Human Reasoning From an Evolutionary Perspective

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Contemporary psychological theories of human reasoning are recapitulating the historical pattern observed for theories of other cognitive functions. Initial theories described human reasoning as a content-free, domain-general process (Braine, 1978; Rips, 1983). These theories were seriously challenged by mounting evidence of domain-specific content effects in human reasoning performance (e.g., Cox & Griggs, 1982; Griggs & Cox, 1983; Cheng & Holyoak, 1985; Gigerenzer & Hug, 1992; Thompson, 1994). In order to salvage content-free theories, their proponents have attributed content effects to "bias" (Rumain, Connell, & Braine, 1983; Evans, 1989) or content-specific parameters that modify the inputs to the content-free system (Braine & O'Brien, 1991; Rips, 1994). Other theorists have abandoned the notion of a content-free reasoner, proposing instead collections of domain-specific rules that are induced from life experiences with classes of situations (Cheng & Holyoak, 1985 and 1989).

More recently, however, others have argued that certain reasoning domains are innately specified in the human reasoning architecture, having emerged in response to evolutionary pressures during the Pleistocene (Cosmides, 1989; Cosmides & Tooby, 1994). I argue that the evolutionary origins of some domain-specific effects in human reasoning may predate the origins of the hominid line (Cummins, in press a and b).

The domain I focus on is deontic reasoning, that is, reasoning about what one may, ought, or must not do (Hilpinen, 1981; Manktelow & Over, 1991). This type of reasoning is distinct from indicative reasoning in which the reasoner is required to determine the epistemic status (truth) of a rule or other description of a state of affairs. Reasoners tend to adopt a violation-detection strategy when reasoning deontically and a confirmation-seeking strategy when reasoning about the epistemic status of rules. This indicative-deontic distinction emerges early in human development and colors the reasoning process throughout adulthood (Cummins, in press a). This strongly suggests a fundamental, primitive distinction in our cognitive architecture. Furthermore, the structure of deontic situations is more easily grasped by young children than is the structure of epistemic reasoning tasks (Harris & Nunez, in press). The ease and speed with which young children detect, understand, and reason about deontic situations is consistent with the existence of an innate domain-specific reasoning module that is evoked when a situation with deontic content is encountered.

Deontic reasoning is also apparent in the cognition of non-human primates, suggesting that the capacity for this type of reasoning predates the emergence of the hominid line. Like most avian and mammalian societies, primate social groups are characterized by dominance hierarchies. In functional terms, a dominance hierarchy is simply the statistical observation that particular individuals in social groups have regular priority of access to resources--particularly reproductive resources--in competitive situations. Rank within the hierarchy is of such importance that non-human primates have been described as consummate tacticians, with much of this tactical reasoning aimed at jockeying for position within the dominance hierarchy (de Waal, 1982; Byrne & Whiten, 1988). Furthermore, there is a direct relation between social reasoning skill and rank within primate hierarchies.

The social reasoning that is required to secure and maintain a high- ranking place within the dominance hierarchy requires the capacity to detect and respond appropriately to a variety of deontic structures, including, most importantly, violations of these structures. For example, those who currently dominate resources determine who may and who may not engage in which activities when, and they punish transgressors. In order to dominate resources, therefore, an individual must have the capacity to recognize violations of permissions and prohibitions. Similarly, in order to avoid agonistic encounters, subordinates must have the capacity to recognize what is permitted and what is forbidden, and to behave accordingly.

It is in the interest of subordinates, on the other hand, to broaden their access to available resources. In other words, it is in their interest to move up in rank. In order to change rank, an individual must have allies who will provide support during a contest of rank. Those who do not have allies can neither move up in rank nor maintain a stable position within the hierarchy, including alpha males (Harcourt & Stewart, 1987; Riss & Goodall, 1977). Primate alliances are formed and maintained on the basis of reciprocal obligations (see Harcourt & de Waal, 1992). For example, Cheney and Seyfarth (1990) report that vervet monkeys are more likely to come to the aid of an individual during an agonistic encounter if that individual has groomed them recently. de Waal (1992) reported observing a subordinate male terminate his long-term alliance with an alpha male in response to the alpha male's increasingly frequent refusals to support him in contests with another male over access to estrus females. Forming and maintaining alliances, therefore, requires effective reasoning about obligations. Taken together, this evidence from primate field studies strongly suggests that deontic reasoning strategies emerged prior to the division of hominids within the primate line.

Finally, there is reason to believe that this type of reasoning may be supported by functionally distinct neural substrates. Damage to the ventro-medial prefrontal cortex in both human and non-human primates has been found to produce a syndrome in which socio-emotional reasoning is

impaired while leaving other types of intelligent reasoning untouched (see Damasio, 1994). There is also some evidence that patients suffering from this syndrome do not show the typical deontic reasoning effects observed in normal subjects (Adolphs, Tranel, Bechara, Damasio, & Damasio, 1996). Although far from conclusive, these data suggest that deontic reasoning might be selectively dissociated from other types of reasoning at the neurological level.

In summary, the robustness of the deontic effect in adult reasoning, its early emergence in human development, the central role played by deontic reasoning in primate dominance hierarchies, and the neurological dissociability of socio-emotional reasoning from other types of intelligent reasoning strongly suggest that some aspect of our reasoning architecture is devoted specifically to problems of deontic content.

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