

Brain lateralization.. and the emergence of language

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The question of the rules by which left hemisphere specialisation (HS) is established for language is connected to issues relating to the origins of language. The setting-up of cerebral asymmetries would have allowed the emergence of language in man and, for Crow, this lies at the origin of speciation. Exploration of the nature of the relationships between variability of the linguistic neural networks and HS, measured with anatomical and functional imaging allows to address the question of the relationships between the neural support for language, HS and the emergence of speech. Indeed, studies of aphasiology, pre-surgical exploration and intra-operative stimulation have shown a strong correlation between right-hand manual preference and LH dominance for language, but there are exceptions to this rule. Aphasias exist after lesions of the right hemisphere in right-handed subjects, as well as functional imaging observations of healthy subjects show in individuals rightward asymmetries during linguistic tasks. This variability provides a unique chance to access, in a differentiated way, the factors which govern the establishment of HS for language.

Motor theories of language state that the neural bases of language develop in the dominant hemisphere for motor control, which is the LH for right-handers, while, according to the perceptive theory of the origin of HS, language install itself in the LH because of the aptitude of this hemisphere to process fast temporal signals, which is indispensable for analysis of linguistic sounds.

We tested the relative influence of explanatory factors related to a motor origin of HS such as manual preference and of factors related to the processing of language sounds such as brain volume and the size of the left planum temporale (LPT, an auditory area, which is more developed on the left side in the general population). We showed that while handedness explained a large amount of variability during speech production, the brain volume and left PT surface best explained the variability measured during speech comprehension. These results support that speech comprehension and production areas are differentially explained by motor and perceptive theories of the origin of HS. Concerning the question of a genetic influence on language's HS, we have shown that a subject (right-handed or not) who has left-handers in his family (FS+), exhibits a reduction in the surface area of his LPT. This suggests that FS+ is accompanied by a smaller strength of HS, independently of personal handedness, suggesting that different genetic factors are involved for hand and language dominance.