Potential drivers of atypically jerky movements in autism

Cook, J. L. 1, Fraser, D. S. 1, Brewer, R. 2, & Huh, B., D. 3,

1 School of Psychology, University of Birmingham, Birmingham, UK
2 School of Psychology, Royal Holloway University of London, London, UK

INTRODUCTION:
A burgeoning literature demonstrates that autistic movements are less smooth – more “jerky” – than non-autistic movements [1]. Atypically jerky movements may underpin some socio-cognitive differences and functional movement (e.g., handwriting) challenges. Despite this, little is known of the mechanisms underlying jerky movements in autism. Increased jerk can be an indicator of a fundamental difference in the way that speed is modulated as a function of the curvature of a movement trajectory but can also result from moving atypically (moving to slow, or too fast) and/or from decomposing long fluid movements into a series of shorter submovements.

METHODOLOGY:

- 21 autistic and 19, age-, IQ- and gender-matched, control participants used a stylus to trace shapes on a Wacom touchscreen device.
- Conditions spanned a range of angular frequencies from 2/33 to 4 because previous studies (2) demonstrate that the way in which speed is modulated as a function of curvature depends on angular frequency. Participants completed 5 trials (10 tracings per trial) per condition.
- X and y position was recorded at 133Hz.

RESULTS: Jerk
There was a significant interaction between group (ASD, CTRL) and condition (angular frequencies 2/33, 2/5, 4/5, 4/3, 2, 3, 4) such that, for the ASD group, kinematics were more jerky compared to the CTRL group and the difference between groups increased with increasing angular frequency.

RESULTS: Submovements - Compared to the CTRL group, the ASD group, decomposed shapes into a greater number of submovements. This difference between groups increased with increasing angular frequency.

RESULTS: Speed - Compared to the CTRL group, the ASD group, moved faster. This difference between groups was only significant at higher angular frequencies.

For all conditions, speed was most predictive of jerk. However, for some conditions the second most important predictor was submovements, whereas for others it was the speed-curvature gradient.

SUMMARY: Together these results suggest that for autistic individuals jerky movements are primarily driven by moving atypically fast. However, the number of submovements and the gradient of the speed-curvature relationship also play a role, and vary in their importance depending on the shape of the movement trajectory. Consequently, these results suggest that helping autistic individuals to simply move more slowly (e.g. to support handwriting skill development) may not be enough to reduce kinematic jerk. Factors including the shape of the movement trajectory and how this relates to speed modulation (as a function of curvature) and the number of submovements, should also be considered.