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

Tom Arthur¹, David Harris¹, Gavin Buckingham¹, Mark Brosnan², Mark Wilson¹, Genevieve Williams¹ & Sam Vine¹
¹Sport and Health Sciences, University of Exeter, UK; ²Centre for Applied Autism Research, University of Bath, UK; Email: tga202@exeter.ac.uk

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