

Attention Allocation during Visual Search in ASD: Results from the ABC-CT Feasibility Study

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Introduction

- Eye-tracking measures show promise as a biomarker paradigm [1], and Visual Search tasks have been used to examine the perceived salience of social vs nonsocial stimuli in people with ASD [2]
- Children with ASD attend less to social vs nonsocial stimuli than typically developing peers [3]
- Visual exploration strategies (e.g., # targets looked at) are associated with individual differences in social impairment and repetitive/restrictive behaviors [4]
- Visual Search may mirror changes in ASD symptomatology in young children

Objectives

1. Determine whether visual search performance can reveal reliable differences between children with ASD and TD controls
2. Examine relations between visual search and ASD symptomatology

Method

- Visual Search (VS) paradigm adapted from prior research [2]
- 20 second viewing/trial; 6 trials
- Eye movements recorded with Eyelink 1000 plus

Dependent Measures

Visual Engagement	% looking = onscreen looking time/total trial length; % target= target looking time/onscreen looking time
Visual Exploration	# objects looked at during trial
Perseveration	Looking time (MS) to each individual object
Detail Orientation	# fixations directed to each individual object

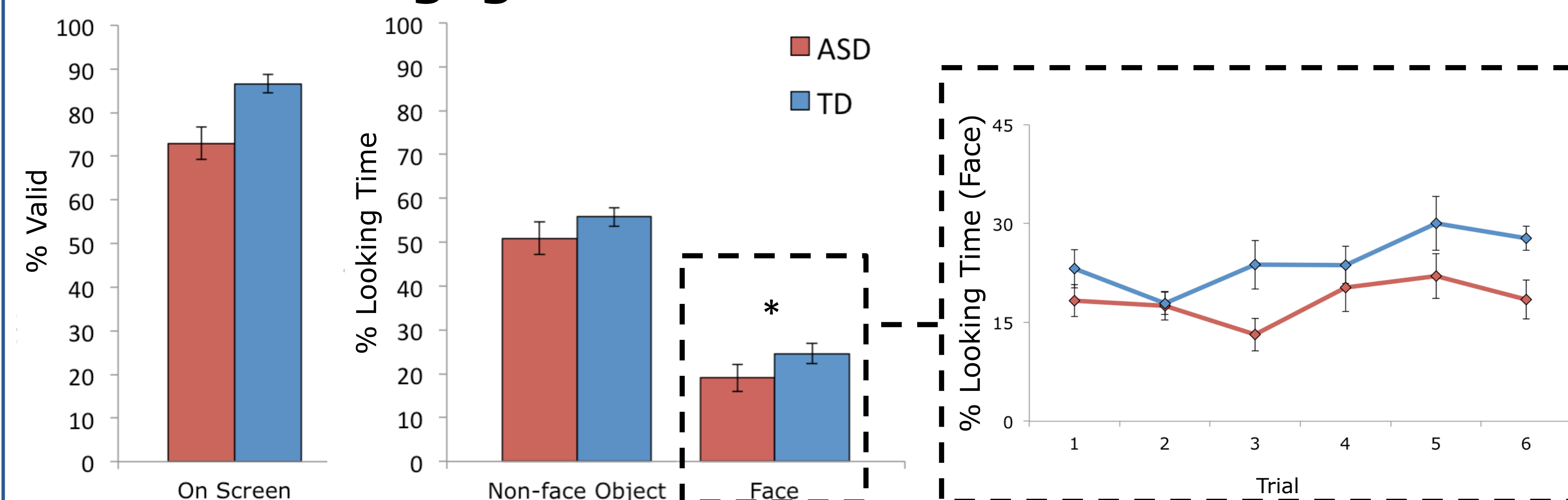
Participants

Data were collected as part of the ABC-CT Feasibility study, which included 51 participants. 46 provided usable data from the VS paradigm.

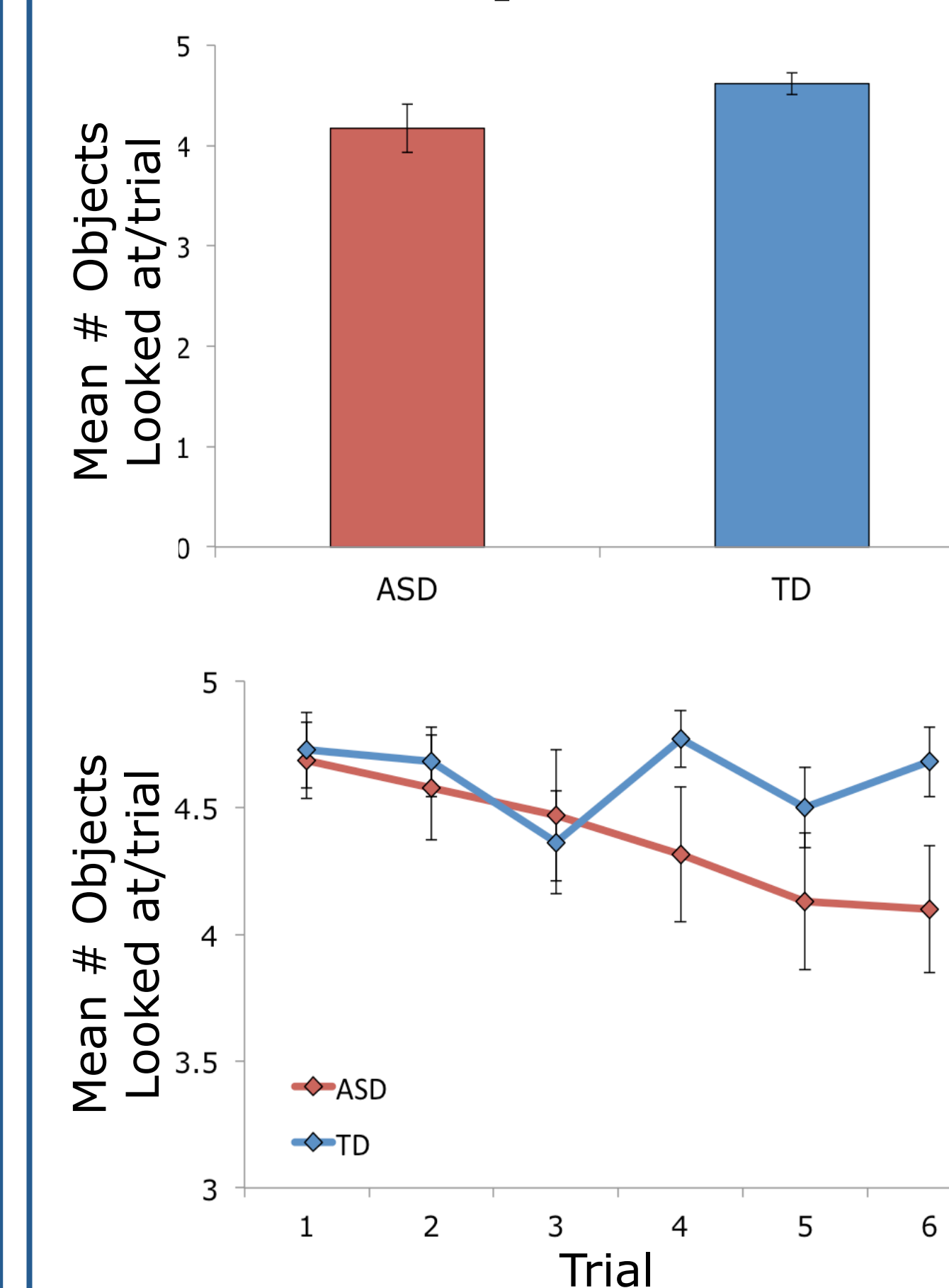
	ASD (n = 23; 18 M)	TD (n = 23; 13 M)	t	p
Age	8.01 (2.23)	6.66 (1.95)	1.95	0.056
ADOS CSS ¹	7.73 (1.64)	1.19 (0.42)	19.76	<0.001
Full Scale IQ	91.27 (19.14)	114.08 (9.34)	5.46	<0.001
Verbal IQ	89.54 (1.21)	115.23 (13.79)	5.22	<0.001
Nonverbal IQ	93.08 (18.69)	111.04 (8.03)	4.50	<0.001
Communication Std Score ²	77.50 (13.43)	111.27 (14.27)	8.59	<0.001
Socialization Std Score ²	75.21 (11.02)	103.58 (12.18)	8.61	<0.001

¹ADOS Calibrated Severity Score; ²Vineland Adaptive Behavior Scales

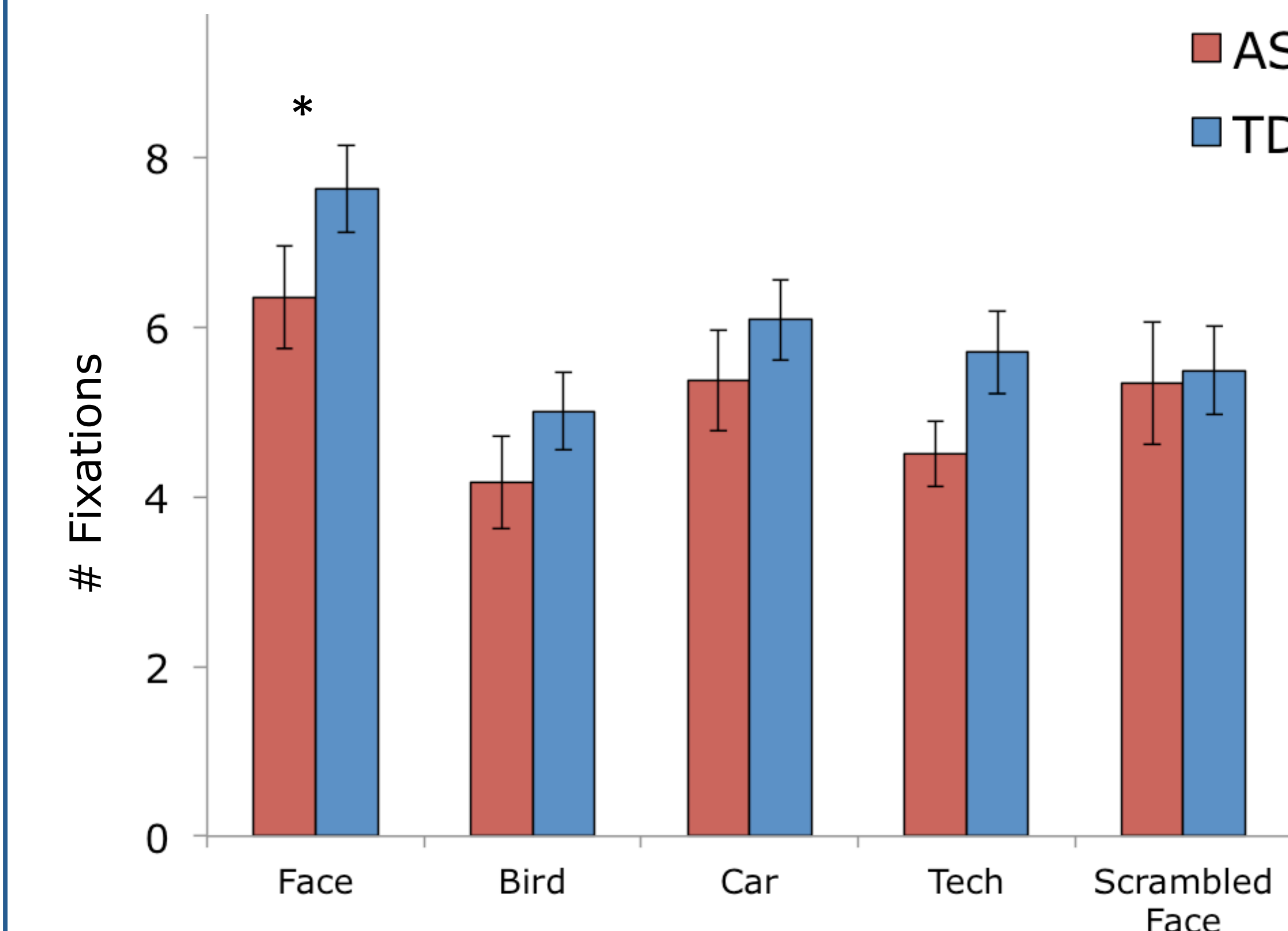
Visual Engagement for Faces Attenuated in ASD



Visual exploration does not differ by DX

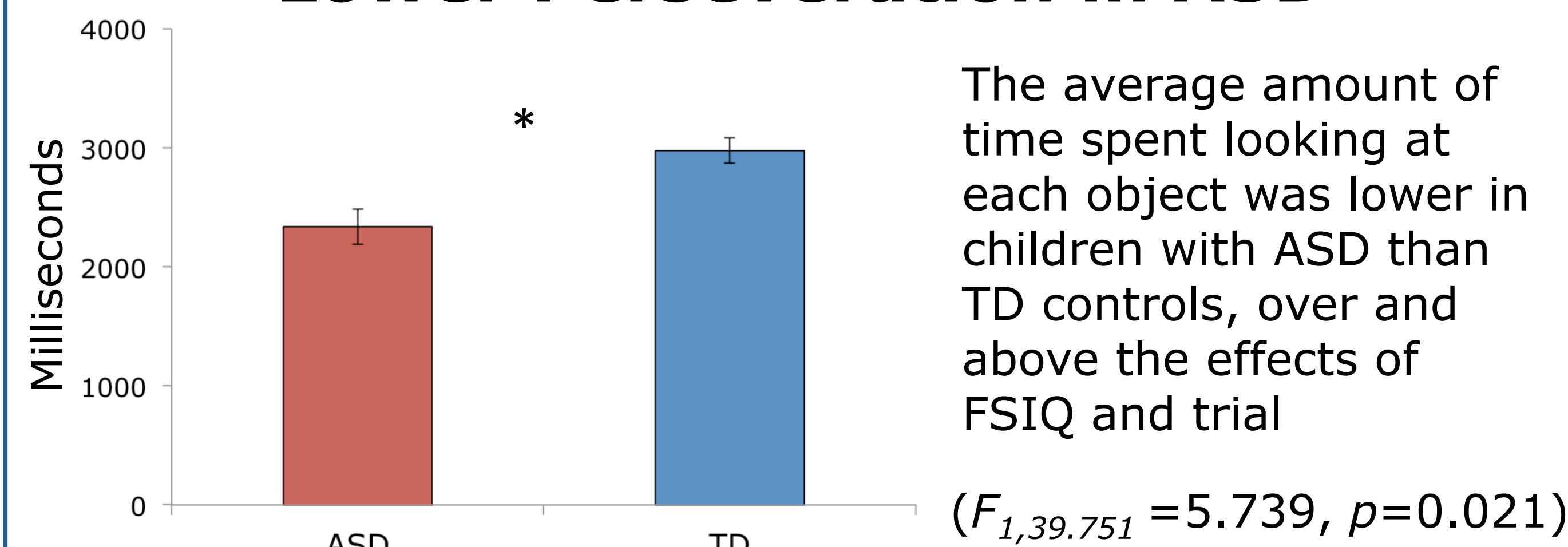


Detail Orientation to Faces Lower in ASD



Children with ASD made significantly fewer fixations to faces than TD controls over and above the effects of trial and FSIQ ($F_{1, 36.861} = 6.027, p = 0.019$). However, children with ASD and TD controls were comparable in the number of fixations directed to other non-social object targets.

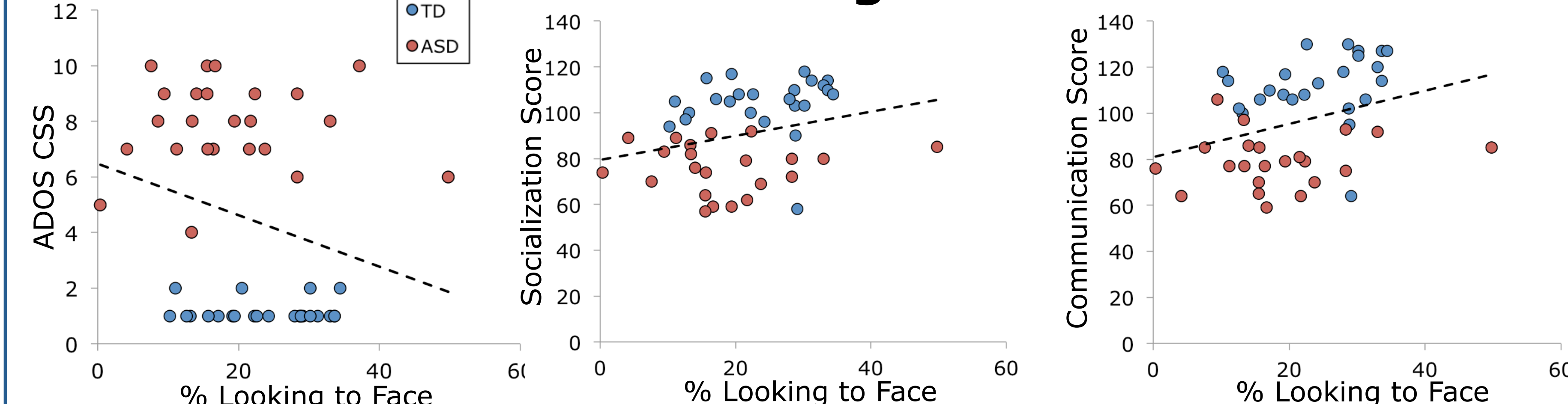
Lower Perseveration in ASD



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Looking to Faces Predicts Symptom Severity and Functioning Level



Given that IQ is correlated with symptom severity and social communicative functioning [5], we examined the associations between visual engagement by faces and ADOS CSS and Vineland Socialization and Communication Scores, independent of intelligence, across all participants. Partialling out the effect of FSIQ, greater looking to the face target was correlated with lower symptom severity ($r = -0.484, p = 0.001$), and better adaptive communication ($r = 0.522, p < 0.001$) and socialization skills ($r = 0.399, p = 0.007$). Significance in correlations did not hold for ASD or TD group separately.

Discussion

- Similar to prior work [1,3], faces captured and held less attention in children with ASD. Children with ASD also perseverated less on each target. Reduced detail orientation for faces, but not non-social targets suggest a specific deficit in social attention.
- Children with ASD and TD did not differ in visual exploration nor in task engagement, suggesting that between-group differences are not attributed to overall task performance. VS is sensitive to differences in social attention between DX groups.
- Associations between attention to faces and functional social/communication skills and symptom severity across all participants recapitulate expected group differences; nonetheless, VS indexes relevant domains of social communicative functioning.
- VS performance may objectively address changes in social functioning or treatment response in clinical trials.

References

[1] Loth, E., Charman, T., Mason, L., Tillmann, J., Jones, E. J., Woodriddle, C., ... & Banaschewski, T. (2017). [2] Gliga, T., Elsabbagh, M., Andravizou, A., & Johnson, M. (2009). *Infancy*, 14(5), 550-562. Molecular autism, 8(1), 24. [3] Frazier, T. W., Klingemier, E. W., Beukemann, M., Speer, L., Markowitz, L., Parikh, S., ... & Ahuja, V. (2016). *Journal of the American Academy of Child & Adolescent Psychiatry*, 55(4), 301-309. [4] Sasson, N. J., Turner-Brown, L. M., Holtzclaw, T. N., Lam, K. S., & Bodfish, J. W. (2008). *Autism Research*, 1(1), 31-42. [5] Kenworthy, L., Case, L., Harms, M. B., Martin, A., & Wallace, G. L. (2010). *Journal of autism and developmental disorders*, 40(4), 416-423.

