Background and Research Question
- Phonological processing deficit is a hallmark of Autism Spectrum Disorder (ASD).1
- The left arcuate fasciculus (AF) has been linked with poor phonological awareness and reading skills.2
- It is yet unclear whether, or how, this translates to children with ASD.
- Research Question: Is neuroanatomical deviation in white-matter associated with phonological deficits in children with ASD? If so, how do such structural anomalies affect children’s reading ability?

Methods
- Participants: The two groups did not differ significantly based on age, IQ, and gender ratio.

<table>
<thead>
<tr>
<th>Group</th>
<th>Age (mean±SD)</th>
<th>IQ (mean±SD)</th>
<th>Gender ratio (F:M)</th>
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<tbody>
<tr>
<td>ASD (26)</td>
<td>11.27(3.43)</td>
<td>108.7(15.02)</td>
<td>0.37</td>
</tr>
<tr>
<td>TD (20)</td>
<td>10.33(3.57)</td>
<td>110.15(14.27)</td>
<td>0.43</td>
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</table>
- Imaging: T1-weighted anatomical and diffusion-weighted images were acquired on a Siemens Tim Trio scanner.
- Behavior: Tests of phonology ( Comprehensive Test of Phonological Processing; CTOPP and Children’s Test of Nonword Repetition; CNRep ) and reading ( Test of Word Reading Efficiency; TOWRE).

Analysis
- Imaging: All images were corrected for eddy currents and motion registered to the subjects’ T1 and MNIs; and used to generate maps of Fractional Anisotropy (FA). TRACULA was used to reconstruct white matter pathways.
- Behavior: A phonological ability score was calculated as the average of z-scores from CTOPP and CNRep.
- A) Are there structural differences in language-related white-matter tracts between TD and ASD groups?
- B) Are structural differences between TD and ASD related to phonological ability?
- C) Are the relationships between structure and behavior distinct between TD and ASD?

Results
- A) Average FA was significantly higher in the TD group compared to the ASD group in left ILF (FDR-p=0.043), left SLFP (FDR-p=0.043), and right AF (FDR-p=0.043).
- B) Overall, average FA values in all four tracts correlated with phonological ability. In ASD, average FA in in left ILF (ρ=0.39, p=0.028), left AF (ρ=0.36, p=0.033), right ILF (ρ=0.39, p=0.025) correlated with phonological ability. In TD, none of the tracts correlated with phonological ability.
- C) In ASD, participants with higher-than-median FA in right ILF scored higher on the TOWRE assessment. In TD, participants with higher-than-median FA in left AF scored higher on the TOWRE assessment. Right ILF did not relate with behavior in TD and left AF did not relate with behavior in ASD.

Conclusion and Discussion
- A) The ASD group exhibits lower FA in left AF, left SLFP and bilateral ILF compared to TD.
- B) All four language tracts are associated with phonological ability. However, only the ASD group showed significant positive correlation between the tract FA values and phonological ability.
- C) Reading ability is further associated with the FA values of right ILF in ASD and the FA values of left AF in TD.
- Overall: White-matter structural abnormalities, especially in the right ILF, is associated with phonological and reading deficits in children with ASD.

References

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