Why Dominant Hand Movements Cause Bilateral Cortical Activation in Emission Imaging

To the Editor:

The contribution of Kato et al.1 contains important laterality related data. But the respected authors resort to undocumented and unwarranted assertions from the literature that one must address in order to arrive at a cogent interpretation of their data.

They used the 1963 article of Nyberg-Hensen and Rinvik2 to support the existence of 10% to 15% uncrossed pyramidal fibers in humans. This article, which is often used for this very purpose, states that “the only safe conclusion to be drawn from the available data is that there may probably be considerable variation with regard to the proportion of crossed and uncrossed corticospinal fibers in man,” never offering or referring to such anatomical documentation in humans as asserted by Kato et al. On the other hand, the current techniques of cortical mapping with sufficient temporal resolution employing electroencephalography, magnetoencephalography, and transcranial magnetic stimulation (TMS) all have demonstrated sequential activation of the major followed by the minor hemisphere on moving the nondominant hand (see below). This temporal feature of bimanual coordination in humans translates into such daily life experiences as (1) the double-click heard with snapping one’s fingers of both hands simultaneously (Derakhshan, unpublished data), (2) the melody lead of the right hand in piano playing (known to musicologists for 160 years), and (3) the precedence of the bowing hand to the fingering in violin playing, recently documented by Priori et al.8 This callosally mediated delay of 10 to 40 ms involving the nondominant hand requires an anatomical explanation not forthcoming from the (unmodified) doctrine of contralaterality of movement control in humans. It reflects the asymmetry occasioned by a 1-way callosal traffic (underpinning all executive functions), manifesting the activating role of the neuronal ensemble located in the major hemisphere over its counterpart in the minor.3,6 The same is reflected in laterality indexed nondominant weakness after callosal transection (natural or iatrogenic) or in ipsilateral paralyses seen in lesions affecting the major hemisphere,9 all due to a diaschisis on cessation of the activating influences mentioned earlier.8 This asymmetry, or laterality of movement control, is uniquely human, not seen in chimpanzees or other monkeys.9,10 Kato et al also refer to another report11 concerning an anatomic anomaly, ie, nondecussation of the pyramids in medulla oblongata, in the same vein of drawing unwarranted support for a conventional interpretation of their findings. The situation is indeed far more sophisticated and exciting than that depicted by the authors, as their data are in favor of the concept of directionality of the traffic from the major to the minor hemisphere in determining a subject’s neural handedness,2 all due to a diaschisis on cessation of the activating influences mentioned earlier.8 This asymmetry, or laterality of movement control, is uniquely human, not seen in chimpanzees or other monkeys.9,10

To recap: It is the major hemisphere that gears into action when any movement is willed, giving the contralateral dominant hand a head start equaling the interhemispheric transfer time (IHTT, measuring 10 to 40 ms). In the laboratory, the first acknowledgment of the precedence of the dominant over the nondominant limb came from Kristeva et al.12 in 1979. Kristeva et al.13 established the same in 1991 using magnetoencephalography, as did Chen et al.14 in 1997, using TMS. Priori et al.15 did the most elaborate study on both right- and left-handers, showing that the TMS-induced interruption of function lasted longer (by an amount equal to IHTT) on the nondominant side as the disrupting influence traveled along the callosum from the dominant to the nondominant side, arriving at the same conclusion as Chen et al, whose subjects were all right-handers. All those cited above have been silent as to the reason behind the finding, with occasional accusation of laziness on the part of the minor hemisphere by some16 or others who interpreted the result17 without any regard for the neurological syndromes adumbrated above and elsewhere.3,4

In this light, the right-handed patients and controls of Kato et al.1 showed ipsilateral activation of the left hemisphere as they used their nondominant hand, as in numerous other studies they cited and many more;18 none, however, were cognizant of the pathway that underpins the asymmetry of such findings, indexed as it is to the subject’s neural handedness: this pathway remains unchanged19 regardless of attempts to “convert” those wired for practicing according to a different mandate of nature than that of a majority who do things in a reverse manner, also according to their own natural mandate.

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