

Supplementary Information

Lateralization of dorsal fiber tract targeting Broca's area concurs with language skills during development

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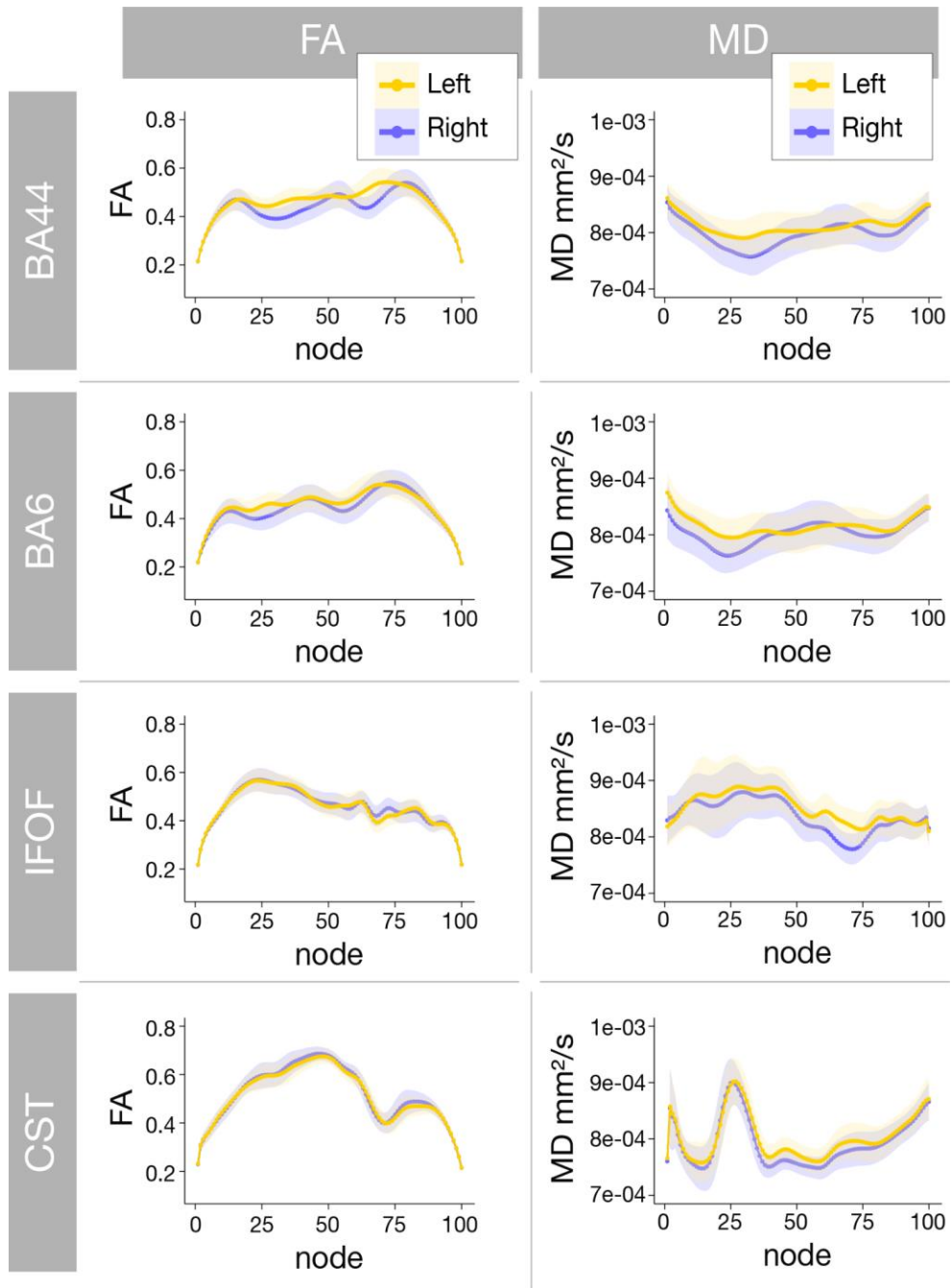


Figure S1: Microstructural diffusion MRI parameters along each tract per hemisphere. The filled areas indicate the respective standard deviations.

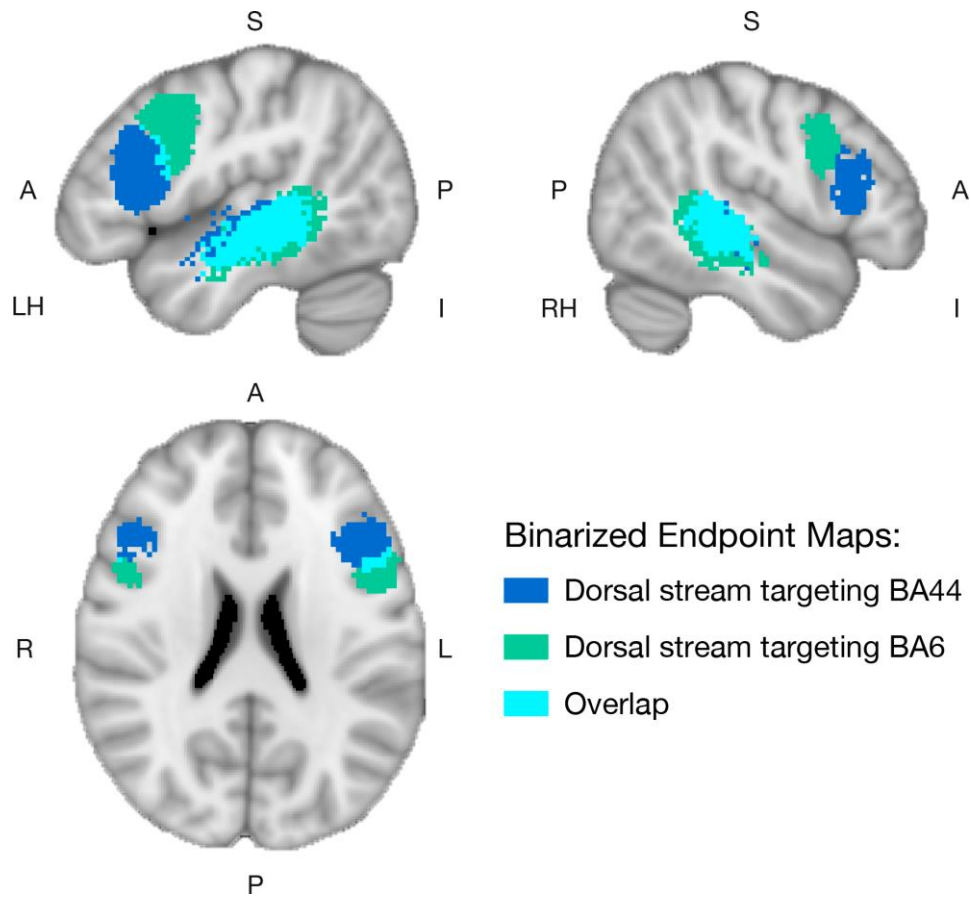


Figure S2: Frontal and temporal projection points of dorsal language tracts.

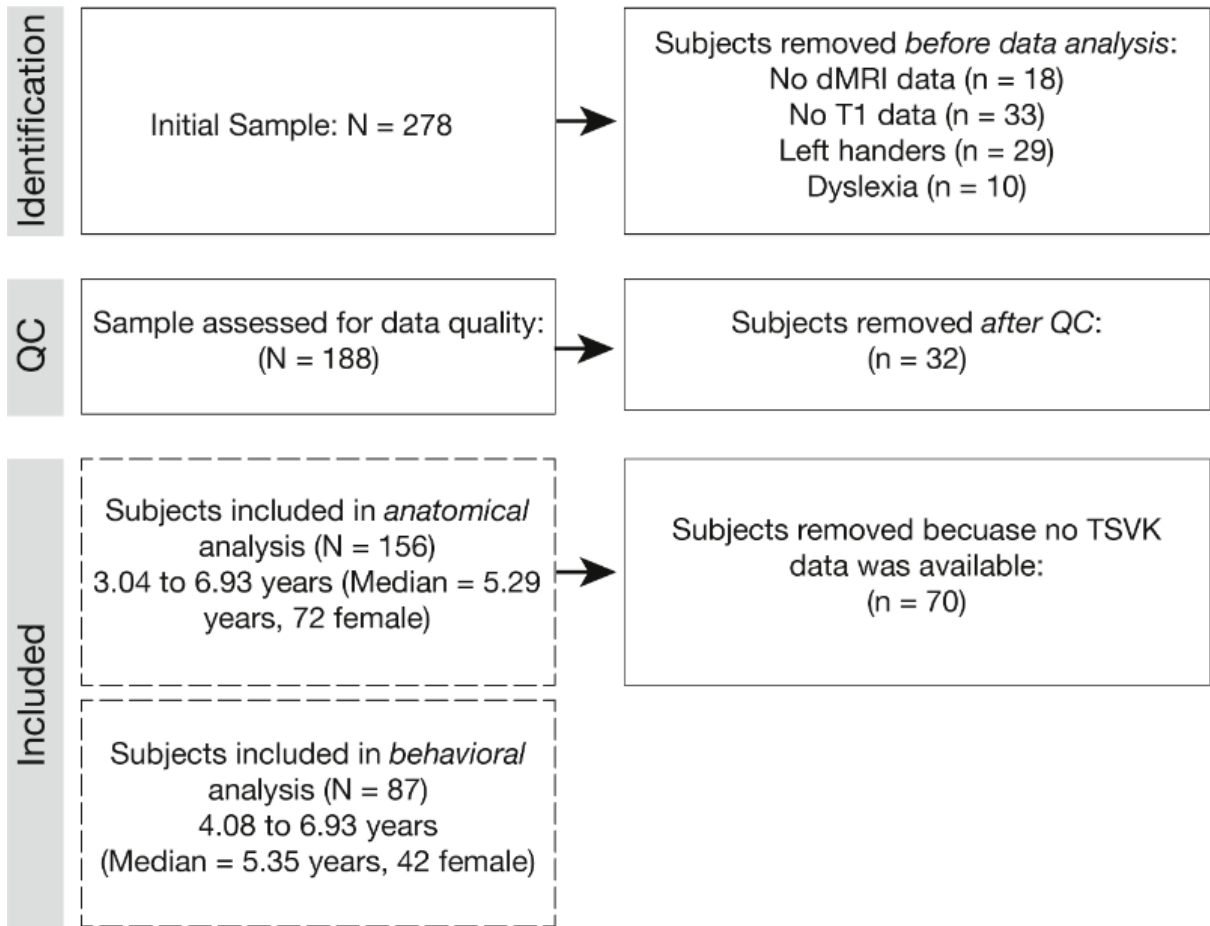


Figure S3: Graphical summary of the subject inclusion procedure.

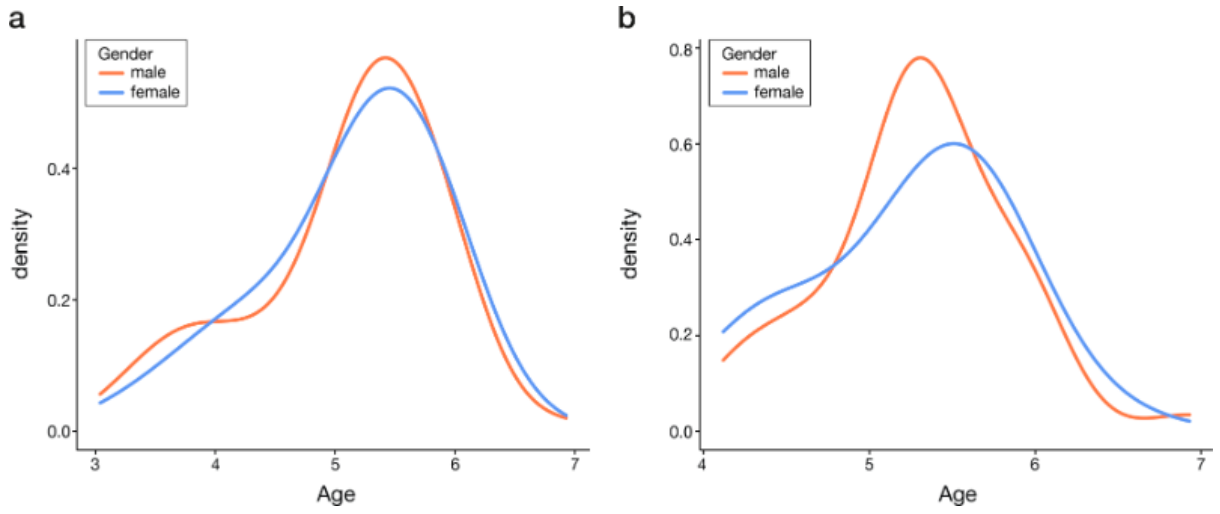


Figure. S4: (a) Age distribution of the initial sample of considered subjects. (b) Age distribution of the final sample of included subjects

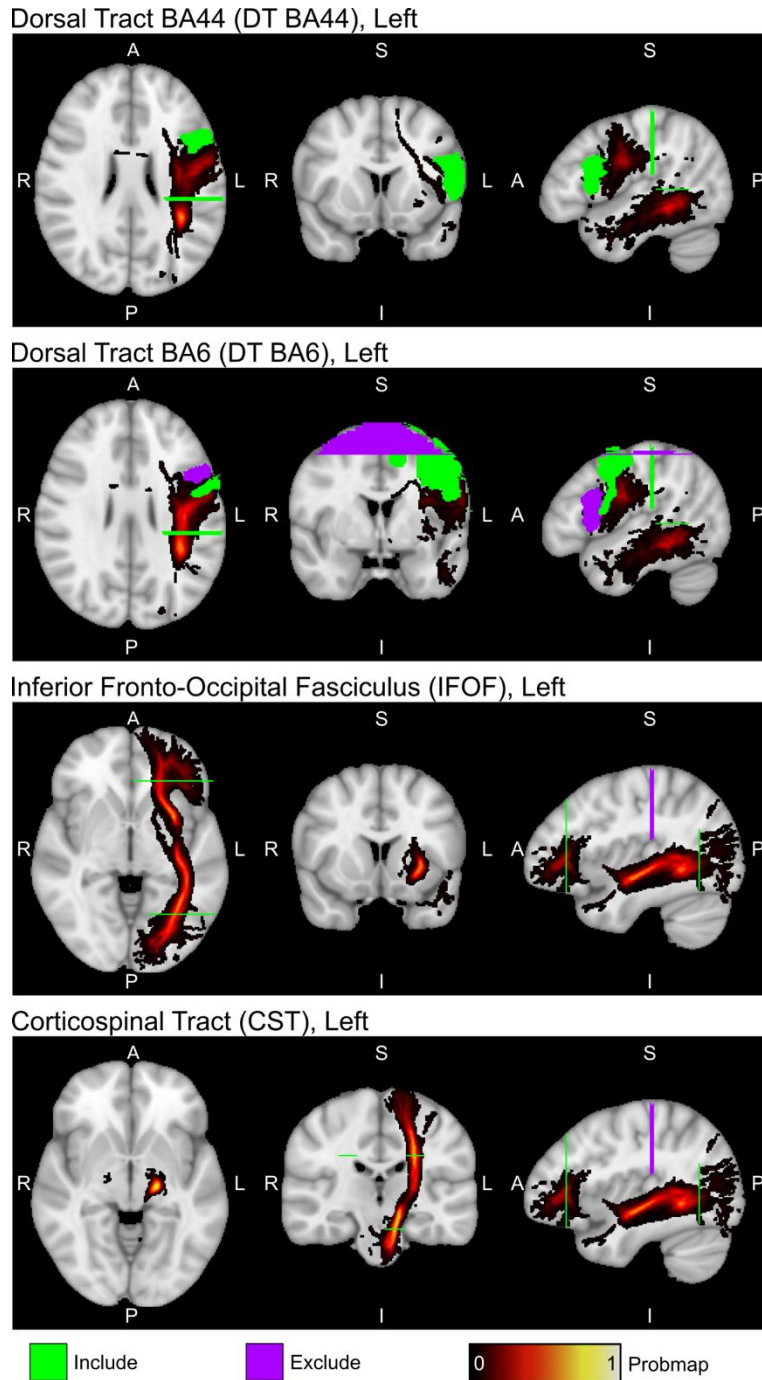
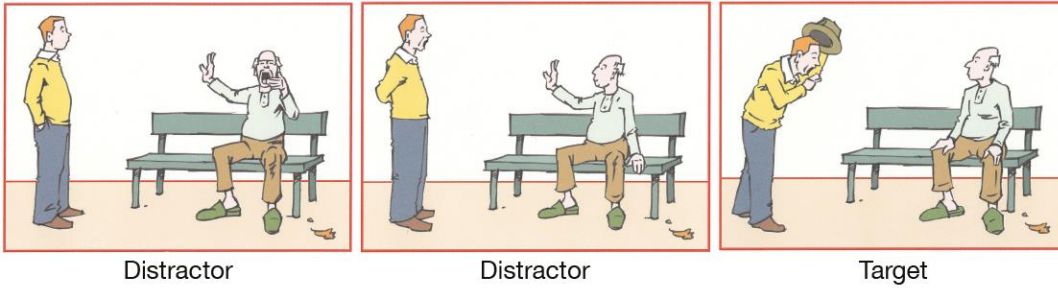


Figure S5: Tractography inclusion and exclusion regions for all tracts within the focus of this study. All tractography recipes are based on the original implementation in pyAFQ, leveraging a combination of predefined inclusion/exclusion masks, in combination with a whole tract probabilistic map. The recipes for the dorsal BA44 and BA6 tracts were based on the arcuate fasciculus implementation from pyAFQ. In contrast to the pyAFQ implementation, the dorsal BA44 tract utilized an additional BA44 inclusion mask. The dorsal BA6 tract was reconstructed using an additional inclusion mask in BA6, as well as additional exclusion masks in BA44 and the projections of the CST. The remaining fascicles were reconstructed using the previously published pyAFQ recipes. For simplicity, only the left respective tracts are displayed in this figure.

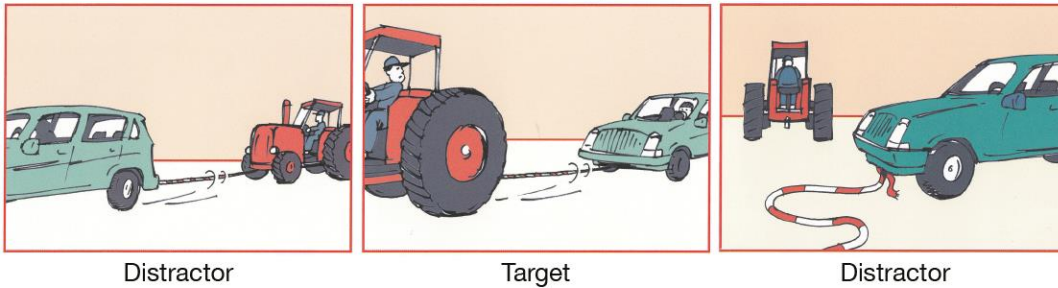


Figure S6: Exemplary Tractography-Based Inclusion/Exclusion Criteria. Subject exclusions due to poor tractography quality were mainly related to faulty reconstructions of the dorsal pathway. **Top:** Correct dorsal pathway reconstructions for both tracts, targeting BA6 and BA44. In all cases, the dorsal path takes the characteristic turn into the temporal lobe and frontally connects both BA6 and BA44 as two separate tracts. **Center:** The example tracts were rejected due to an incorrect pathway, leaving the main characteristic curve (see encircled segment). **Bottom:** The example tracts were rejected as they do not entail specific and separate endings in either BA6 or BA44.

Den Opa grüßt der Mann, der gähnt. (The man who yawns greets the grandpa.)



Das Auto wird vom Traktor gezogen. (The car is pulled by the tractor.)



Der Junge isst die Möhre. (The boy eats the carrot.)

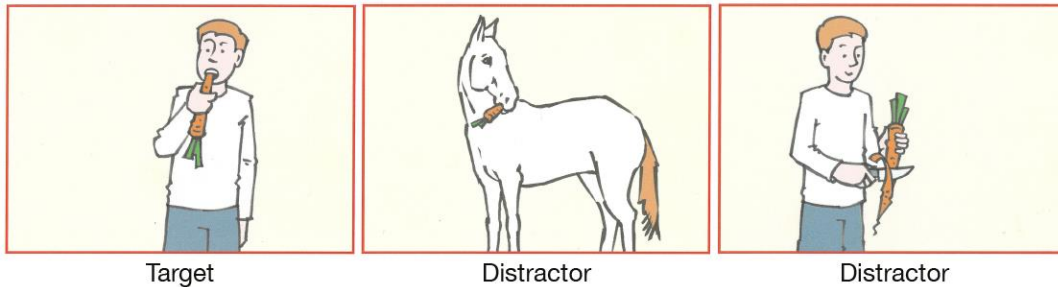


Figure S7: Exemplary sentences and pictures for the assessment of language development. Children are auditorily presented with a sentence and asked to choose one of three pictures. The target picture reflects the structure and content of the sentence, while the two distractor pictures differ in the displayed Actor-Patient-Relation (top: marked by case marking and center: marked by a passive construction) or can only be described by different content words (bottom). Source: Siegmüller et al., Test zum Satzverstehen von Kindern (TSVK), 1. Auflage 2010 © Elsevier GmbH, Urban & Fischer, München We are not liable or responsible for any claims by third parties.

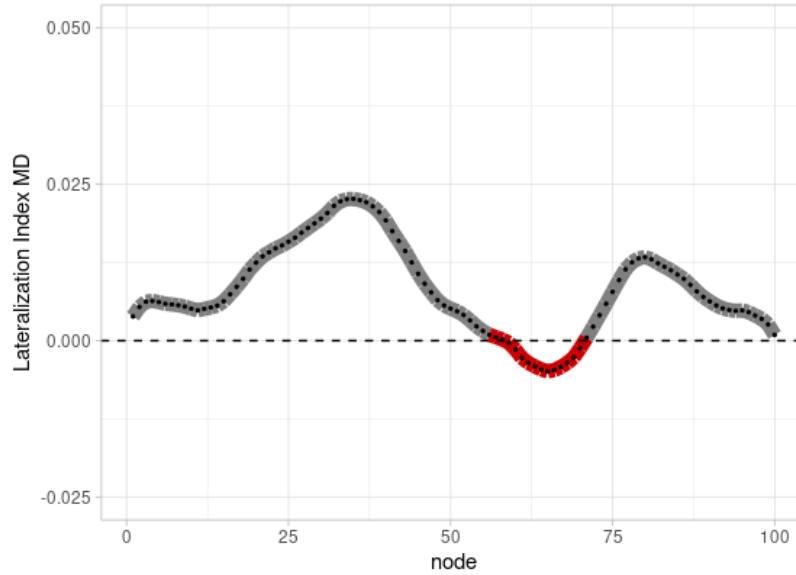


Figure S8. Significant effect of gender on microstructural lateralization. We find that mean diffusivity (MD) asymmetry in the horizontal part of the dorsal tract targeting BA44 is stronger in females compared to males.

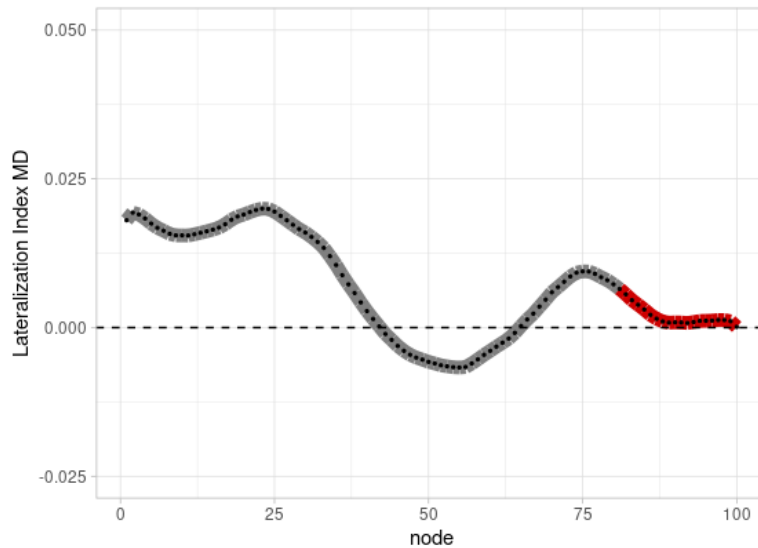
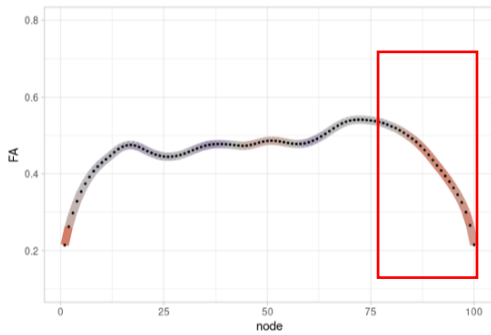


Figure S9. Significant partial correlation of handedness with microstructural lateralization in mean diffusivity (MD) in the posterior-vertical of the dorsal tract targeting BA6. We find a negative relation, meaning that higher handedness scores (the more consistently right-handed subjects were) were related to weaker MD lateralization in this part of the dorsal tract.

Correlation Profile:
Left dorsal tract targeting BA44
(FA X Language)



Correlation Profile:
Right dorsal tract targeting BA44
(FA X Language)

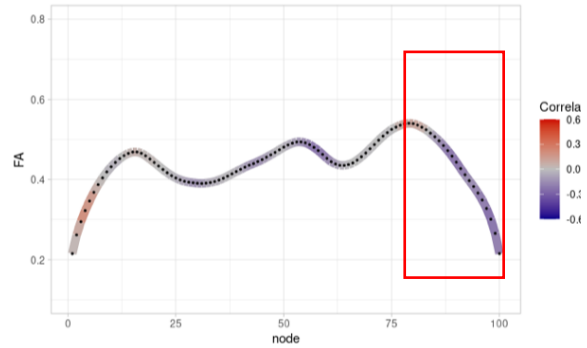


Figure S10. Descriptive hemispheric correlation profiles of language skills with fractional anisotropy (FA) in the left and right dorsal tract targeting BA44. In the region that showed a significant partial correlation of microstructural asymmetry with language (approximately red rectangle) we observed opposing, however non-significant, correlational patterns. The left dorsal tract targeting BA44 showed a positive relation of FA with language skills, while the right dorsal tract targeting BA44 showed a negative relation.