

## Introduction

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# Lateralization, Praxis, and Communicative Gestures: Developmental and Comparative Perspectives

This special issue is the result of a workshop held in the fall of 2012 at Paris Descartes Université, Paris, France. The goal of the workshop was to explore the relationships between different aspects of hand-use lateralization, that is, hand preference for praxis and communication through their developments in human infants, and by comparing them with nonhuman primates who also lack language. The workshop brought together an interdisciplinary group of scholars: comparative and developmental psychologists, ethologists, and neuroscientists convened for 1 day of talks and discussions. This special issue gathers the contributions of some of those participants.

The first article (MacNeilage) places hand-use lateralization within a larger context by synthesizing evidence of left brain/right side asymmetries in routine whole-body actions in several species of marine mammals. The reported data suggest a commonality of patterns between humans and marine mammals for leading the right side in turning asymmetries. MacNeilage postulates that such asymmetries may be the result of a left-hemisphere intentional control and more generally, a left-hemisphere specialization for movement dynamics (Sainburg, 2005).

Three articles are concerned with the lateralization of motor behavior in human fetuses and human infants.

Hepper notes the early emergence of lateralized behaviors during the prenatal period (from 10 weeks gestation). He proposes that mediation of these behaviors is most likely genetic and that the pattern of fetal lateralization is the precursor of the laterality observed postnatally. Although it can be tempting to relate the behavioral biases with structural and functional differences between the hemispheres, Hepper cautions against interpreting the former as a casual effect of the latter. In her article, Fagard questions the relationships between hand preference and hemispheric specialization for language. Even as early fetal signs of lateralization become better known, she notes that there is still too little evidence about: (1) how genetic and environmental factors interact to lead to mature handedness and language lateralization; and (2) what exactly is the nature of the relationship between both processes of lateralization. Are handedness and hemispheric specialization for language causally related (and in which direction) or independent in origin? To answer these questions, Fagard calls for considering their codevelopment during early ontogeny. In their article, Michel and colleagues tackle the issue of the relationships of the development of handedness and that of hemispheric specialization for speech processing. They borrow the developmental sequence proposed by Arbib's (2006) mirror system hypothesis about the linkage of action and language. This view is based on the idea that hand preference must reflect a lateralized difference in neural control of manual actions and speech actions (gestures) that will ultimately lead to speech. Michel and colleagues employ embodiment theory to suggest that

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asymmetrical sensorimotor experiences, positively valenced with the preferred hand and negatively valenced with the nonpreferred hand, create mental representations lateralized in the opposite hemisphere, and thus hemispheric specialization of function is different for right- and left-handers.

Four articles are concerned with the question of handedness patterns in nonhuman primates. Hopkins notes first that findings on handedness in nonhuman primates reveal inconsistent evidence for population-level handedness within and between species. By discussing some of the methodological and statistical challenges to comparative studies of handedness in human and nonhuman primates, the author proposes a framework with the goal to set a consensus on evaluating the validity of different handedness measures and the characterization of individual hand preferences. A number of criteria are thus presented: (1) to consider only those behaviors or tasks that elicit consistent biases at the individual level of analysis, (2) to record both bouts and events of hand use for characterizing handedness, and (3) to combine evidence from captive monkeys and apes with those obtained from wild groups or populations.

Meguerditchian and colleagues review the recent literature related to two particular complex behaviors, namely bimanual coordinated actions and gestural communication with respect to their potential and specific implications for the origins of hemispheric specialization in humans. The authors conclude that hand preference for bimanual coordinated actions in several nonhuman primate species highlight the role of ecological factors in the evolution of handedness. In addition, they note that the reports of pronounced patterns of right-handedness for communicative gestures in different terrestrial primate species indicate that hand preferences might be related to a specific left-hemispheric communicative system and, as such, may constitute precursors of the hemispheric specialization for language.

Bourjade and colleagues describe an interesting application of the distinction between handedness for manipulation and handedness for communication in an experiment with Olive baboons. They observed more consistent hand preferences for communicative gestures than for simple grasping actions irrespective of the direction of laterality. They conclude that behavioral asymmetries for gestural communication and for manipulative actions in baboons rely on independent brain processes that manifest as differences in the strength of hand preference. Similarly, Meunier and colleagues review hand preferences for grasping versus pointing to objects at several spatial positions in human infants and in three species of nonhuman primates using the same experimental procedure. They report a remarkable con-

vergence in the distribution of hand biases of human infants, baboons and macaques (see also, Meunier, Fizet, & Vauclair, 2013). Although there is a population-level right handedness for the communicative gesture, there is no population-level preference for grasping and an interesting divergence between capuchin and other species' hand preferences in the pointing task.

The works presented in this special issue highlight both the progress and the remaining challenges in the investigation of the pre- and postnatal handedness changes and the potential relation of handedness development with language and communicative lateralization and language development (notably speech development). These contributions also stress the value of a comparative psychology approach, in particular, how it appears to strengthen the distinction between manual gestures and object manipulation in relation to handedness. The studies of nonhuman primates provide support for the hypothesis that the human left-lateralized language may be derived from a gestural communication system that was present in the common ancestor of macaques, baboons, and humans. As a recent review article (Cochet & Byrne, 2013) demonstrates, it is no longer tenable to adhere to a simplistic human/animal partition with respect to handedness. We consider that this special issue contributes to this search for a better understanding of the phylogenetic precursors of human handedness and of its developmental characteristics.

## NOTES

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