possible world argument in which prescientific hypotheses can be explored. This is not a process amenable to falsification, even though it borrows data from the natural sciences, but it is a process that helps us to think hard about hypotheses we might like to construct. It was this kind of thinking that Darwin put to great effect when constructing his natural history.

Handedness: Neutral or adaptive?

Charlotte Faurie and Michel Raymond

Institut des Sciences de l'Evolution, Université Montpellier II, 34095 Montpellier Cedex 05, France.
faurie@isem.univ-montp2.fr raymond@isem.univ-montp2.fr
http://www.isem.univ-montp2.fr/GE/Adaptation/FaurieHome.php

Abstract: Corballis seems to have not considered two points: (1) the importance of direct selection pressures for the evolution of handedness; and (2) the evolutionary significance of the polymorphism of handedness. We provide arguments for the need to explain handedness in terms of adaptation and natural selection.

According to Michael C. Corballis, the brain lateralization for vocalization might precede the lateralized control of the hands. This certainly has to be taken seriously. However, we would like to comment on two points that he has apparently not considered: (1) the importance of natural selection for the evolution of handedness; and (2) the significance of the polymorphism of handedness.

In the theory presented by Corballis, handedness is described as a neutral character. Right-handedness is regarded as a direct consequence of the left-hemisphere dominance for vocalization. It is, however, difficult to consider handedness as a neutral character. For most manual tasks, especially those tasks involved in competitive activities, increasing performance by the specialization of one hand is certainly adaptive. For example, lateralized cats are faster at catching a virtual prey on a screen with one paw, compared to cats that have not specialized one of their paws (Fabre-Thorpe et al. 1991). In humans, hand or arm lateralization, whatever the side, is probably an adaptation for many activities, such as tool making and tool use (MacNeilage et al. 1987) or stone throwing (Calvin 1982; 1983a; 1987; 1993).

In fights, being lateralized certainly is an advantage. For example, many weapons are held with only one hand. Increasing the power, speed, and maneuverability of a particular arm or hand, that is, specializing it, is certainly pivotal. Aggressive interactions are responsible for fundamental selection pressures acting during primate and human evolution (e.g., Archer 1994; Bridges 1996; Daly & Wilson 1989; Furlow et al. 1998; Guilaine & Zammit 2001; Haas 1990; Wrangham & Peterson 1996; Zollikofer et al. 2002). The higher prevalence of right-handedness might well be due to a previously existing cerebral bias. But the specialization of one forelimb leading to right- or left-handedness is better viewed as the result of natural selection. The constitutive cerebral bias might well have driven the adaptive lateralization towards right-handedness. Nevertheless, it is unclear how the left-brain lateralization for vocalization alone, without natural selection for hand or arm specialization, would lead to the actual right-handedness.

An important problem is not tackled by Corballis's theory. The existence of a polymorphism of handedness remains unexplained. Yet, it is observed in all known human populations (Raymond & Pontier, in press) and described since the Palaeolithic (e.g., Bermùdez de Castro et al. 1988; Groënen 1997a; 1997b; Lalueza & Frayer 1997). Left handedness is associated with several fitness costs (e.g., Aggleton et al. 1993; Annett 1987a; Coren & Halpern 1991; Daniel & Yeo 1994; Gangestad & Yeo 1997; Geschwind & Galaburda 1985a; 1985b;1985c; Grouios et al. 1999; McManus & Bryden 1991). The persistence of an apparently stable proportion of left-handers implies the balancing of these costs by some advantages.

One of the observed costs is the smaller size and weight of left-handers (Coren 1989; O'Callaghan et al. 1987; Olivier 1978). Size is a component of the reproductive value, at least in males (Mueller & Mazur 2001; Pawlowski et al. 2000). However, smaller size and weight is probably not a disadvantage in weapon fights. This is indicated by the fact that weapon fighting sports, such as fencing, do not have weight categories for competitions, as opposed to hand fighting sports, such as boxing. Generally, all sports using an object mediating an interaction between two opponents – racket, sword, ball – do not have weight categories, as opposed to all other interactive sports without such objects. This suggests that when weapons were prevalent in hominids, the weight (and probably height) disadvantage of left-handers in fights was considerably reduced. In addition, a frequency-dependent advantage favours left-handers in interactive sports (Goldstein & Young 1996; Grouios et al. 2000; Raymond et al. 1996). The persistence of the polymorphism of handedness might well be partly explained by an advantage of left-handers in weapon manipulation and fights. This polymorphism, as well as handedness itself, needs to be understood in the view of adaptation and natural selection.

Are human gestures in the present time a mere vestige of a former sign language? Probably not

Pierre Feyereisen

Department of Psychology, University of Louvain, PSP/CODE, B-1348 Louvain-la-Neuve, Belgium. **pierre.feyereisen@psp.ucl.ac.be**
www.code.ucl.ac.be

Abstract: Right-hand preference for conversational gestures does not imply close connections between the neural systems controlling manual and vocal communication. Use of speech and gestures may dissociate in some cases of focal brain damages. Furthermore, there are limits in the ability to combine spoken words and concurrent hand movements. These findings suggest that discourse production depends on multiple components which probably have different evolutionary origins.

Numerous theories have been advanced in an attempt to explain the manual asymmetry observed in many human activities. Corballis argues for a new evolutionary scenario on the basis of evidence from palaeontology, comparative psychology, and behavioural neuroscience. According to his account, right-handedness in genus Homo derives from an association of gestures and vocal signals in the communicative behaviour of our direct ancestors, whereby the dominant mode of communication progressively shifted from a manual to vocal modality. The hypothesis is intended to be falsifiable and indeed, several aspects of the theory deserve discussion. This commentary aims to examine the relevance of the specific argument concerning present-day human gestural activity. There is no doubt that people gesture as they talk and that in right-handers, these gestures are predominantly performed by the right hand. It does not follow, however, that the primitive language of humankind used the gestural modality and that present-day gestures are merely the remainder of that earlier stage. The alternative view favoured by other investigators is that spoken language derives from vocal communication or, more exactly, that gestures and speech coevolved in parallel from the beginning and that there are only limited connections between the two production systems.

Why do speakers gesture while talking? There is no simple answer to this question because different kinds of gestures probably depend on different mechanisms involved in discourse production. Some hand movements are called *iconic* or *representational* gestures because, like a drawing in the air, they depict the concept they express. Other gestures, sometimes called *beat* or *batonic* gestures, have simpler forms, no meaning, and relate to phrasal stress to emphasise some parts of speech. *Deictic* or *pointing* gestures constitute a third category in which reference is achieved