# Evolutionary and Neuroscientific Account of the Self

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***Abstract*—Llinas and other neuroscientists argue that no centralized structure in the brain corresponds to a Cartesian self, and thus conclude that the self is an illusion. Crick and Koch, look instead for a monitoring center of self-related activities. In neuroscience, though, the self should be seen in the context of a brain that results from natural selection. The brain has evolved for the coordination of external information with information about the internal states of the organism, taking into account the previous experience of the organism and its genetic inheritance. But these are the very functions normally ascribed to a self. Since the brain is distributive, the self should also be distributive. Furthermore, most of the brains functions are unconscious. The self should also be expected to be mostly unconscious. This eliminates Llinas paradoxes. We will present an extended review of neuroscience studies that seems to support to this distributive picture of the self. They range from recognition of self photographs, to disentangling ones motion from anothers, to representation of observed intentional actions, to inhibition by demanding perceptual tasks of the self-monitoring functions hypothesized by Crick and Koch.**

***Index Terms*—evolution, neuroscience, distributive, brainimaging**

Developmental psychology research suggests the self emerges through the infants comparing and distinguishing states of the self from those of others. This reflects a long tendency, which can be traced to Descartes, to equate the self with the sense of self. As a result, some neuroscientists like Llinas have concluded that no structure in the brain corresponds to a Cartesian self and that the sense of self is no more than an internal perception [1]. He thus believes that the self is an illusion. Others like Crick and Koch have looked for a monitoring center of self-related activities (the favorite choice is the frontal or pre-frontal cortex). Nevertheless, with the advent of neuroscience we should consider the self in the context of the brain, and the brain as a biological entity, that is, as resulting from natural selection. This is the approach that we take in our presentation. Our intent is to explain this new evolutionary account of the self and to provide some supporting evidence from neuroscience, particularly brain imaging studies.

In a biological context, we realize that the brain has evolved for the coordination of external information with information about the internal states of the organism, taking into account the previous experience of the organism and its genetic inheritance (e.g., through basic emotions that will guide it to survive, reproduce, etc.). But these are the very functions normally ascribed to a self. Since the brain/self has thus evolved for interaction with the social and physical environment, we should expect the brain to perform a great variety of tasks as it distinguishes self from other. For this reason, and given that the brain is characteristically distributive, the self should also be expected to be distributive. Furthermore, most of the brains functions, including cognitive functions, are unconscious. In view of the tasks the brain performs to tell self from non-self, the self should thus also be expected to be mostly unconscious, as the brainimaging evidence suggests. The self should not be confused with the sense of the self, anymore than an object should be confused with its perception. It is when we ignore this point and expect a conscious (worse, Cartesian) self that all sorts of paradoxes arise, such as those that troubled Llinas.

Previous theoretical and experimental (functional magnetic resonance imaging) work by one of us (Munevar) supports this evolutionary and neuroscientific approach [2]. An extended review of brain imaging studies seems to add support to the biologically expected distributive picture of the self. We have divided that review into several categories: self-recognition, self-referential, theory of mind, reward system, heading and orientation, mirror neurons, and motion. For example, the right frontoparietal network is involved with recognition of self photographs [3]. The extrastriate body area may support the disentangling ones motion from anothers, although in apparent cooperation with the superior temporal sulcus (STS), ventral premotor cortex, and the angular gyrus in the posterior parietal cortex. The STS may also be involved in the representation of observed intentional actions. It is interesting to note, incidentally, that very demanding perceptual tasks actually inhibit the activation of the frontal areas that we would have expected as part of the self-monitoring functions hypothesized by Crick and Koch. Many other studies dovetail with our previous findings that suggest that allometric orientation is processed in areas activated by Self but not by Best-Friend conditions, and, tellingly, that areas that distinguish both Self and Best Friend from unfamiliar Others are anatomically diminished in schizophrenics.

## REFERENCES

[1] R.Llinas, *I of the Vortex*. Harlow, MA: MIT Press, 2001.
[2] G. Munevar, A darwinian account of self and free will. *Evolution 2.0: implications of Darwinism in Philosophy and the Social and Natural Sciences*, ed. by Weinert, F. and Brinkworth, M.H. Berlin: Springer, 2011. pp. 43-63.
[3] Q. L. Uddin, T. J. Kaplan, I. Molnar-Szakacs, E. Zaidel, and M. Iacoboni, Self-face recognition activates a frontoparietal mirror network in the right hemisphere: an event-related fMRI study, *Neuroimage* 25, 2005. pp. 926C935.