

Surprising Associations Between Surprised Facial Expressions and Heart Rate Variability

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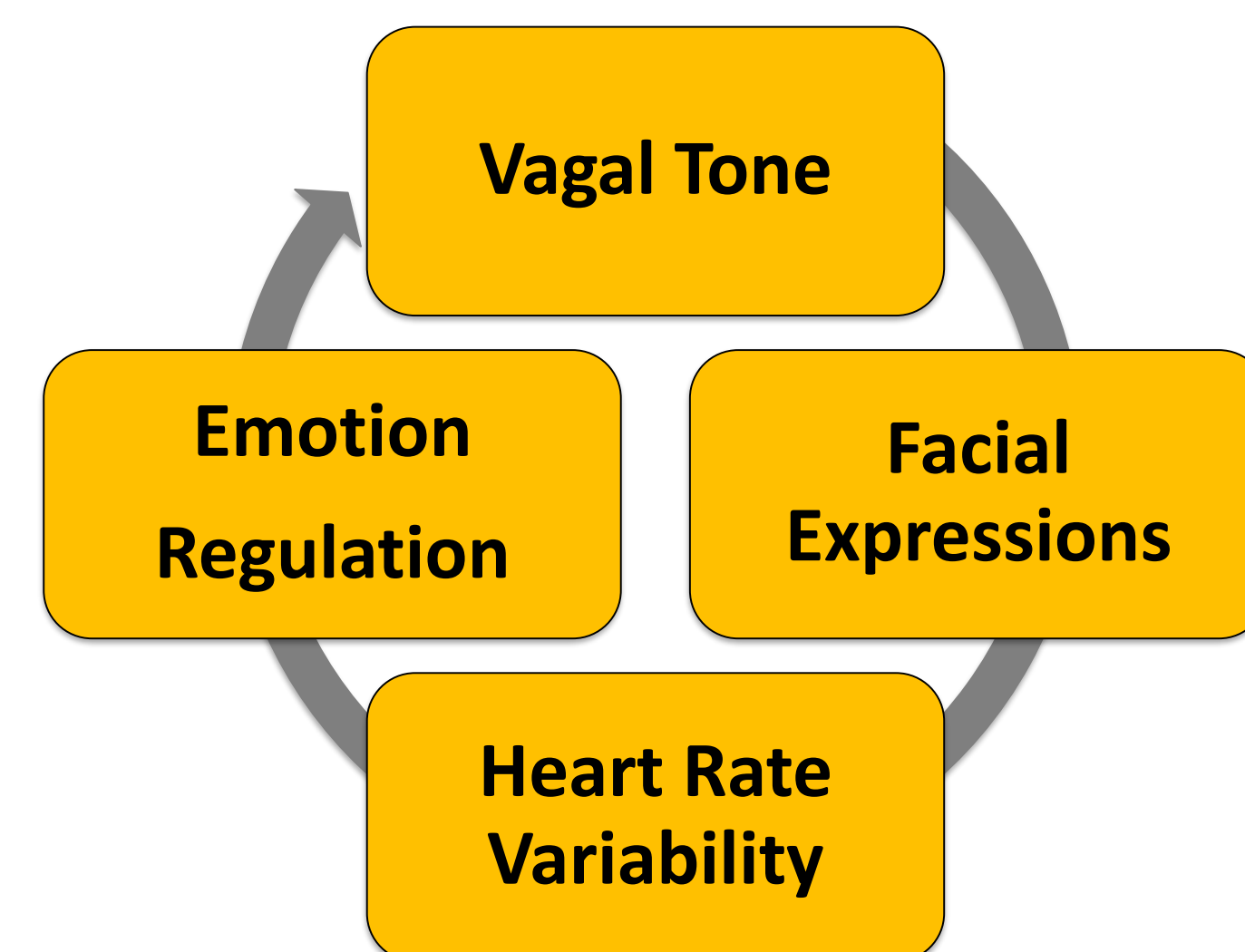


INTRODUCTION

- It is theorized that the interaction between facial muscle nerves and vagal tone (a parasympathetic component) is one of various mechanisms underlying emotion regulation (Porges 2003).
- Vagal tone is critical for emotion regulation, and it modulates Heart Rate Variability (HRV) (Thayer & Lane, 2000).
- Root Mean-Squared Successive Differences – RMSSD) and (Respiratory Sinus Arrhythmia – RSA) are HRV markers that directly reflect vagal tone and are linked with facial expressions.
- Higher RSA = decreased likelihood of experiencing negative emotions during stress (Fabes & Eisenberg, 1997) .
- Higher RMSSD = better emotion regulation (Williams et al., 2015)
- Inhibiting facial expression = Reduced negative emotion (Duclos & Laird, 2001)
- Smiling during recovery from stress = Decreased Heart Rate (Kraft & Pressman, 2012) and Faster cardiovascular recovery (Fredrick & Levenson)

OBJECTIVES

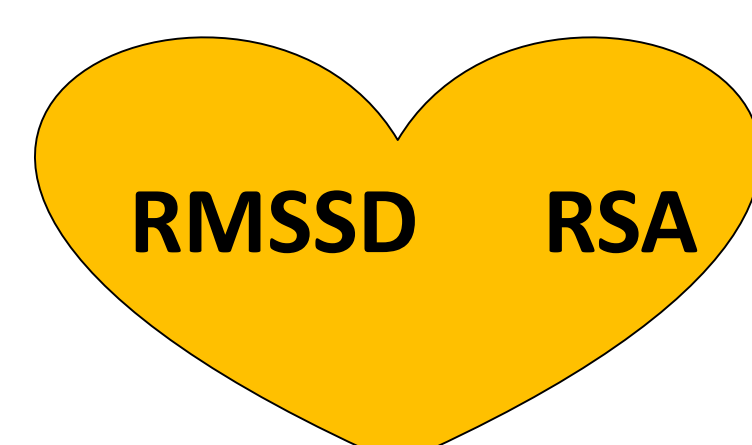
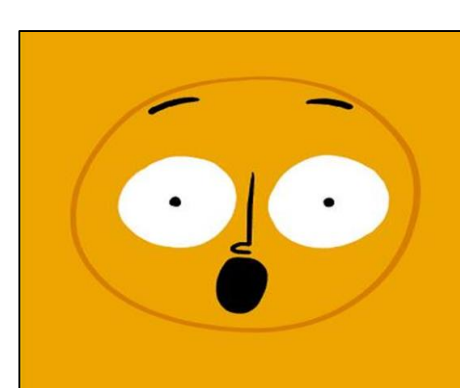
- Can other facial expressions, tell us anything about RMSSD and RSA at rest periods?
- We aim to characterize the associations between facial expression at rest and HRV markers RMSSD and RSA. This will allow us to better understand in which way vagal tone aids parasympathetic function at rest.



METHODS

MEASURES

- Participants' Facial Expressions were recorded continuously while sitting quietly. **0 – 5 Minutes**
- Participants' Heart Rate (HR) in beat-to-beat intervals was recorded.
- Facial movements categorized into SURPRISED or NEUTRAL expressions and calculated their INTENSITY (0-1) AND DURATION (ms) **Variables**
- HRV markers extracted from and between normal R-R intervals (ms) and summarized in 60 sec bins.



PARTICIPANTS

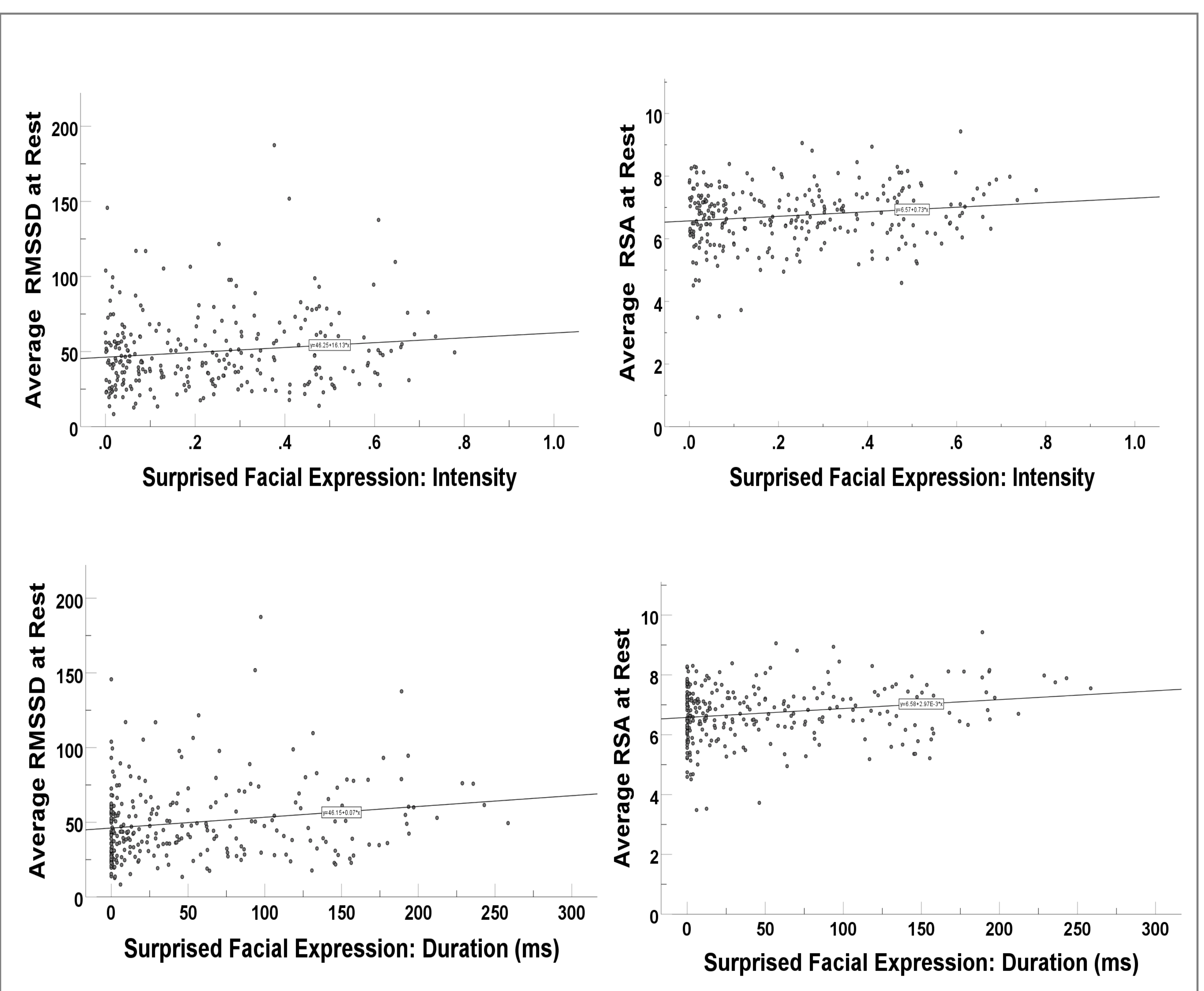
- 268 participants (202 Females) took part in this study. Females = 202. The average age was 20.59 ± 3.27 . Average Body Mass Index (BMI) was 24.60 ± 5.65 .

STATISTICAL ANALYSIS

- Pearson correlation analysis were conducted to assess the relation between facial expressions and RMSSD and RSA.
- No demographic effects were found by demographic factors (i.e., Age, Gender, and BMI) on facial expressions, RMSSD, or RSA measures.

RESULTS

- Higher Intensity of surprise facial expression ($M = .23 \pm .20$) was positively correlated with higher RMSSD ($M = 50.22, \pm 25.63$), $r(268) = .128, p = .036$ and higher RSA ($M = 6.74 \pm .92$), $r(268) = .159, p = .009$.
- Longer duration of surprise facial expression ($M = 51.93 \pm 61.00$) was positively correlated with higher RMSSD $r(269) = .173, p = .004$ and with higher RSA $r(268) = .196, p = .001$.
- Intensity of neutral facial expression ($M = .37 \pm .14$) was neither correlated with RMSSD ($M = 50.22 \pm .25.63$) $r(268) = -.062, p = .314$, or RSA ($M = 6.74 \pm .14$) $r(268) = -.071, p = .248$.
- Duration of neutral facial expression ($M = 112.09 \pm 87.38$) was neither correlated with RMSSD $r(269) = -.045, p = .460$, or RSA RMSSD $r(269) = -.073, p = .236$.



CONCLUSIONS

- Higher intensity and duration of surprised facial expression was associated with higher RMSSD and RSA.
- Neutral facial expressions were not associated with any of these HRV indicators.
- These findings can help illuminate mechanisms underlying emotion regulation mechanisms, like facial expression and HRV.
- These findings can inform affective computing methods that use Facial Expression and HRV as markers of human emotions.

References

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