

INTRODUCTION

- Two tasks of dynamic attention with differing levels of social content were compared between groups of autistic & non-autistic persons divided by mental age (MA)
- Unique social attention (attention to eyes, faces, and bodies) styles are thought to contribute to the criteria associated with a diagnosis of autism.^{1,2}
- On the biological motion (BM) task, generally considered to reflect social processing, autistic children display more errors & longer response times (RTs),^{3,5,6} although performance improves during adolescence^{4,7}
 - These improvements are thought to reflect compensatory strategies, with evidence of processing differences on BM tasks between autistic and non-autistic individuals^{6,8}
- Among autistic persons, the link between BM performance and IQ has led to suggestions that higher-order cognitive skills are essential to their processing^{11,13}
- Among non-autistic persons, the lack of association between BM and IQ has led to suggestions that task performance is processed automatically, using social elements to guide the accuracy of responses^{9,10}

- On the multiple object tracking (MOT) task, thought to reflect non-social processing, comparisons of autistic and non-autistic individuals provide mixed evidence¹⁵
- MOT performance is associated with IQ for both autistic and non-autistic groups, suggesting cognitive mechanisms are used in dynamic, non-social perception for both^{16,17}

STUDY GOAL

Examine performance on social (BM) and non-social (MOT) attention tasks in relation to MA and IQ among autistic and non-autistic children and teens

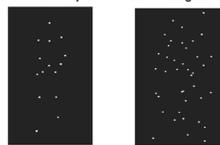
PARTICIPANTS

- The participants included 34 autistic children (29 boys, 4 girls, 1 transgender, $M_{years} = 13.21$, $SD = 3.94$), and 34 non-autistic children (20 boys, 14 girls, $M_{years} = 10.21$, $SD = 2.43$).
- The participants were matched by MA (Autistic: $MMA = 11.02$, $SD = 3.46$; Nonautistic: $MMA = 11.04$, $SD = 3.48$) and were split into younger and older MA groups according to the median MA of 11 years.

METHOD

1. 3D Biological Motion Task²⁰

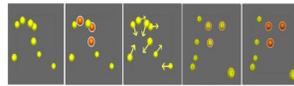
Performance: the average number of distractor dots through which participants can accurately determine walking direction



a. Dots indicate whether the point-light walker moves in left or right direction
b. Number of noise dots increased after correct responses and decreased after incorrect response.

2. 3D Multiple Object Tracking Task²¹

Performance: the maximum speed that participants can track three of eight spheres (i.e., the speed threshold).



a. Eight yellow balls appear on screen; b. Three balls turn red and then return to yellow; c. The balls begin to move, and participants simultaneously track the three previously highlighted balls; d. participants indicate which balls were highlighted. Balls speed up with correct trials

3. Wechsler Abbreviated Scale of Intelligence - Second Edition (WASI-II)^{23,24}



The WASI-II was used to measure cognitive skills. Four subtests make up the full-scale intelligence quotient (FSIQ) score. Two non-verbal subtests (Block Design & Matrix Reasoning) comprise the Perceptual Reasoning Index (PRI) score.

RESULT

Figure 1: Biological Motion Scores

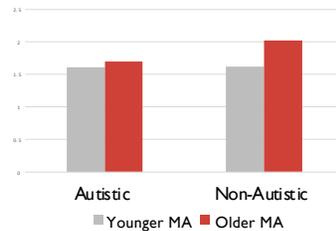
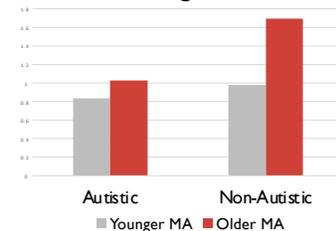


Figure 2: Multiple Object Tracking Scores



Biological Motion (Fig. 1)

- The older MA participants performed better than the lower MA participants, ($F(1,64) = 4.66$, $p=.04$)

Multiple Object Tracking (Fig. 2)

- The nonautistic participants performed better than the autistic participants ($F(,64)=12.33$, $p<.001$)
- The older MA participants performed better than the lower MA participants ($F(1,64)=15.31$, $p<.001$).
- A diagnostic group x MA group interaction ($F(1,64)=5.10$, $p=.027$) indicated that diagnostic group differences were primarily present in the older MA group

Correlations with Cognitive Measures (Table 1)

- Autistic group:** MOT and BM correlated with IQ measures
- Non-Autistic Group:** Only MOT correlated with IQ measures

Table 1: Correlations: PRI & FSIQ with BM and MOT

	PRI		FSIQ	
	Nonautistic	Autistic	Nonautistic	Autistic
BM	0.177	.477**	0.088	.467**
Sig. (0.05)	$p = .318$	$p = .004$	$p = .622$	$p = .005$
MOT	.467**	.456**	0.322	.352**
Sig. (0.05)	$p = .005$	$p = .007$	$p = .063$	$p = .041$

CONCLUSION

- BM was associated with IQ only for autistic persons
- MOT performance differences emerged between the autistic and nonautistic groups in higher MA
- IQ was associated with MOT performance for both groups
- On the MOT autistic and non-autistic participants are suggested to have processed the task in a cognitive manner, whereas on the BM, only the autistic participants appeared to process the task in a cognitive manner
- Consistent with theories of social attention, the autistic participants appeared to use other higher-order cognitive strategies on the BM task, whereas the non-autistic participants are suggested to have automatically processed the social elements of the BM task⁸
- These results reflect an attention style among autistic persons which is suggested to deliberately recruit higher-order cognitive attention strategies on social and non-social attention tasks^{8,23}

REFERENCES

- Feld-Yar, T., Kliberg, L., Portugal, A. M., & Thorpe, E. (2023). Social attention: Developmental foundations and relevance for autism spectrum disorder. *Biological Psychiatry*, 94(1), 8-17. <https://doi.org/10.1016/j.biopsych.2022.09.035>
- Parkes, M. A. (2012). Biological motion processing as a hallmark of social cognition. *Cerebral Cortex*, 22(5), 961-975. <https://doi.org/10.1093/cercor/bhr145>
- Federer, A., Parma, V., Vicovaro, M., Radassi, L., Carrarini, L., & Rosone, L. (2020). Anomalous perception of biological motion in autism: A conceptual review and meta-analysis. *Scientific Reports*, 10(1), 4674. <https://doi.org/10.1038/s41598-020-61232-3>
- Todorova, G. K., Haxton, R. E. M., & Pollick, F. E. (2019). Biological motion perception in autism spectrum disorder: A meta-analysis. *Motivation and Emotion*, 43(4), 585-600. <https://doi.org/10.1002/emo.2209>
- Sogin, A. P., Cook, J., & Blakemore, S. J. (2010). Unaffected perceptual thresholds for biological and non-biological form-from-motion perception in autism spectrum conditions. *PLoS ONE*, 5(10), e13991. <https://doi.org/10.1371/journal.pone.0013991>
- van Boissel, J. A., & Lu, H. (2013). A predictive coding perspective on autism spectrum disorders. *Frontiers in Psychology*, 4, Article 19. <https://doi.org/10.3389/fpsyg.2013.00019>
- McKay, L. S., Simons, D. J., & Moore, P. (2012). Do distinct atypical cortical networks process biological motion information in adults with Autism Spectrum Disorder? *NeuroImage*, 59(2), 1524-1533. <https://doi.org/10.1016/j.neuroimage.2011.08.033>
- Rutherford, M. D., & Trope, N. F. (2012). IQ predicts biological motion perception in autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 42(10), 2005-2015. <https://doi.org/10.1007/s10803-011-1240-2>
- Trope, N. F. (2008). Biological motion perception. In A. Bazerman (Ed.), *The senses: A comprehensive reference* (pp. 231-238). Oxford: Elsevier.
- Chang, D. H., & Trope, N. F. (2009). Characterizing global and local mechanisms in biological motion perception. *Journal of Vision*, 9(5), 1-10. <https://doi.org/10.1167/9.5.8>
- Engle, V., Saldouk, H., Khan, Z., Ling, S., & Rutherford, M. D. (2023). Distinct biological motion perception in autism spectrum disorder: A meta-analysis. *Journal of Autism and Developmental Disorders*, 53(11), 4843-4860. <https://doi.org/10.1007/s10803-021-05352-7>
- van der Hellen, P. A. (2016). A cognitive architecture account of the visual local advantage phenomenon in autism spectrum disorders. *Vision Research*, 126, 278-290. <https://doi.org/10.1016/j.visres.2016.04.004>
- Trope, N. F., & Westcott, C. (2004). The inversion effect in biological motion perception: evidence for a "life detector". *Current Biology*, 14(8), 821-824. <https://doi.org/10.1016/j.cub.2004.03.022>
- Mosconi, L., Dawson, M., Swanson, L., Habel, S., & Baron-Cohen, S. (2006). Enhanced perceptual functioning in autism: An update, and eight principles of autistic perception. *Journal of Autism and Developmental Disorders*, 36(1), 57-63. <https://doi.org/10.1007/s10803-005-0949-0>
- Scherf, K. S., Luna, B., Kinch, R., Minshew, N., & Behrmann, M. (2008). Missing the big picture: Impaired development of global shape processing in autism. *Autism Research: Official Journal of the International Society for Autism Research*, 1(2), 114-129. <https://doi.org/10.1002/aur.17>
- Koldewyk, K., Weigelt, S., Kanwisher, N., & Jiang, Y. (2011). Multiple object tracking in autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 41(10), 1394-1405. <https://doi.org/10.1007/s10803-011-1194-4>
- Tullo, D., Lavry, B., Faubert, J., & Bertone, A. (2024). Characterizing attention resource capacity in autism: A multiple object tracking study. *Journal of Autism and Developmental Disorders*, 54(8), 2852-2875. <https://doi.org/10.1007/s10803-023-05974-z>
- Wang, P., Brady, M., Fitzgerald, M., & Trope, N. F. (2009). No evidence for impaired perception of biological motion in adults with autistic spectrum disorders. *Neuropsychologia*, 47(14), 3225-3235.
- Langille, L., Gazith, A., Whitham, M., Meyerhoff, H. S., & Fosshee, J. (2023). The impact of audio-visual, visual and auditory cues on multiple object tracking performance in children with autism. *Perceptual and Motor Skills*, 130(5), 2047-2068. <https://doi.org/10.1177/00131445231187894>
- Johansson, G. (1973). Visual perception of biological motion and a model for its analysis. *Perception & Psychophysics*, 14(2), 201-211. <https://doi.org/10.3758/BF03121278>
- Pringle, Z. W., & Storm, R. W. (1988). Tracking multiple independent targets: Evidence for a parallel tracking mechanism. *Spatial Vision*, 3(3), 179-197. <https://doi.org/10.1163/156858888001022>
- Wechsler, D. (2011). *Wechsler Abbreviated Scale of Intelligence—Second Edition (WASI-II)* (Database record). APA PsycTests.
- Miller, J. C., Raines, J. M., & Jowkar, M. S. (2022). The missing piece in block design tasks: Resolving performance differences elicited by design with identical stimulus parameters. *Attention, Perception, & Psychophysics*, 84(2), 616-624. <https://doi.org/10.3758/s13414-021-02149-8>
- Rutherford, M. D. (2013). Evidence for specialized perception of animate motions. In M. D. Rutherford & V. A. Kuhlmeier (Eds.), *Social perception: Detection and interpretation of emotion, agency, and intention* (pp. 115-138). Boston.
- Palliciano, E., Burr, D. (2012). When the world becomes "too real": A Bayesian explanation of autistic perception. *Trends Cogn. Sci. (Reg. Ed.)*, 16, 304-310. <https://doi.org/10.1016/j.tics.2012.10.004>