



# CARDIAC VAGAL CONTROL DURING HANDHOLDING AND DURATION OF ROMANTIC RELATIONSHIPS IN COLLEGE COUPLES



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## Abstract

Emerging evidence suggests a positive association between cardiac vagal control, measured by respiratory sinus arrhythmia (RSA), and quality of intimate relationships.

No study has examined whether physiological synchrony between individuals in romantic relationships, indexed by covariation of RSA, is associated with relationship quality.

The present study examined the association between quality of romantic relationships and covariation of RSA in 18 college couples.

Participants filled out questionnaires on their relationship quality, and four 10-minute electrocardiographic (ECG) recording segments followed. After the 10-minute resting baseline, participants were asked to hold an object (tennis ball) or hold their partner's hand for 10 minutes in counterbalanced order. Subsequently, another 10-minute baseline was recorded.

Although there was no association between the covariation of RSA and the average scores of relationship quality reported by each couple, the covariation of RSA during handholding was associated with the length of the relationship. Couples exhibiting higher covariation of RSA were in romantic relationships for a longer period of time.

This result suggests that in young couples in the beginning stages of romantic relationships, the duration of the relationship rather than its quality is associated with physiological synchrony as indexed by covariation of partners' RSA.

## Introduction

Within the framework of Polyvagal theory (Porges, 1995), individuals with high cardiac vagal control (CVC), as measured by respiratory sinus arrhythmia (RSA), should exhibit better social functioning.

Higher resting RSA is associated with better social support (Horsten et al., 1999), greater marital quality in young couples (Smith et al., 2010), and greater affection and intimate partner relationship quality in women diagnosed with breast cancer (Kogan, Allen, & Weihs in preparation).

Synchrony is the temporal covariation of discrete events (Feldman, 2007).

Mother-infant and father-infant gaze synchrony is associated with increased vagal control (Feldman & Eidelman, 2007).

Active participants in a fire-walking ritual exhibit synchrony in heart rate with their related onlookers (Konvalinka et al., 2011).

Skin conductance concordance between patients and therapists is associated with patients' ratings of perceived therapist empathy (Marci et al., 2007).

No study to date has examined whether covariation of RSA between individuals in romantic relationships is associated with relationship quality.

The present study explored the construct of physiological synchrony, assessed by RSA covariation, and relationship quality in young couples in romantic relationships.

## Method

### Participants

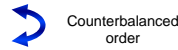
A total of 18 female participants and their romantic partners (all males), who reported being in exclusive romantic relationships for at least two months, participated in the study (Mean age of females = 20 years, SD = 0.8 years, Range of 18 - 21 years; Mean age of partners = 21 years, SD = 2.6 years, Range of 19 - 29 years; Mean relationship duration = 18.6 months, SD = 12.4 months, Range of 3 - 41 months).

### Procedure

To record the ECG signal, NeuroScan system with two AgCl electrodes attached below collar bones was used. A sample rate of 1000 Hz was used to record the ECG signal. No instructions on how to breathe were given to the participants.

Four 10-minute ECG segments were obtained from female participants and their partners:

- Resting baseline 1
- Holding an object (tennis ball)
- Holding partner's hand
- Resting baseline 2



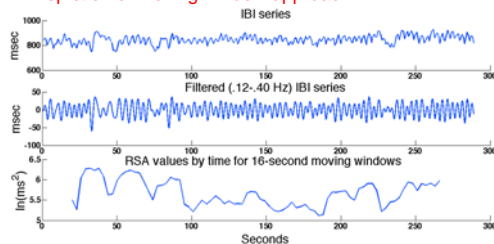
Participants filled out two measures of relationship quality, the Dyadic Adjustment Scale (DAS) and the Social Relationships Inventory (SRI).

### ECG Data Reduction

The raw digitized ECG signals from each 10-minute segment were analyzed off-line. Interbeat interval (IBI) series from the raw ECG recording was extracted by using QRSTool Software (Allen, Chambers, & Towers, 2007). The extracted interbeat series was hand-corrected for artifacts such as missed, erroneous, or ectopic beats.

The interbeat interval series for each partner and each ECG segment was transformed to a time series sampled at 10 Hz. To derive a time-varying estimate of RSA, this signal was digitally filtered in the .12-.40 Hz band, and the log of the variance of the filtered signal was obtained in a series of moving windows (described below in Figure 1), resulting in an RSA series for each partner and for each ECG segment.

### Depiction of moving window approach



The IBI series (top panel) is bandpass filtered (.12 - .4 Hz) to include frequencies encompassing respiration (middle panel) and then RSA is taken as the natural log of the variance of each window of this series (lower panel). In this example, with 16 second moving windows, each point in the lower panel represents the RSA from the filtered series for the window beginning 8 seconds prior and extending 8 seconds after that data point. In the present study, a range of window sizes (5-30 secs) and window offsets (2-14 secs) were explored.

Covariation in partners' RSA was estimated by the cross correlations of these RSA series.

The maximal covariation value was obtained for each couple during each of the 4 segments, allowing the moving window size to vary from 5 to 30 sec in length, allowing the window overlap to range from 2 to 14 sec, and allowing the lag to range from 1 to 28 sec. Sample series are shown in Figure 3.

## Results

### RSA covariation by condition

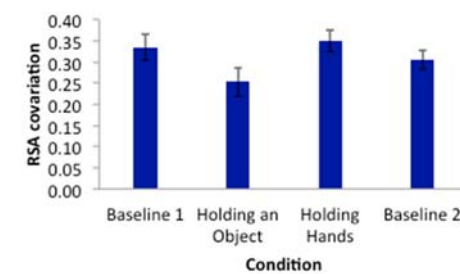


Figure 2. A repeated measures ANOVA revealed no statistically significant differences in partners' RSA covariation between conditions ( $F(3, 48) = 2.57, p > .05$ ). Error bars represent standard errors.

### RSA covariation in romantic partners during handholding

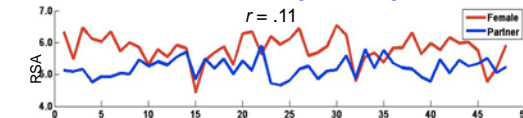


Figure 3a. A series of RSA values in romantic partners with low covariation during handholding condition. Window size = 5 sec; Offset = 10 sec; Lag = -2 sec.

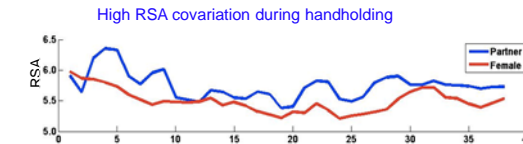


Figure 3b. A series of RSA values in romantic partners with high covariation during handholding condition. Window size = 30 sec; Offset = 12 sec; Lag = -1 sec

### No association was found between RSA covariation in romantic partners during handholding and self-reported quality of romantic relationship.

	Social Relationships Inventory (average of partners' scores)	Dyadic Adjustment Scale (average of partners' scores)	Dyadic Adjustment Scale: Affection (average of partners' scores)
RSA covariation during handholding	.18 (ns)	-.19 (ns)	-.08 (ns)

### RSA covariation in romantic partners during handholding was associated with duration of romantic relationship.

	RSA covariation in romantic partners			
	Baseline 1	Holding an Object	Holding Hands	Baseline 2
Relationship duration	-.04 (ns)	-.24 (ns)	.45 ( $p < .05$ )	.32 (ns)

## Results (cont.)

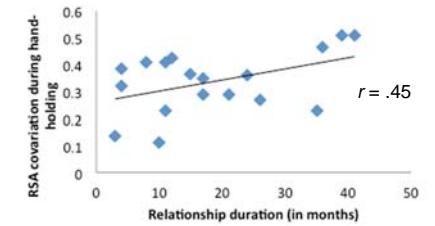


Figure 4. RSA covariation in romantic partners during handholding was positively correlated with duration of romantic relationship ( $r = .45, p = .03$ , one-tailed).

## Discussion

Contrary to prediction, there were no significant differences in partner RSA covariation between experimental conditions.

Contrary to prediction, there was no significant association between partner RSA covariation during handholding and self-reported measures of relationship quality and affection.

A significant correlation between partner RSA covariation during handholding and duration of romantic relationship emerged, suggesting that in young couples in the beginning stages of romantic relationships, the duration of the relationship rather than its self-reported quality is associated with physiological synchrony as indexed by covariation of partners' RSA.

The association between RSA covariation and relationship duration was specific to the handholding condition. Future investigations will need to establish whether those romantic partners who exhibit physiological synchrony tend to stay together longer or whether those who stay together longer develop more physiological synchrony.

The moving window approach utilized in this study provides a suitable methodology for future examination of covariation of RSA in dyads. Although promising, given that this method is designed to maximize cross-correlation in each segment, cross-validation in independent samples is needed.

Future investigations will need to establish whether the association between RSA covariation and relationship duration is observed in long-term committed relationships independent of age and whether RSA covariation is associated with relationship quality in more established romantic relationships.

## References

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Handouts available: [www.psychofizz.org](http://www.psychofizz.org).

