## Pumping for gestural origins: The well may be rather dry

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**Abstract:** Corballis's explanation for right-handedness in humans relies heavily on the gestural protolanguage hypothesis, which he argues for by a series of "intuition pumps." Scrutinizing the mirror system hypothesis and modern gesture as components of the argument, we find that they do not provide the desired evidence of a gestural precursor to speech.

Corballis traces gestural protolanguage in earlier hominids to vocal protolanguage in later hominids, giving rise to a legacy of overwhelming right-handedness in humans. His argumentation follows an extended path, one that is unfortunately more frequently based on appealing to intuitive plausibility than providing a critical evaluation of data. Here, we will be working the handles on two of Corballis's "intuition pumps," arguing that neither the mirror system nor human gesturing produce the flow of evidence he desires.

A recent version of the mirror system hypothesis argues that "Broca's area in the human contains a mirror system for grasping that is homologous to the F5 mirror system of [the] monkey, and this provides the evolutionary basis for language parity; i.e., an utterance means roughly the same for both speaker and hearer" (Arbib 2003a, p. 609). The central component of this hypothesis is simply a system that integrates perception and motor control. Corballis and Arbib go significantly further, however, drawing drastic evolutionary conclusions based on the link between skilled manual action in a nonhuman primate, sharing of intentional states, and a brain region that in humans is specifically involved in language production. The discovery itself is clearly important – neurons in primate F5 provide a substrate for integrating perceptual processing with motor activity, thereby potentially making manual tasks subject to joint attention among different individuals. Nevertheless, using the phenomenon as a pillar of language evolution is taking a long step beyond the data, where simpler interpretations are also available.

For example, there is ample and growing evidence that perceptual and motor systems routinely interact in the brain, working together in creating and shaping cognitive processes (e.g., Barsalou 1999; Hommel et al. 2001). The mirror system may be a powerful [instead of "prototypical"] example of such convergence, but is unlikely to be unique. Perceptuo-motor integration demonstrably plays a role in other aspects of human language and cognition, more likely traceable to activity in distributed networks than being restricted to Broca's area alone. Corballis appeals to the reader's evolutionary intuition by invoking the mirror system findings, the importance of which depends largely on assuming that perceptual and motor integration is playing a special, language-specific role. Our intuition is the opposite, that it would be surprising if such integration were not found to be a basic function of multiple brain areas underlying cognition. Finding that joint attention can play a role, is already implied by imitative, observational, or simply socially facilitated learning that both humans and nonhuman primates can show to varying degrees. Those phenomena are not specifically linked to F5 or Broca's area, which suggests that the integrative processing strategy involved is basic and widespread.

Taken at face value, the discovery of mirror neurons can lead one in many possible directions, and it does not specifically support a gestural-origins hypothesis of language. Unfortunately, speculation seems particularly prone to run roughshod over available data when language evolution becomes the topic of discussion. Rizzolatti and Arbib's (1998) argument that mirror system function can instantiate an elementary case grammar is a case in point. Both these authors and Corballis attach very specific evolutionary hypotheses to a neural phenomenon whose implications are as yet just beginning to be explored. It seems wiser to exercise more restraint, until there is at least some sense of the many different roles that mirror neurons, or something like them, may be playing in various brain regions across species.

Gesturing in modern humans is another of the intuition pumps Corballis invokes. Here, the data do convincingly show that gesture is an important partner to normal speech, and that it develops into a full-fledged linguistic system when the vocal-auditory channel is unavailable. Once again, however, implications for the evolutionary emergence of human language are much less clear. Gestures observed in conjunction with modern speech are largely not linguistic in nature, being iconic instead and lacking the requisite complex structure (Goldin-Meadow & McNeill 1999). Contrary to intuition, in fact, gesturing does not necessarily further the talker's linguistic goals (Krauss et al. 1995). In addition, the fact that manual signing can develop into an explicitly linguistic system demonstrates only that critical aspects of the human capacity for language are likely modality-independent. Rather than specifically implicating gesture as the origin of spoken language, this outcome readily suggests other interpretations – for example, that increasingly complex general sequential-learning capacities played a critical role (Christiansen et al. 2001; Conway & Christiansen 2001).

As before, the strongest implication may be that convergence among perceptual and motor systems is a critical underlying component of language. As Kendon (1991) points out, multimodal information is continually brought forth as an essential part of human cognition. That gesture can effectively stand in for signaling in the auditory-vocal modality highlights that integration is important, but not that the manual component per se has played a special role. On the contrary, speech is the normal means of linguistic communication across the entire human species, with gesturing always being ancillary. Gesture takes on language properties only by dire necessity, which is surely not the sort of evidence that compels a view that language evolved sequentially from gesture to speech. It instead suggests primacy for the latter, but with both modalities being more fundamentally rooted in the integration of sensory and motor channels in underlying neural organization.

While ultimately about right-handedness, Corballis's argument relies most heavily on the gestural-origins hypothesis and the various bits of evidence that can be marshaled in its support. In our view, he has not produced a straightforward progression of inexorable inferences and necessary implications. Instead, he presents a series of intuition pumps and primes the reader to think along the lines desired. Making the case requires rather more than intuitively pumping for it, and a critical and balanced evaluation of the data would be a better way to proceed.