Music-related Decreases in Autonomic Arousal in Children with Autism Spectrum Disorders

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Abstract (50 words max.)

This study examined the impact of music on autonomic response as one potential mediator for the relationship between music and social engagement improvements (e.g., Allen, Hill, & Heaton, 2009). Our results indicated a significant decrease in HR and increase in HRV during music listening, which may reflect a calmed state.

Summary (500 words max.)

Autism Spectrum Disorders (ASD) are an urgent health concern as prevalence rates continue to increase. New reports indicate approximately 1 in 110 children are affected by ASD (Centers for Disease Control and Prevention, 2009). Additionally, social skill deficits outlined by the Diagnostic and Statistical Manual for Mental Disorders – 4th Edition (DSM-IV; American Psychiatric Association, 2000) make children with ASD easy targets for bullying, teasing, and peer rejection (Knott, Dunlop, & Mackay, 2006) and subsequent social isolation (Chamberlin, 2001). However, music consistently produces social behavior improvements in individuals ASD. Music therapy, listening to music, and playing music have lead to significant increases in vocalization, eye contact, head orienting, and to decreased aggressive behaviors, self-injury, internal arousal, and stereotypical behaviors. (Allen, Hill, & Heaton, 2009; Lundqvist, Andersson, & Viding, in press).

The Polyvagal Theory (Porges, 1995, 1998, 2001, 2003, 2005, 2007, 2008) offers a theoretical position from which to explain these observed improvements in social engagement (e.g., vocalization, eye contact, head orienting). The Polyvagal Theory outlines a Social Engagement System that consists of interconnected (via neural substrates) cranial nerves. Children with ASD show dysfunction in Social Engagement System cranial nerve X (i.e., vagus nerve) by exhibiting decreased high frequency heart rate variability (HF HRV) to unfamiliar people and at baseline (e.g., Ming, Julu, Brimacombe, Connor, & Daniels, 2005). This suggests that children with ASD show a “fight-flight” (i.e., sympathetic) state at baseline and to unfamiliar individuals. Interestingly, music may have both the ability to calm cardiovascular functioning (Iwanaga, Kobayashi, & Kawasaki, 2005) and to improve social behaviors in children with ASD (Whipple, 2004).

The current study seeks to identify the underlying physiological mechanisms that might mediate the effect between music and social engagement. Specifically, we hypothesize that children with ASD will show increased HF HRV and decreased heart rate (HR) when
listening to music compared to exposure to another auditory stimulus (i.e., book-on-tape).

Data analyses were conducted on 22 children, aged 4-7, previously diagnosed with an ASD. Participants were administered a 3-minute baseline video, 12-minute listening period, and 3-minute recovery video while cardiac measures were recorded with a LifeShirt®. Participants were matched across two groups, Music vs. Book-on-Tape, by auditory hypersensitivities and receptive vocabulary scores.

Due to *a priori* hypotheses, all tests conducted were one-tailed. During the listening period, the Music group had a significantly higher HF HRV than the Book-on-Tape group, $F(1,16) = 3.53, p < .05$. Moreover, the group (i.e., Music vs. Book-on-Tape) x time (baseline, task, recovery) interaction for HF HRV approached significance, $F(2,26.00) = 2.38, p = .056$ with the Music group showing increased HF HRV from baseline to listening. Similarly, the Music group showed a significant baseline to task decrease in HR, $F(1,15) = 5.68, p < .05$.

Taken together, these results show an increase in HF HRV and decrease in HR for the Music group, from baseline to task, which may reflect a calmed physiological state. Future studies should examine the mediating effect of this soothed autonomic state on social engagement behaviors.

References:


Research in Autism Spectrum Disorders.


