

Racial Bias in the ADOS: Comparison of DIF and MNLFA Among More Than 11,000 Participants from NDAR and SSC



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1. Background

- Racial bias in autistic diagnostic tools may impede accuracy in diagnostic assessment.
- Statistical methods can identify which items function differently for different races.
- Moderated nonlinear factor analysis (MNLFA) accounts for multilevel data (e.g., ADOS modules), offering an advantage over traditional differential item functioning (DIF) analyses.
- 3 studies have identified small amounts of racial or sex bias in a few ADOS items using samples n=600-2500^{1,2,3}.

2. Sample Characteristics

Data	White	Black	Asian	Total
SSC	2164	110	111	2385
NDAR	8680	1754	598	11032
Mod. 1	2579	917	294	3790
Mod. 2	1739	318	148	2205
Mod. 3	4393	457	184	5034
Mod. 4	2133	172	83	2388
	10844	1864	709	13417

3. DIF Model Design

- Fit a 2-factor model (SA: Social Affect & RRB: Restricted/Repetitive Behavior) to 10 ADOS algorithm items common across 4 modules.
- Bias quantified as **Expected Score Standardized Differences**, interpretable as Cohen's *d*.

$$ES_{si} = \sum_{k=1}^m P_{ik}(\theta) X_{ik}, ESSD_i = \frac{\overline{ES_F} - \overline{ES_R}}{SD_{ItemPooled}}$$

Figure 1: Items indicating least to most DIF

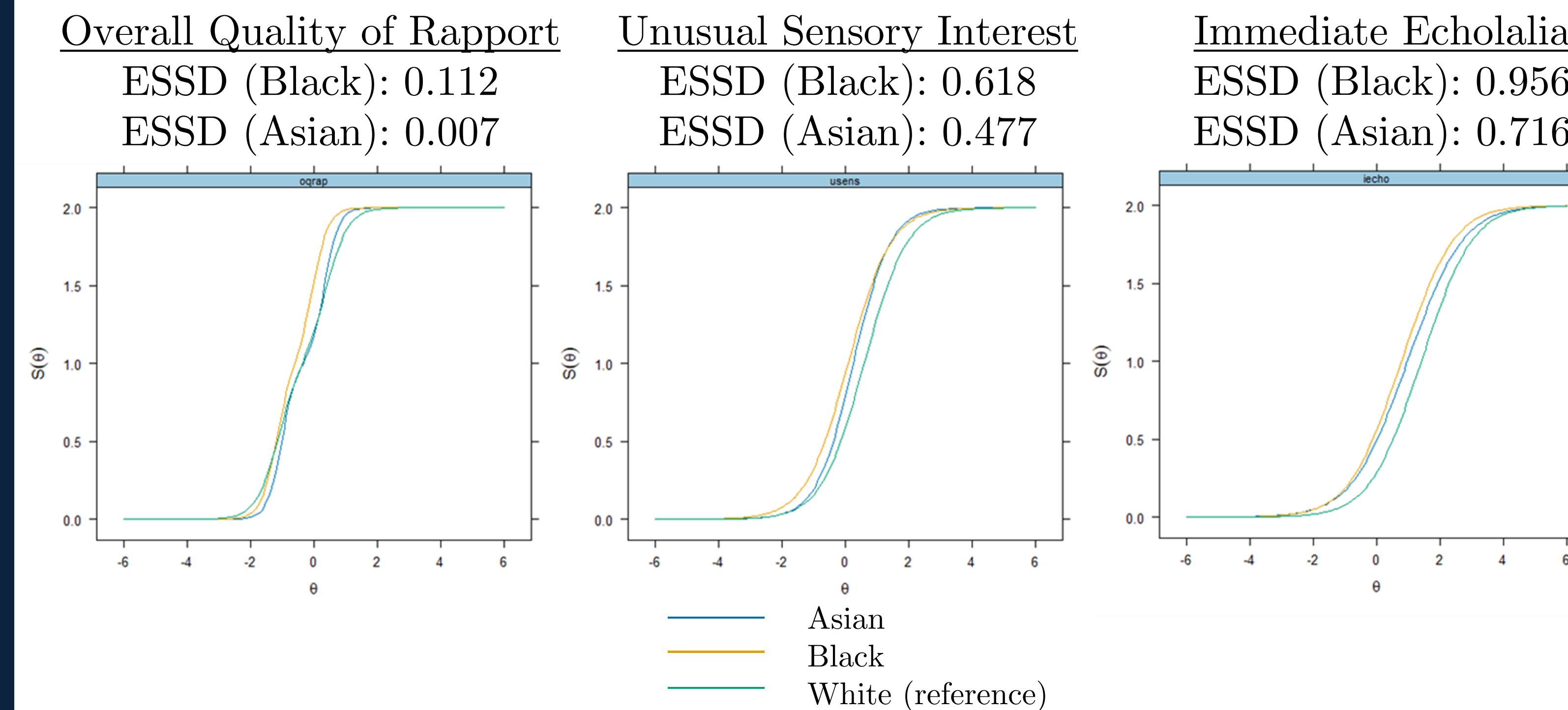
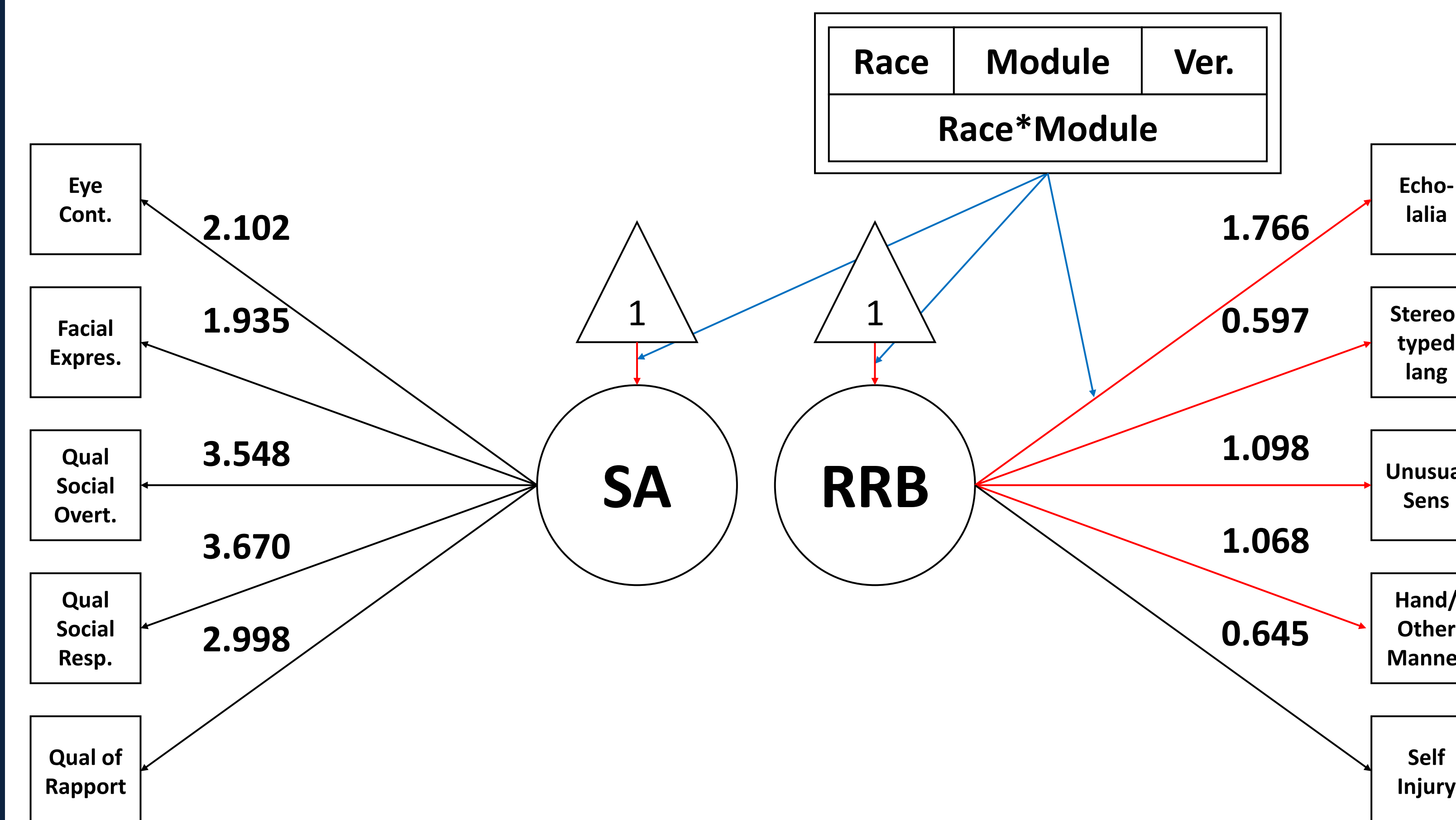


Figure 2: Illustrative MNLFA model with covariates moderating factor means and loadings (blue lines = moderating effects, red lines = effects receiving sig. moderation)



Scan the QR code for additional tables and figures.

[1] Harrison et al., 2017. *JADD* [2] Kalb et al., 2022. *JAMA Network Open* [3] Yu et al, under review

4. DIF Results

- Black participants were
 - strongly overscored on echolalia
 - moderately overscored on unusual sensory interest, and on hand/other mannerisms
 - moderately underscored on eye contact.
- Asian participants were **moderately overscored** in echolalia, unusual sensory interest, self injury, and stereotyped language.

5. MNLFA Results

- Compared to White:
 - Black participants** were
 - 0.367 higher on SA factor means
 - 0.497 higher on RRB factor means
 - Most overscored in Module 4
 - Asian participants** were
 - 0.434 higher on SA factor means
 - 0.340 higher on RRB factor means
 - Most overscored on Module 2
- There were large moderating effects of version and module on factor means.

6. Discussion

- Accumulating evidence that Black (and now Asian) participants are overscored on ADOS items: stereotyped language^{1,2} & echolalia¹.
- Our results of underscoring eye contact item contradicts previous analysis (overscoring¹).
- New overscoring identified on sensory and mannerisms items for Black participants, and self-injury for Asian participants.
- Data should not be combined across versions and modules without multilevel handling.