(1,74)=13.08, p<.001), which was qualified by a trend toward a CS type interaction (F(1,74)=3.37, p=.071), where the Low RSA group, as compared to the High RSA group, had a comparatively greater slope difference for the CS− (right panel) than the CS+ (left panel).

Day 1 Method

Habituation: As can be seen in Figure 3, the mean square root transformed SCR difference for High vs. Low RSA participants was .098 vs. .065, respectively, on Day 1. However, the mean square root transformed SCR difference for first conditioning trial vs. habituation trial for the Low RSA group, as compared to the High RSA group (F(1,74)=3.68, p=.005), was not a significant difference.

Conditioning: The High RSA group showed a greater initial drop in SCR across trials as compared to the Low RSA group (F(1,64)=4.55, p<.05). There was also the consistent finding on Day 8 of greater reactivity to the CS− as compared to the CS+. Relative to Low RSA participants, High RSA participants demonstrated a trend toward reduced withdrawal from previously rewarding stimuli, as measured by SCR, and less SCR reactivity to the CS+ after the start of conditioning Day 3.

Day 8 Method

- Parallel to Learning phase.
- Unpaired Presentation: Method parallels Day 1, with 6 unconditioned (UCS) presentation trials each of CS+ and CS− (as per Figure 1a).
- Bi-Conditioning: Method parallels Day 1 conditioning, with 8 presentations each of CS+ and CS− (as per Figure 1b), followed by one unconditioned presentation each of CS+ and CS−.

Results

- To test the predictive value of the High and Low RSA Day 1 groupings, they were used to compare SCRs to the stimuli 8 days later.

- Unpaired Presentation: As shown in Figure 4 (right panel), for the CS+, the High RSA group showed a greater initial drop in SCR across trials as compared to the Low RSA group (F(1,64)=13.15, p<.01).
- Bi-Conditioning: The Low RSA group showed greater reactivity to the CS+UCS pairing (F(1,64)=4.55, p<.05), as shown by increases in SCR that took more trials to reduce as compared to High RSA participants.

Discussion

- Supporting Thayer and Brosschot’s (2005) theory, Raio-Paradd and colleagues (2001) found that while viewing pleasant, neutral, and unpleasant pictures, higher resting HRV was associated with lower within-trial emotion-modulated startle magnitudes. Participants with the highest HRV showed the least differentiated emotion-modulated startle effects, whereas those with the lowest HRV showed significantly increased startle responses to not only negative, but also neutral, images.

- Results from the present study are consistent with these findings in a fear-conditioning paradigm using skin conductance response (SCR) as the dependent measure.

- Relative to Low RSA participants, High RSA participants demonstrated a trend toward reduced withdrawal from previously rewarding stimuli, as measured by SCR, and less SCR reactivity to the CS+ after the start of conditioning Day 3.

- There was also the consistent finding on Day 1 of greater reactivity to the CS− as compared to the Low RSA group, as compared to High RSA group, suggesting less differentiated arousal.

- The present study extended prior work by demonstrating results generally consistent with these findings on Day 8.

- However, correlational analyses suggested that individual differences in logRSA did not account for much variability in overall skin conductance responses (R^2=.003 for CS+ and R^2=.002 for CS-) during the Conditioning trials on Day 1.

- In sum, results trend toward supporting Thayer and Brosschot’s (2005) theory that individuals with higher cardiac vagal control recover more quickly, and have generally reduced physiological reactivity, from emotional or physiologically demanding situations.

References


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