Title: Auditory vs. Visual Sustained Attention to Response Task Performance Trajectories in Down Syndrome

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Introduction: Youth with Down syndrome (DS) generally have poorer auditory than visual processing. For example, they experience more difficulty with auditory than visual short-term memory (STM; Jarrold & Baddeley, 1997). Interestingly, the same has not been found for sustained attention (SA) as measured with the sustained attention to response task (SART) paradigm (Faught, Conners, & Himmelberger, 2016). However, additional comparisons of auditory vs. visual SART performance in youth with DS are warranted considering the DS cognitive phenotype. The purpose of this study was to compare auditory and visual SART performance trajectories on a block-by-block basis in DS.

Method: This study was part of a larger study exploring indirect effects of SA and language through STM in DS. Thirty-five youth with DS aged 10- to 22-years-old (M = 15.94, SD = 3.37) participated in the larger study. SA was measured using the SART paradigm originally described by Robertson, Manly, Andrade, Baddeley, and Yiend (1997). In both an auditory and visual SART, participants pressed a computer key in response to eight non-targets and resisted pressing a key in response to the target. Non-targets were audio recordings of animal names in the auditory SART and line drawings of the same animals in the visual SART. The target was the name or drawing of a dog. Animals were presented in 25 continuous blocks over eight minutes, with 200 non-target and 25 target presentations total. Dependent variables were omission errors (i.e., failing to press in response to non-targets) and commission errors (i.e., pressing in response to the target). Omission errors reflect distractions from ongoing task performance, whereas commission errors additionally reflect response inhibition difficulties (Johnson et al., 2007).

Results: After determining multi-level modeling was appropriate by checking the interclass correlation (ICC), the best fitting models for omission and commission errors were identified using the likelihood ratio test. Of primary interest were participants’ performances (i.e., error rates) across the 25 blocks of the eight-minute auditory and visual SARTs. For omission errors, the ICC for the intercept-only model was .62, indicating 62% of variance in scores was nested within people. A significant block x modality interaction (p = .033) indicated an increase in omission errors across blocks that was greater in the auditory than visual modality. The modality specific combined models for omission errors were as follows: Auditory Omissions = 1.76 + .03*Block and Visual Omissions = 1.88 + .01*Block. For commission errors, the ICC for the intercept-only model was .81, indicating 81% of variance in scores was nested within people. A significant block x modality interaction (p = .049) indicated an increase in commission errors across blocks that was greater in the visual than auditory modality. The modality specific combined models for commission errors were as follows: Auditory Commissions = 0.13 + .00*Block and Visual Commissions = 0.18 + .01*Block.

Discussion: Results suggest youth with DS have more difficulty sustaining attention over time in the auditory than visual modality. However, they have more difficulty with inhibition over time in the visual than auditory modality. Results have implications for assessing cognitive and language skills in individuals with DS. Difficulty sustaining attention over time in the auditory modality could contribute to poor performance on auditory tasks that are prolonged. Thus, assessment of auditory skills in individuals with DS should be short in duration whenever possible. Also, increased difficulty inhibiting responses over time in the visual modality could contribute to poor performance on prolonged visual tasks that have an inhibition element. This should be taken into consideration when designing visual assessments.

References/Citations: