Neural correlates of impaired motor-auditory prediction in Autism Spectrum Disorder
van Laarhoven, Thijs; Stekelenburg, J.J.; Eussen, Mart; Vroomen, J.

Document version:
Publisher's PDF, also known as Version of record

Publication date:
2017

Link to publication

Citation for published version (APA):

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Take down policy
If you believe that this document breaches copyright, please contact us providing details, and we will remove access to the work immediately and investigate your claim.
Electrophysiological Correlates of Impaired Motor-Auditory Prediction in Autism Spectrum Disorder

Introduction

The amplitude of the auditory N1 in the event-related potential (ERP) is typically attenuated when sounds are self-generated compared to externally generated sounds. This effect has been ascribed to internal forward models predicting the sensory consequences of one’s own motor actions. A recently proposed theory posits that - unlike individuals with typical development (TD) - individuals with Autism Spectrum Disorder (ASD) have no strong predictive internal forward model of the world around them. This lack of ‘prior’ knowledge makes it difficult to predict upcoming events and may severely compromise interactions with the environment.

Here, we tested the hypothesis of impaired predictive coding in ASD by examining the neural underpinnings of sensory consequences of motor-auditory predictions in individuals with ASD. We hypothesized that - due to a lack of robust internal representations - individuals with ASD rely more on bottom-up incoming sensory signals, as if every stimulus is being experienced afresh.

Following this reasoning, we expected smaller attenuation effects for self-generated sounds in subjects in the ASD group, compared to their neurotypical age and gender matched counterparts in the TD group.

Method

Participants

ASD: N = 26, 6 female, mean age 18.04, mean TIQ 111.50
TD: N = 26, 6 female, mean age 18.77, mean TIQ 101.78

Experimental conditions

1. Motor-Auditory (MA)
   Subjects pressed a mouse button at a steady pace of ~1200 ms, which generated a 50 ms pure tone of 1000 Hz.
2. Auditory (A)
   The pure tones were replayed at the same pace as in the MA condition, but no button-press was required.
3. Motor (M)
   Subjects pressed a mouse button at the same pace as in the MA condition, but no pure tones were presented.

Participants

ASD: N = 26, 6 female, mean age 18.04, mean TIQ 111.50
TD: N = 26, 6 female, mean age 18.77, mean TIQ 101.78

160 trials / condition

Results

For the TD group, the amplitude of the auditory N1 was attenuated in the motor-auditory condition compared to the auditory condition, indicating that the motor action predicted the sound and dampened the sensation. In the ASD group, there was no auditory N1 attenuation in the motor-auditory condition compared to the auditory condition, indicating that they relied more strongly on bottom-up auditory cues - instead of top-down predictions based on prior knowledge.

These results show that individuals with ASD make less use of internal forward models to interpret the sensory environment and support the notion of impaired predictive coding abilities as the underlying cause of atypical multisensory processing in ASD.

Conclusions

References