Heart Rate Variability During Cognitive, Language, and Metalinguistic Tasks in Typically Developing Children

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Introduction

- Heart Rate Variability (beat-to-beat variation - HRV) has been used in psychophysiological research as an indicator of cognitive effort and its relationship to performance (Christensen & Wright, 2014; Thayer & Lane, 2009).
- The ability to reduce HRV in response to attentive demands is often positively associated with cognitive function, including better processing speed, working memory, learning, and receptive language function (Patirquin et al., 2013).
- Some evidence that higher HRV is associated with better receptive language ability in children with ASD (Watson et al., 2010).
- The aims of the current study were to better understand the relationships between HRV and performance on cognitive and language tasks in typically developing children.
- Better understanding of these relationships could inform clinical decisions and shed light on how children with developmental disabilities approach language and cognitive tasks.

Research Questions

1. Does mean HRV predict performance on language, cognitive, and/or metalinguistic tasks?
2. Is there a relationship between task performance and HRV in typically developing children?

Method

- At the 2016 Minnesota State Fair, children completed the following assessments:
  - Metalinguistic awareness probe
  - Metalinguistic probe (right) comprised tasks used by other researchers to evaluate vocabulary and morphology metalinguistic skills.
  - Parents completed the Behavior Rating Inventory of Executive Function (BRIEF; Gioia, G.A., Isquith, P.K., Guy, S., Kenworthy, L. (2000))
  - Of the 200 children who participated, we were able to collect HRV data on 25, 4- to 8-year-old children with the Empatica E-4.

Results

Pearson Correlations did not reveal significant relationships in the data between HRV and language or cognitive tasks.
- KBIT and HRV: p = .71
- CELF Recalling Sentences and HRV: p = .43
- BRIEF Global Executive Composite (GEC) and HRV: p = .10
- Metalinguistic Probe and HRV: p = .51

HRV Measurement Device

- Researchers used the Empatica E-4 wristband to collect HRV data.
- This device uses photoplethysmography (PPG) to measure continuous heart rate.

Conclusion

Based on the limited sample and data available, we did see trends toward positive relationships which motivates further study in this area.

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Key References