For centuries, the apparent symmetry of the hemispheres of the brain stimulated speculations about the duality of mind or gradients of function in the planes of the three dimensions: front-to-back (Gall, Broca), left-to-right (Dax) and top-to-bottom (Jackson). Front-to-back has lost its appeal and top-to-bottom is canonical (albeit still contentious), leaving left-to-right as the currently hot topic in the arena of human frontier science.

Legend has it that Gall chose the frontal (supraorbital) part of the brain as the seat of the language instinct because certain verbose students of his acquaintance had protruding eyes. If true, the legend proves that the wildest of hunches occasionally is pregnant with consequences. In this case, the hunch was the existence of a fronto-occipital gradient of faculties subserved by the brain. Gall’s insight triggered the French anthropologist’s lively formulation of the Dax–Broca doctrine, conjoining Dax’s claim that the speech faculty resides in the left hemisphere with Broca’s originally limited claim that the language faculty resides in the frontal cortex. Dax and Broca arrived at their claims from consideration of patients with speech deficits after stroke or brain damage; on the basis of observations originally reported in 1836, Marc Dax claimed that aphasia invariably follows a left-hemisphere lesion.

The Dax–Broca doctrine was not generally accepted and was actively opposed by Hughlings Jackson. Yet, at the historic session of the British Association for the Advancement of Science in Norwich in 1868, Broca enjoyed the enthusiastic support of the audience. The contrary Jacksonian view of the organization of the brain (top-to-bottom) strangely reflected the social strata of Victorian society; it was no accident that Jackson had returned to London in 1859 to abandon medicine in favour of philosophy. His philosophical interests were sustained by his interest in epilepsy, stimulated by the ‘Jacksonian’ fits suffered by his wife. Likewise, Penfield’s classic works drew exclusively on evidence from patients undergoing surgery for focal cerebral seizures, in whom speech deficits were induced by electrical currents. In terms of left dominance, bilaterality and right dominance, the results of the Wada test showed that 90% of subjects were left dominant, 5% bilateral and 5% right dominant. In none of these cases could it be safely concluded that normal speech or language function depended exclusively on the activity of the damaged or excited regions, and it remained a problem that healthy brains could be differently organized.

In attempts to solve this conundrum by means of imaging, we now witness the return of the question of the left–right gradient to the debate of the origins and lateralization of the language faculty in healthy brains. The modern use of largely non-invasive methods of functional brain imaging in healthy volunteers has confirmed that language is a more fundamental faculty than speech, a faculty possessed even by the speechless. The brain regions involved in language perception and generation appear to be more numerous than is taught conventionally, and to include centres in cerebellum, primary and association auditory cortices, Broca’s area, striate cortex, and primary and supplementary motor cortices. The sensory speech area, so named by Wernicke, has eluded precise localization, and whether or not this centre occupies a confined cortical area remains a puzzle. Complex interaction among widely dispersed regions of cerebral cortex is also suggested by the findings that depression of activity occurs in regions not believed to be actively involved in language function. Therefore, the question of what is meant by language lateralization is most pertinent.

In this issue of Brain, Springer et al. cogently re-examine the question of how lateralized to the left hemisphere normal language processing really is. They test the hypothesis that the dominance distribution in healthy individuals is as reported for patients for whom the Wada test is de jure if not de facto the gold standard of laterality. In fact, in defiance of the hypothesis, the authors report that there are no right-hemisphere dominant normal subjects among right-handed individuals. The hypothesis, as expected, survived the test in patients with epilepsy, although more patients appeared to be in the bilateral category than predicted.

In the report, the definition of ‘dominance’ is a measured laterality index. This variable is, by application, continuous, because it is based on a statistical but nonetheless arbitrary cut-off of a continuously varying measurement (the blood oxygenation level-dependent magnetic resonance contrast). The interpretation of the continuous laterality index as dominance raises new questions, as does the claim that the significance of left–right differences can be inferred from the significance of local changes. Indeed, it is not certain that the hemispheres are differentially active to the same degree as voxels, which separately revealed activity in the right or left hemisphere.

Springer et al. adopt a distributed recording of haemoglobin oxygenation, and call the difference dominance. Classically, dominance is a functional concept...
subject to a functional measure. In older studies, dominance measures were based on the assessment of discontinuous variables, in keeping with the entire locationist approach to brain function. Our forebears would not have thought to count the number of active neurons in the brain to assess dominance, but this is the short version of the present approach. As such, the authors’ definition of dominance and the corresponding measurement defy classic locationist dogma. The results are consistent with the claim that large numbers of neurons in both hemispheres of healthy humans increase their activity during the execution of a language task. How are we to prove that they are all engaged in language processing, rather than in housekeeping tasks imposed by, but different from, the language processing in the left hemisphere? Activity in the parlour often leaves much related but completely different work to be done in the kitchen.

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