

Expecting the unexpected: An examination of active inference in autistic adults using immersive virtual reality.

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Introduction

- The integration of prior expectations, sensory information, and environmental volatility is said to be atypical in autism [1], yet few studies have tested these predictive processes in active movement tasks.
- This is despite the fact that most autistic people experience sensorimotor difficulties (e.g., clumsiness, sensory issues, impaired motor coordination; see [2]).
- This study examined how movement is dynamically controlled in autism, during uncertain and volatile interceptive actions.

Materials and methods

30 participants with a diagnosis of Autism Spectrum Disorder (ASD) and 60 neurotypical (NT) controls were recruited.

Participants wore an HTC Vive Head Mounted Display and intercepted virtual tennis balls with a handheld 'racquet' controller.

On each trial, these balls would bounce with either normal or unexpectedly-high levels of elasticity.

Participants completed two blocks of trials in a counterbalanced order:

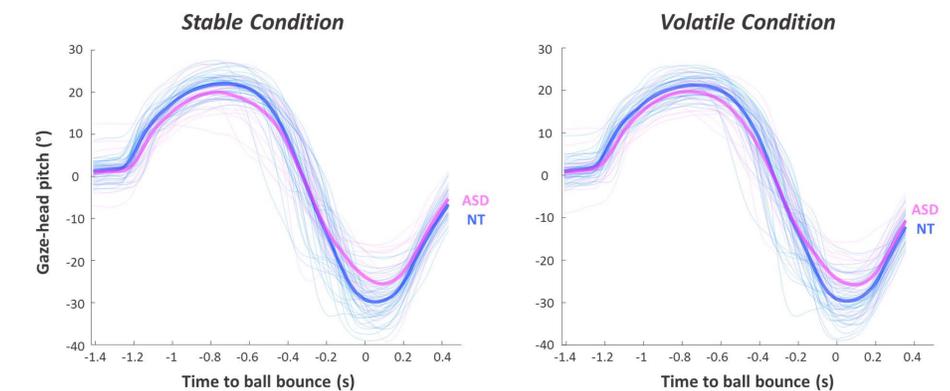
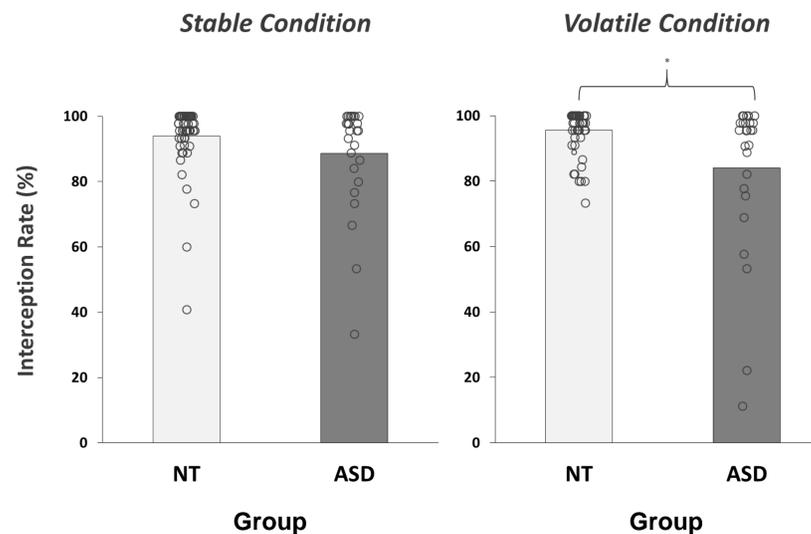
1. In the **stable block**, the probability of facing a normal ball remained fixed (at 67%).
2. In the **volatile condition**, probabilities switched unpredictably over time between highly- (83%), moderately- (67%) and non-predictive (50%).

We measured participants' interception performance, motor responses, and gaze behaviours for each condition, using a combination of kinematic and eye-tracking analyses.

Results

Although autistic participants intercepted a lower number of balls *overall*, performance differences were only significant in the volatile condition ($W = 963.00$, $p < .01$, $BF_{10} = 21.50$).

Autistic participants positioned gaze at a higher location than NT individuals around the point of bounce (see time '0' *below*). This reflected a greater tendency to prepare for bouncy balls, or 'expect the unexpected'.



The ASD group also showed marginally lower ranges of motion and reduced behavioural surprise, when compared to NT participants (p 's $< .025$; $BF_{10} > 2.34$). NT participants reduced these metrics under more volatile task conditions (all p 's $< .05$).



Discussion

- Results support proposals that volatility processing is atypical in autistic people [1], and suggest that suboptimal active inference mechanisms may underpin a range of sensorimotor difficulties.
- Research into the source of these differences is needed, to assist in the development of future evidence-based interventions.

References

- [1] Lawson, R. P., Mathys, C., & Rees, G. (2017). Adults with autism overestimate the volatility of the sensory environment. *Nature Neuroscience*, 20(9), 1293.
- [2] Fournier, K., Hass, C., Naik, S., Lodha, N., & Cauraugh, J. (2010). Motor coordination in autism spectrum disorders: a synthesis and meta-analysis. *Journal of Autism and Developmental Disorders*, 40(10), 1227.