Is there a social motion preference in autistic adults?

Magdalena Matyjek[1,2], Nico Bast[3], Salvador Soto Faraco[2]

1 HUMBOLDT-UNIVERSITÄT ZU BERLIN

2 Universitat Pompeu Fabra Barcelona

3 GOETHE UNIVERSITÄT FRANKFURT AM MAIN

BACKGROUND & AIMS

- Autism is associated with attenuated social attention and sensory atypicalities [1].
- In comparison to neurotypical (NT) children, autistic (AUT) children look less at social (SOC) motion scenes and more at geometrical (GEO) ones [2]. Yet, it is unknown whether this imbalance persists into adulthood.
- The underlying mechanism may be the atypical assignment of saliency in sensory processing [2], as indexed by the pupil responses (reflecting the activity of locus coeruleus) [3,4].
- We tested (behavioural) looking preference and saliency assignment (pupil responses) for SOC vs. GEO motion in AUT and NT adults.

HYPOTHESES

AUT and NT would differ in the relative:

Hyp. 1: looking preference

Hyp. 2: pupil responses

so that: $(SOC_{NT} - GEO_{NT}) > (SOC_{AUT} - GEO_{AUT})$

METHODS

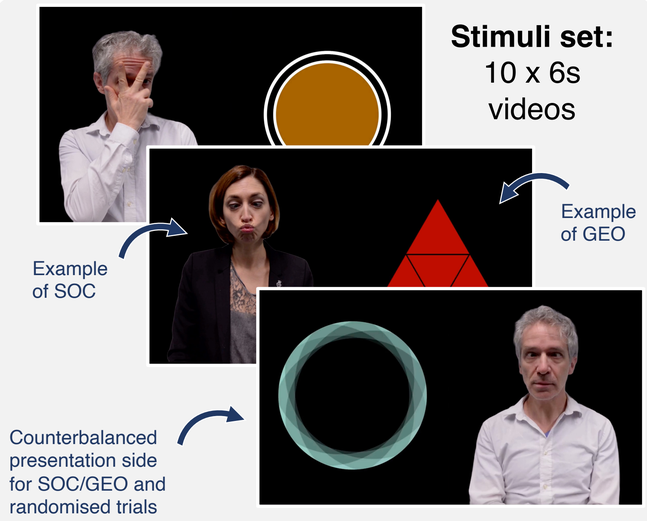
SAMPLE

- N = 66, 34 NT and 32 AUT
- M age = 20 (SD = 10.4), no group difference
- 34 F, 27 M, 5 Other, no group difference

EYE TRACKING

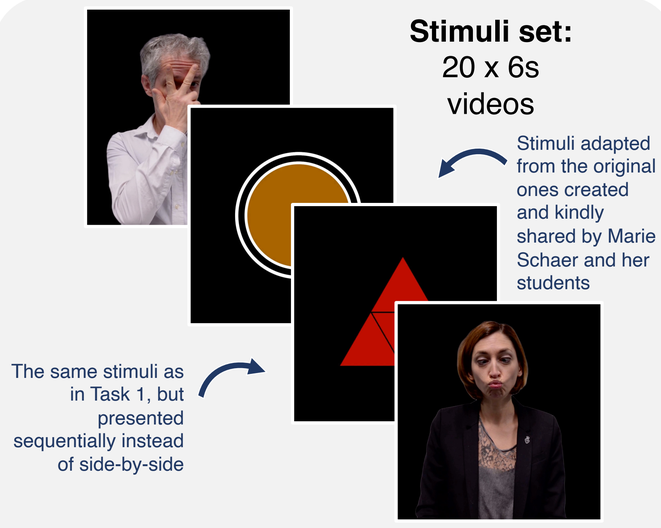
- Eye tracker: Tobii Pro Spectrum, no chinrest
- Binocular recording at 120 Hz
- 5-point calibration

TASK 1: looking preference



Measurement:
Looking preference (SOC/SOC+GEO)

TASK 2: pupil responses



Measurement:
Pupil response

RESULTS

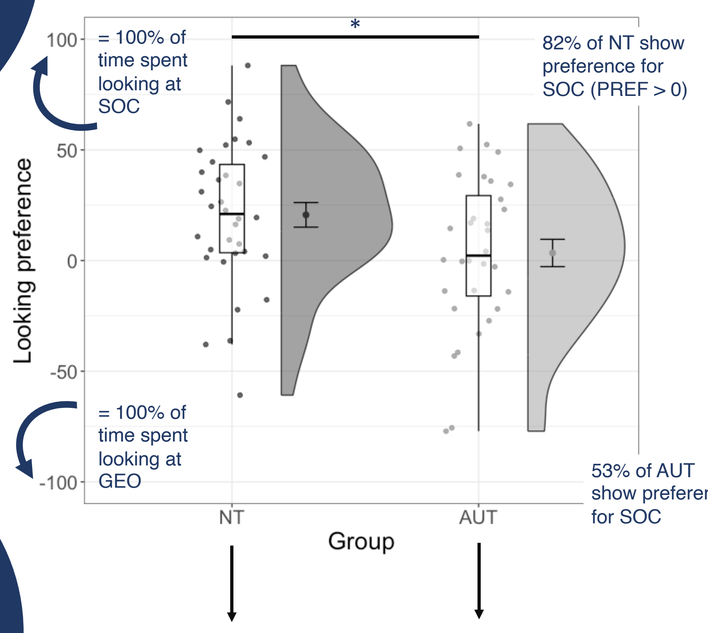
PLANNED ANALYSES

Preregistration:

TASK 1: LOOKING PREFERENCE

Model:
preference ~ group + (1|subject) + (1|trial)

Behavioural looking preference per group



$t(339) = 8.10$, $p_{corr} < .001$

$t(319) = 1.17$, $p_{corr} = .88$

Posthoc t-tests per group (mu = 0)

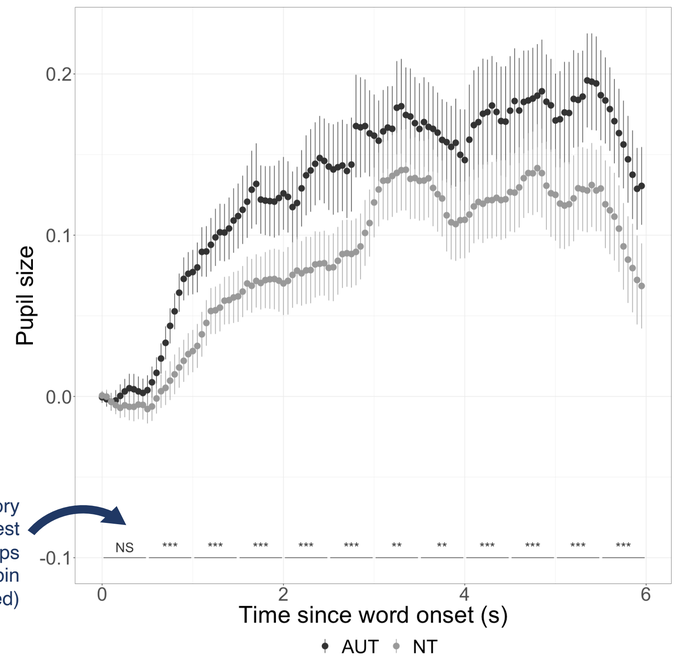
TASK 2: PUPIL RESPONSE

Relative pupil size (difference between SOC and GEO)

Time course of pupil response modelled with 3rd order orthogonal polynomials

Model:
Pupil(SOC-GEO) ~ poly(time,3)*group + luminance + contrast + (poly(time,3)|subject)

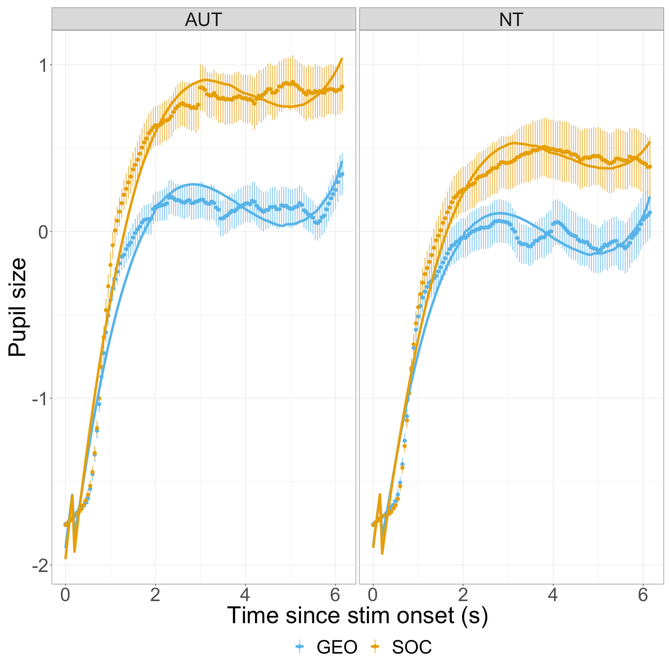
Relative pupil response over time per group



Confirmatory post-hoc t-test between groups per 0.5s bin (Holm corrected)

The model yielded a group effect on the cubic term (group*time^3 interaction) [b = -0.8, $t(66)$ = -2.3, p = .03]

Pupil response per group and condition



A model with absolute condition responses yielded a group*condition interaction [b = -0.18, $t(16103)$ = -18.6, $p < .001$] and 3-way interactions of group, condition, and all three time terms (all $p < .006$)

The neurotypical group shows a clear preference for social motion, while the autistic group does not show any looking preference on a group level.

While both groups showed a larger pupil response to SOC than GEO, the shape of the relative difference between pupil responses in the two conditions is different between the groups: AUT dilate pupils faster to SOC than NTs, and this difference persists over time (at least up to 6s).

Preprint:

EXPLORATORY ANALYSIS

Because larger pupil sizes in AUT vs. NT for SOC were an unpredicted result, we further tested whether this effect could be explained by **social anxiety traits** (measured with Liebowitz Social Anxiety Scale; LSAS [5]):

pupil ~ poly(bin,3)*group*__LSAS__ + luminance + contrast + (poly(bin,3)|ID)

LSAS was not significant as main effect, nor did it have a significant effect on any other term in the model (all $p > .25$). Bayes Factors revealed overwhelming evidence in favour of the model without social anxiety (BF10 > 100).

So: the larger pupil sizes for SOC in AUT than NT cannot be explained by social anxiety traits.

DISCUSSION

Looking preference

Autistic and non-autistic adults differ in their looking preference for social and geometrical motion. While the non-autistic group shows a strong preference for the social motion, there is no clear preference for either motion type in the autistic group.

Saliency of social and geometrical motion

Social motion seems to be perceived as more salient (as measured by pupillary responses) by both groups. However, the pupil in the autistic group dilated faster and stronger for this type of motion, which could not be explained by social anxiety traits. It is possible that this difference indexes increased effort for processing of social motion in autists.

Conclusion

Social motion preference (or lack thereof) might be a potential autism marker, even in adulthood.

Responsible autism research

- Inviting feedback and suggestions from the autism community
- Accommodating for sensory needs (additional lab space, adjustable lighting, precise timings and agenda, encouraging the use of sensory toys)
- Community events (Social Impact grant: “Building bridges for autism”)

Literature

[1] Chita-Tegmark, M. (2016). Social attention in ASD: A review and meta-analysis of eye-tracking studies. Research in Developmental Disabilities, 48,79–93.
[2] Polzer, L., Freitag, C. M., & Bast, N. (2022). Pupillometric measures of altered stimulus-evoked locus coeruleus-norepinephrine activity explain attenuated social attention in preschoolers with autism spectrum disorder. Autism Research, 15(11).
[3] Joshi, S., Li, Y., Kalwani, R. M., & Gold, J. I. (2016). Relationships between pupil diameter and neuronal activity in the locus coeruleus, colliculi, and cingulate cortex. Neuron, 89, 221–234.
[4] McBurney-Lin, J., Lu, J., Zuo, Y., & Yang, H. (2019). Locus coeruleusnorepinephrine modulation of sensory processing and perception: A focused review. Neuroscience and Biobehavioral Reviews, 105, 190–199.
[5] Liebowitz, M. R., Gorman, J. M., Fyer, A. J., & Klein, D. F. (1985). Social Phobia: Review of a Neglected Anxiety Disorder. Archives of General Psychiatry, 42(7), 729–736.

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 945380.