

Cardiac Vagal Tone and Social Engagement: Support for the Polyvagal Theory

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Introduction

- The polyvagal theory (Porges, 1995) posits that one of the operations of the vagus nerve and the autonomic nervous system is to regulate the Social Engagement System (SES).
- The SES controls the extent to which attention is directed to others and energy is invested in social engagement behaviors.
- Respiratory sinus arrhythmia (RSA) is one index of vagal control, also known as cardiac vagal tone.
- Manifestations of vagal control:
 - High vagal tone is related to greater emotional expressivity (Cole et al., 1996).
 - Decreased cardiac vagal control is related to depression in adults and children (Roitman, 2007).
 - Vagal tone was positively related to social functioning in male children (Eisenberg et al., 1995).
- This study investigates social engagement and positive affect as additional correlates of cardiac vagal tone and manifestations of the Social Engagement System.**

Method

Participants

Study 1: 86 undergraduate students, 42% male
Study 2: 94 adults, mean age 26.4, 32% male

Selected Measures

Study 1:

- Self-Transcendence scale** (Cloninger, Svrakic & Przybeck, 1983)
- Respiratory sinus arrhythmia (RSA)**: See Box 1.

Study 2:

- Satisfaction with Life scale** (Pavot & Diener, 1993)
- Life Orientation Test- Revised** (LOT-R; Scheier & Carver, 1994)
- Respiratory sinus arrhythmia**: See Box 1.

Results

Study 1

Baseline RSA and:

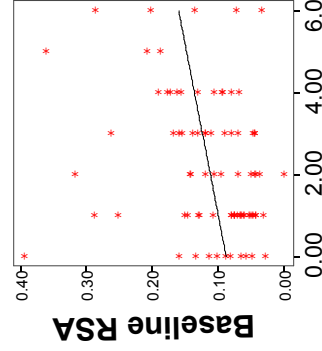
Transpersonal Identification ($r = 0.265^*$)

Study 2

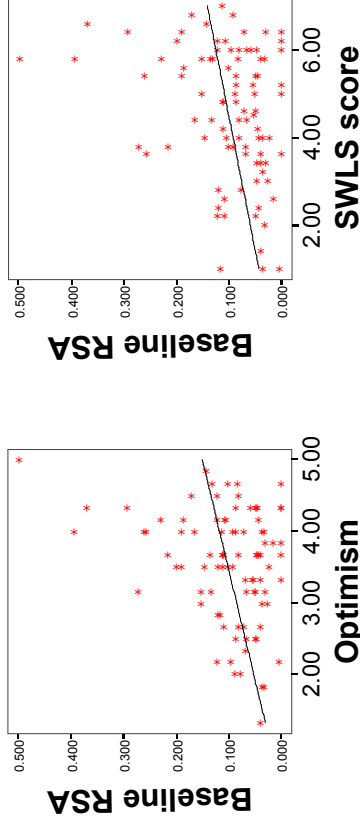
Baseline RSA and:

LOT-R (Optimism; $r = 0.290^{**}$)

Satisfaction with Life ($r = 0.278^{**}$)



Transpersonal Identification



Discussion

- Across two data sets, RSA was related to trait indicators of social engagement and positive life orientation.
- These findings suggest that cardiac vagal tone, as measured by RSA, plays a role in both trait affect and social connectedness.
- In one sample, RSA was positively correlated with Transpersonal Identification vs. Individuation, a subscale of the Self-Transcendence Scale that measures to the extent to which individuals feel they are part of a larger social whole.
- In another sample, RSA was positively correlated with optimism and satisfaction with life, trait markers of long-term positive engagement with life.
- These findings support the claims of the polyvagal theory that social engagement and positive life orientation have accompanying physiological states.
- Cardiac vagal control may play a role in motivating social connectedness and building social and personal resources over time by motivating positive social engagement.

References

- Cloninger, C.R., Svrakic, D.M. & Przybeck, T. R. (1983). A psychological model of temperament and character. *Archives of General Psychiatry*, 50(12), 975-990.
- Cole, P.M., Zahn-Waxler, C., Fox, N.A., Usher, B.A. & Welsh, J.D. (1996). Individual differences in emotion regulation and behavior problems in preschool children. *Journal of Abnormal Psychology*, 105(4), 518-529.
- Eisenberg, N., Fabes, R.A., Murphy, B., Masck, P., Smith, M. & Karbon, M. (1995). The role of emotionality and regulation in children's social functioning: A longitudinal study. *Child Development*, 66, 1360-1384.
- Grossman, P. (1983). Respiration, Stress, and Cardiovascular Function. *Psychophysiology*, 20(3), 284-299.
- Pavot, W. & Diener, E. (1993). Review of the Satisfaction With Life Scale. *Psychological Assessment*, 5(2), 164-172.
- Porges, S.W., 1995. Orienting in a defensive world: mammalian modifications of our evolutionary heritage: a polyvagal theory. *Psychophysiology* 32, 301-318.
- Roitman, J. (2007). Cardiac vagal control in depression: A critical analysis. *Biological Psychology*, 74, 200-211.
- Scheier, M.F., & Carver, C.S. (1984). LOT-R. [Online]. Available <http://www.psy.miami.edu/faculty/ccarver/OCCScales.html>.

Box 1: Respiratory Sinus Arrhythmia: Measure of Cardiac Vagal Tone

- Cardiac vagal control can be measured by respiratory sinus arrhythmia (RSA).
- We computed RSA as the difference between the minimum interbeat interval (IBI) during inspiration and the maximum IBI during expiration, measured in seconds (Grossman, 1983).
- Analyses were conducted using the mean of RSA values over a two minute baseline period.

Measurement of RSA

ECG data was collected by placing three disposable electrodes on the torso, two below the lowest rib with another electrode below the navel to serve as a ground. The ECG signal was amplified by an isolated bioelectric amplifier set to a gain of 500 with a bandpass of 0.1 – 1000 Hz (BLF-07, SA Instrumentation Co., San Diego, CA). The digitized signal was subsequently analyzed using James Long Co. IBI Analysis System software (James Long Co., Caroga Lake, NY) to detect the presence of R spikes and a file of interbeat intervals was created. The time between intervals was in milliseconds, with an accuracy of ± 1 ms.