Autistic and non-autistic individuals show comparable anticipation of visual targets: Results from the Autism Biomarkers Consortium for Clinical Trials (ABC-CT)

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Background

- In human vision, anticipating the location of a visual stimulus allows an individual to generate an eye-movement towards the stimulus more rapidly, increasing the efficiency of perception
- Saccade latency, the time it takes to initiate an eye-movement towards a stimulus after it appears, is a low-level index of anticipation
- Saccade latency has been used as a marker of differences in visual-attentional processing in autism spectrum disorders (ASD)
- Predictive skills of individuals with ASD may differ from TD individuals, and these differences may influence features associated with ASD
- There is mixed evidence regarding deficits in predictive processing in ASD

Hypotheses

1. Saccade latency will decrease as target number increases (i.e., participants will anticipate the targets and look faster to them as time goes on)
2. Autistic participants will be slower to look at targets overall as measured by overall block time when compared to non-autistic (TD) participants
3. Measures of saccade latency, changes in anticipation over time, and overall block time will correlate with clinical characteristics

Methods

Participants

Data collected in the Autism Biomarkers Consortium for Clinical Trials (ABC-CT)

Diagnostic Group	n (female)	Age in years (SD)	Full-Scale IQ (SD)
ASD	280 (65)	8.55 (1.65)	96.58 (18.11)
TD	119 (36)	8.51 (1.62)	115.12 (12.55)

Behavioral Data

- Diagnosis was confirmed via the Autism Diagnostic Observation Schedule 2nd Edition (ADOS), the Autism Diagnostic Interview (ADI), and clinician confirmation of DSM-5 criteria
- Adaptive behavior was determined using the Vineland Adaptive Behavior Inventory, face perception was determined using the NEPSY, and IQ was determined using the Differential Ability Scales (DAS)

Eye Tracking Data Collection

- Saccade latency data was collected as part of the ABC-CT eye tracking (ET) calibration procedure
- Data was collected using the SR Research Eyelink 1000 Plus binocular remote eye tracker at 500 Hz in EDF file format

Analyses

- Saccades were parsed using an online heuristic filter
- Saccade latency was calculated as the appearance of target minus the beginning of detected saccade
- Median saccade latency was calculated as the median of up to 5 latency values for each block (Figure 2a)
- Increases in anticipation (learning) across blocks were the slope of the best linear fit of the median saccade latencies (Figure 2c)
- Anticipation within blocks was measured as total time per block (Figure 2b)

Methods

Procedure

- Participants were presented with multiple identical fixation tasks (blocks) in which five targets were presented in a fixed order in the corners and center of the screen (Figure 1)
- Once the participant fixated on a target for ~200ms, the experimenter cued the next target

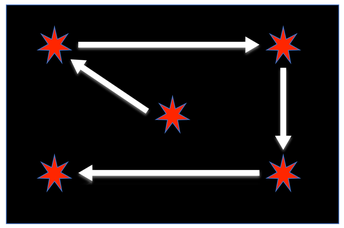

Figure 1. Example calibration screen with targets and arrows demonstrating order of presentation

Results

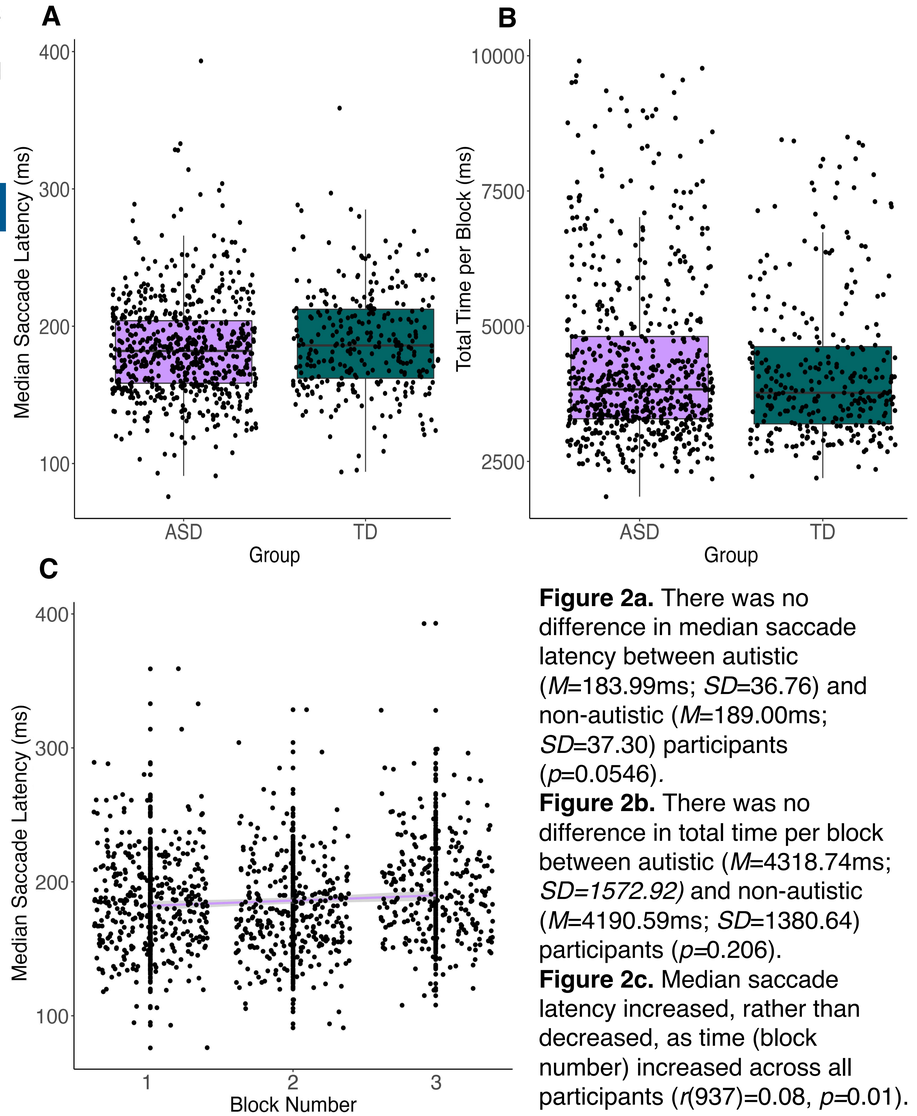

Figure 2a. There was no difference in median saccade latency between autistic (*M*=183.99ms; *SD*=36.76) and non-autistic (*M*=189.00ms; *SD*=37.30) participants (*p*=0.0546).

Figure 2b. There was no difference in total time per block between autistic (*M*=4318.74ms; *SD=1572.92)* and non-autistic (*M*=4190.59ms; *SD*=1380.64) participants (*p*=0.206).

Figure 2c. Median saccade latency increased, rather than decreased, as time (block number) increased across all participants (*r*(937)=0.08, *p*=0.01).

Results

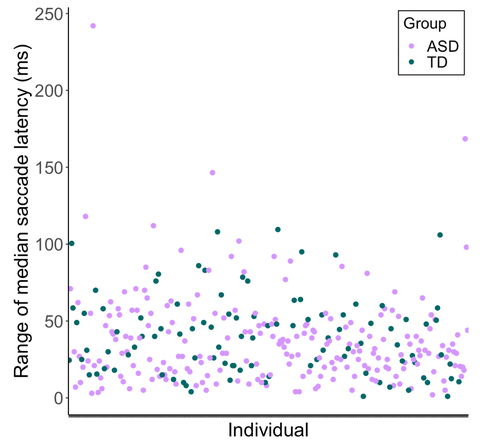

Figure 3. The range of each participant's median saccade latencies (ms) across their calibration blocks

There was widespread individual variability among both autistic and non-autistic participants in saccade latency.

Saccade latency variability did not correlate with adaptive behavior (Vineland Composite score): ASD: *r*(216)=0.121, *p*=0.075; TD: *r*(96)=-0.056, *p*=0.582, or with autism characteristics (ADOS severity score): ASD: *r*(217)=-0.004, *p*=0.953; TD: *r*(97)=-0.030, *p*=0.767, or with IQ: ASD: *r*(217)=0.035, *p*=0.608; TD: *r*(97)=-0.0699, *p*=0.492.

Median saccade latency variability correlated with face recognition (NEPSY score) ASD: *r*(211)=0.135, *p*=0.0485; TD: *r*(97)=0.228, *p*=0.0231.

Conclusions

- No differences in saccade latency or total block time between ASD and TD groups indicate that in this measure of prediction, groups did not differ
- Median saccade latency increased, rather than decreased over time for both diagnostic groups suggesting participants were not learning to anticipate targets. This may also indicate fatigue
- Substantial individual variability of median saccade latencies across blocks was not related to diagnostic status or cognitive ability
- Results align with previous research hypothesizing that differences in saccade latency to social information reflect prioritization of social information rather than low-level differences in visual attention

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