Auditory processing during visual attention in typically developing children and children with Autism Spectrum Disorder: An ERP study

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INTRODUCTION

Autism Spectrum Disorder (ASD) is a group of neurodevelopmental disorders characterized by permanent communication deficit, social interaction problems and limited interests, repetitive behavior patterns and activities (APA, 2013).

Attention deficits are not only frequent in ASD (Lyall et al., 2017), but also are one of the most prominent markers of ASD, and, according to some studies, these differences can be observed at the age of six months (Clifford et al., 2013), including inability to shift attention efficiently and quickly between different sensory modalities' stimuli (Gomot et al., 2006).

GOAL

The goal of the study is to investigate the language comprehension in children with ASD in two conditions: when children are attracted by the visual task (multimodal presentation) and when there was no visual task (unimodal presentation).

HYPOTHESIS

We assume that neurophysiological mechanisms of language processing differ in children with ASD between multimodal and unimodal paradigms while TD children are able to comprehend language effectively despite the visual stimuli presence.

METHOD

Procedure and materials

The experiment consisted of two blocks:

1. The participants were instructed to listen to one syllable /pa/ repeated by the speaker - auditory task.
2. The same auditory stimuli were presented, but additionally, participants were asked to press the button at the moment a cat appears at different positions of the screen - auditory-visual task (Figure 1).

Participants

19 TD native Russian-speaking children (12 males, 7 females, age range 7.06 - 11.03 years, Mage = 8.6, SD = 3.7).

Analysis

- Nine fronto-central electrodes (Fz, FC1, FC2, Cz, FC3, FCz, FC4, C1, C2) which recorded auditory ERPs (Rojas et al., 2018) were selected for the analysis (Figure 2).
- Average amplitude for each electrode was extracted from two time windows: 30–60 ms and 110–180 ms and analyzed by Paired Sample T-Test in R (R Core Team, 2019) between two conditions.

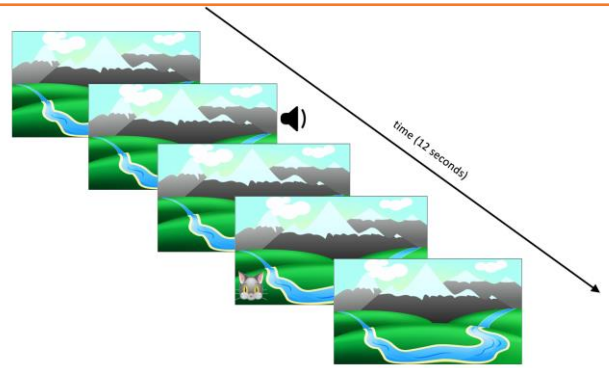

Figure 1

RESULTS AND CONCLUSION

The preliminary results showed that there were no significant differences in any of the electrodes between auditory and auditory-visual tasks in the TD group (all $p > 0.05$).

Thus, TD children were able to process language effectively in both conditions.

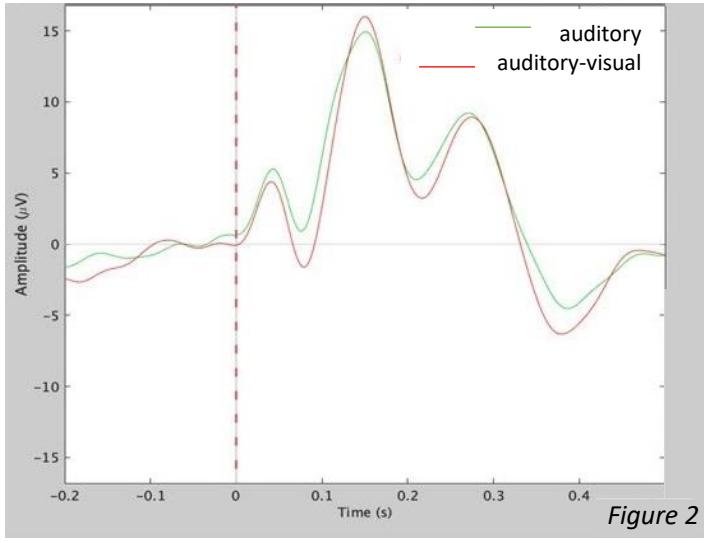

Figure 2

REFERENCES

Clifford, S. M., Hudry, K., Elsabbagh, M., Charman, T., Johnson, M. H., & BASIS Team (2013). Temperament in the first 2 years of life in infants at high-risk for autism spectrum disorders. Journal of autism and developmental disorders, 43(3), 673–686.

DSM-5. 5th Edition. Washington, DC: American Psychiatric Association; 2013. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders.

Gomot, M., Bernard, F. A., Davis, M. H., Belmonte, M. K., Ashwin, C., Bullmore, E. T., et al. (2006). Change detection Lyall, K., Schweitzer, J. B., Schmidt, R. J., Hertz-Picciotto, I., & Solomon, M. (2017). Inattention and hyperactivity in association with autism spectrum disorders in the CHARGE study. Research in autism spectrum disorders, 35, 1–12.

Rojas, G. M., Alvarez, C., Montoya, C. E., de la Iglesia-Vayá, M., Cisternas, J. E., & Gálvez, M. (2018). Study of Resting-State Functional Connectivity Networks Using EEG Electrodes Position As Seed. Frontiers in neuroscience, 12, 235.

RStudio Team (2020). RStudio: Integrated Development for R. RStudio, PBC, Boston, MA URL http://www.rstudio.com/.