Using Mobile Technology to Assess a Phenotypic Measure of Autism in a Large Cohort of Children from India and Malawi

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1. Introduction

Social attention emerges early in life and shapes cognitive and emotional development. Typically, children prefer attending to social (e.g., faces) over non-social (e.g., objects) stimuli. Reduced **social preference** is an early and reliable marker of **Autism Spectrum Conditions (ASC).** However, existing benchmarks of social preference across the **early childhood period** are largely derived from high-income, high-resource countries.

We used a scalable tablet-based **Preferential Looking Task (PLT)** with **N=3,920** children (0-6 years) from **Delhi, India** and **Blantyre, Malawi** to examine how social preference varies by age and sex. We aim to inform culturally relevant benchmarks of social preference and improve the global applicability of PLTs as an early ASC screening tool.

Questions

1. What are the early childhood (0-6 years) norms for social preference by age and sex in India and Malawi?
2. Do social preference scores discriminate children with Autism Spectrum Conditions (ASC) in this sample?

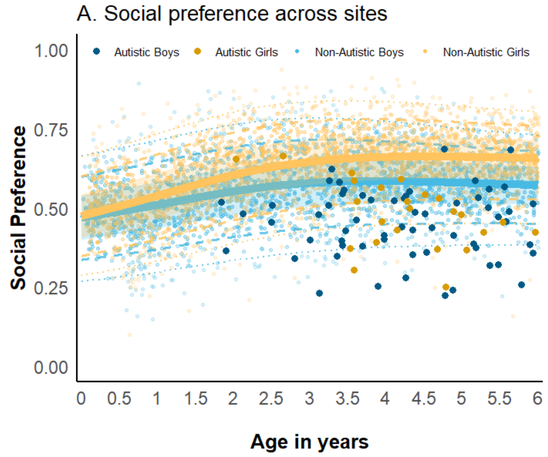
2. Methods

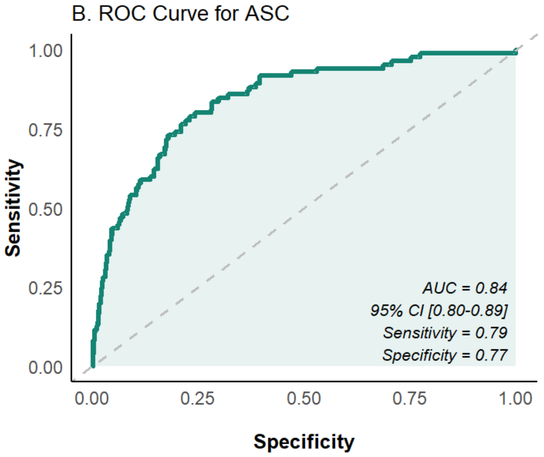
We assessed social preference using a **tablet-based PLT** from the **STREAM** project (Williams et al., 2024). Children viewed side-by-side, **culturally relevant** social and non-social videos (Fig. 1). The child's face was recorded via the tablet's front camera to quantify looking time towards each stimulus type.

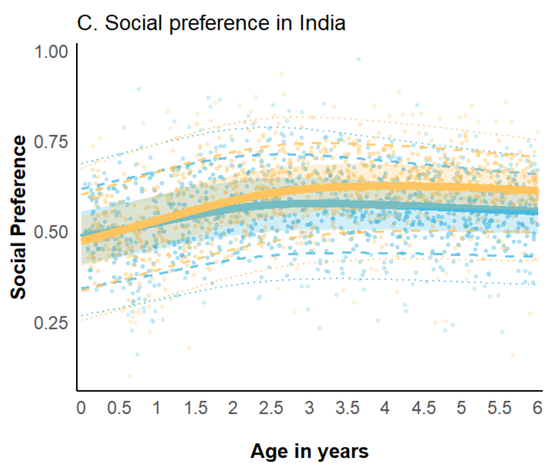
Figure 1

Data Analysis

- Videos were processed using an artificial neural network model (Dubey et al., 2022; Chitnis et al., 2024) to extract face and eye features and classify gaze as directed at the social or non-social stimuli
- Social preference was calculated as: $\left(\frac{Total\ frames\ with\ gaze\ on\ social\ stimuli}{Total\ frames\ with\ gaze\ on\ either\ stimuli}\right)$
- Generalised Additive Models for Location, Scale, and Shape (GAMLSS) derived age-adjusted z-scores
- We tested age, sex, and country effects: $lm(Social\ Preference \sim Sex * Country * Age)$
- A Receiver Operating Characteristic (ROC) analysis evaluated the ability of social preference scores to distinguish children with and without ASC







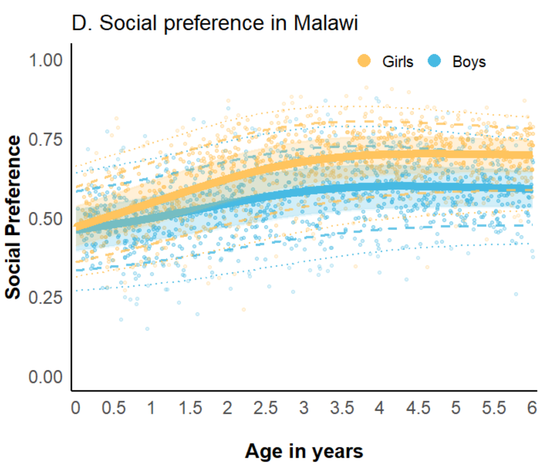


Figure 2. (A) Scatterplot showing the distribution of social preference scores across **both** sites (India and Malawi). **(B)** Receiver Operating Characteristic (ROC) Curve illustrating the ability of social preference scores to discriminate ASC from non-ASC. **(C)** Scatterplot of social preference scores for India only. **(D)** Scatterplot of social preference scores for Malawi only. In panels **(A)**, **(C)**, and **(D)**, boys are shown in **blue** and girls in **yellow**.

N	India		Malawi		Total
	Boys	***Girls***	***Boys***	***Girls***	
ASC	45	21	16	3	85
Non-ASC	940	926	996	973	3835
Total	985	947	1012	976	3920

3. Results

- Social preference increased non-linearly with age, **rising between 1-2.5 years, then plateauing** (Fig. 2A)
- **Sex * Age** interaction: **boys plateaued earlier than girls** (***β*** < -0.001, ***p*** < 0.001)
- Greater **sex** difference in **Malawi** vs. India (***β*** = -0.38, ***p*** = 0.002)
- Greater **age**-related increases in **Malawi** (***β*** < 0.001, ***p*** < 0.001, Figs. 2C-D)
- ROC analysis (Fig. 2B): Social preference discriminated ASC from non-ASC with ***good*** **accuracy** (**AUC** = 0.84, **95% CI** [0.90, 0.89], **sensitivity** = 0.79, **specificity** = 0.77)

4. Conclusions

- Social attentional bias emerges early in this large and diverse sample
- Developmental trajectories are generalisable across two understudied cultures, with clear sex differences
- Scalable PLTs reliably distinguish children with and without ASC in these settings
- Accounting for age and sex will improve the sensitivity of social preference as a screening measure in identifying autistic children

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References