Directionality of Callosal Traffic Determines Laterality of Motor Control

I. Derakhshan

Department of Neurology, Cincinnati University, Cincinnati and Department of Neurology, Case Western Reserve University, Cleveland, Ohio

TO THE EDITOR: The finding in the informative article by Goble and Brown (2008) in support of a “sensory-modality-based hypothesis of handedness” is liable to a different interpretation than that offered by the authors as follows:

After providing a mental template for movements of different excursions with either limb, their subjects enacted the same movements ipsilaterally and contralaterally. In fact this experiment and the results may be readily replicated by drawing from memory a line of certain length that was viewed earlier by a subject, using the dominant and nondominant hands (separately or simultaneously). It will be seen that the lines drawn by the dominant hand are longer than those drawn by the nondominant hand (as was the case in their right-handed subjects), with a difference amounting to the interhemispheric transfer time (Derakhshan 2006, 2008). First described by Hall and Hartwell (1884), this observation indicates that the dominant side moves faster (i.e., makes wider excursions) than the nondominant side, regardless of whether the movements are carried out on-line or by using a mental template as utilized by the authors (memory). Further, it has been shown that the asynchrony between the limbs is enhanced by lesions affecting the anterior callosum (Bonzano et al. 2008; Preilowski 1972).

Thus according to the one-way callosal traffic scheme advocated here, all commands are initiated in the same hemisphere (called action or major hemisphere), with those movements to be carried out by the nondominant side (i.e., the side ipsilateral to the major hemisphere) implemented by the other (minor) hemisphere once it receives the command via the callosum. There is, however, a 15–20% discrepancy between some people’s neural (as just defined) and avowed (behavioral) handedness, for reasons detailed elsewhere (Derakhshan 2006; also see Table 4 of McPherson and Renfrew 1953). Thus it may be stated that in the experiments conducted by the authors, the nondominant side made shorter excursions (“undershoot” the target), whereas the dominant side made longer ones (“overshooting” the target) because of the directionality of callosal traffic underpinning the subjects’ handedness, with the left hand lagging behind the right as the command issued in the left hemisphere traveled to the right hemisphere. This interpretation of the events together with numerous other clinical correlations indicate that the minor hemisphere (right, in ~80% of people) is dedicated to the affairs of the nondominant side of the body, but always at the behest of the major hemisphere (wherein all sensory modalities achieve consciousness). Here, it is of cardinal significance that the laterality ratio given earlier is similar to that in laterality of seizure onset at the public at large—that is, approximately four to one in favor of the left hemisphere, as recently documented by Ossenblok et al. (2007), whereas the model advocated by Goble and Brown predicts a 50% binomial distribution of seizure onset between hemispheres (a figure not supported by modern accounts on the subject).

REFERENCES


