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LANGUAGE PATHWAYS IN HUMANS AND CHIMPANZEES

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Although chimpanzees raised in a human linguistic environment develop rudimentary symbolic capabilities, they fail to develop beyond the level of a 2-3 year old human child in this regard. Thus, there must be something fundamentally different about the human brain that allows human children to continue after chimpanzees stop. We are using diffusion tensor imaging (DTI) to investigate the hypothesis that the key difference resides in the pattern of white matter connectivity. DTI scans were acquired from 36 adult female chimpanzees, three post-mortem chimpanzee brains and a large sample of adult human males and females. A tract based spatial statistics (TBSS, FSL, */http://www.fmrib.ox.ac.uk/fsl/* analysis of white matter fractional anisotropy skeletons revealed widespread leftward asymmetry in fractional anisotropy in humans, particularly along long distance fascicles linking association cortices within a hemisphere such as the arcuate fasciculus language pathway, that was absent in chimpanzees. Examination of color maps of the principal diffusion eigenvector indicated widespread similarity between humans and chimpanzees in most brain regions, but marked differences in the region of the arcuate fasciculus. Finally, probabilistic tractography (Fdt toolbox, FSL, http://www.fmrib.ox.ac.uk/fsl/) was used to reconstruct the arcuate fasciculus in humans and chimpanzees, revealing a pathway that was relatively larger and that projected much further ventrally on the lateral surface of the temporal lobe in humans compared with chimpanzees. These results shed light on how the brain of our common ancestor with chimpanzees may have been modified in the human lineage to endow our species with the capacity for language,

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