Darwin's Continuum and the Building Blocks of Deception
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Deception in non-human animals is one of the most fertile areas of research to pursue philosophical questions in cognitive ethology, but it is an area rife with controversy (Byrne and Whiten 1988; Whiten and Byrne 1988.) The literature on deception is interwoven with questions and claims about intelligence, levels of representation, intentionality, and consciousness (Dennett 1983; Mitchell 1986; Perner 1991). Our aim in this chapter is not to survey or evaluate the entire literature; rather, we use the phenomenon of deception as a case study, in a framework of some relevant conceptual distinctions, to illustrate a point about the graded continuity of mental phenomena across species.

Darwin famously stated: "If no organic being excepting man had possessed any mental power, or if his powers had been of a wholly different nature from those of the lower animals, then we should never have been able to convince ourselves that our high faculties had been gradually developed. But it can be shewn that there is no fundamental difference of this kind" (Darwin 1871: 445). That is, while there may be notable differences among closely related living species because of rapid evolutionary changes and lost ancestral varieties, given the theory of natural selection, there should be no *inexplicable* jumps in cognitive abilities. Conversely, when faced with what seem to be differences *in kind* between related species' abilities, we should look for other cognitive abilities that may underlie these differences (cf. Allen and Bekoff 1997; Pinker 1994 and Deacon 1997, from different perspectives, discuss language in this context).

With this in mind, we examine the traditional distinctions between levels of deception in animals and suggest some cognitive abilities that may serve as building blocks to account for the apparent gaps between these levels, focusing on the order of primates. We then present an experiment that tests for deception in lemurs, suggesting directions for further empirical work in this area.

Three Categories of Deception

Deception may be defined broadly as an agent's producing or withholding an act or a signal so that it is misinterpreted by another to the advantage of the agent (see Mitchell 1986 and Hauser 1996; cf. Whiten and Byrne 1988, Hauser 1997). As such, deception always involves misrepresentation, and it takes (at least) two animals to make misrepresentation lead to deception. These animals may be of different species -- e.g. predators and prey -- or the same species, as in the case of "sexual mimicry" (Wickler 1965, 1968; see also Hockham 2000, 2001, and Weldon and Burghardt 2001, for discussion of the link between mimicry and deception) or in instances where one monkey leads another way from a known food source (see below).

But if we are interested in determining what sorts of cognitive abilities are required to carry out different types of deception, we should not begin by looking at the complexity of the misrepresentation. Sometimes, using fairly simple signals in the service of deception -- e.g. a misdirecting eye gaze -- may require significant cognitive abilities, whereas there may be no cognition at all behind informationally rich displays of misrepresentation -- e.g., butterfly wings with intricate patterns that make the wing-ends look like the butterfly's head (Robbins 1981). Camouflage and other "hard-wired" displays count as deception on our broad first- pass definition, as long as we allow "producing signals" to include the production (or even possession) of *misleading appearances*.

In our view, the relevant gradations in the cognitive abilities involved in deceptive signals or behaviors should be delineated by the historical processes that produced them, the flexibility with which they can be displayed, and the degree to which the deceiving animal understands