Dominance Hierarchies and the Evolution of Human Reasoning

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Abstract. Research from ethology and evolutionary biology indicates the following about the evolution of reasoning capacity. First, solving problems of social competition and cooperation have direct impact on survival rates and reproductive success. Second, the social structure that evolved from this pressure is the dominance hierarchy. Third, primates that live in large groups with complex dominance hierarchies also show greater neocortical development, and concomitantly greater cognitive capacity. These facts suggest that the necessity of reasoning effectively about dominance hierarchies left an indelible mark on primate reasoning architectures, including that of humans. In order to survive in a dominance hierarchy, an individual must be capable of (a) making rank discriminations, (b) recognizing what is forbidden and what is permitted based one's rank, and (c) deciding whether to engage in or refrain from activities that will allow one to move up in rank. The first problem is closely tied to the capacity for transitive reasoning, while the second and third are intimately related to the capacity for deontic reasoning. I argue that the human capacity for these types of reasoning have evolutionary roots that reach deeper into our ancestral past than the emergence of the hominid line, and the operation of these evolutionarily primitive reasoning systems can be seen in the development of human reasoning and domain-specific effects in adult reasoning.

Key words: Human reasoning, evolution, deontic reasoning, transitive reasoning, non-human primates, neocortical ratio, dominance hierarchy.

Historically, the psychological investigation of learning and cognition has followed a common pattern. Initially, content-free, domain-general mechanisms are posited to explain a particular phenomenon. Subsequent research then seriously challenges these theories, and they are modified in order to include species-specific or other innate domain-specific constraints. The resulting explanations are typically hybrids of domain-general and domain-specific processes, yielding a description of the cognitive architecture that is complex indeed.

For example, early stimulus-response theories of classical conditioning described this capacity as a domain-general one in which an association could be made between any two stimuli through repeated pairings. The factor that was believed to influence the conditioning process was simple temporal contiguity. Subsequent research, however, quashed this pristinely simple view of the mind. It soon became apparent that the conditioning of a simple association between two stimuli depended less on the pairing itself than on the relationship between the pairing and the outcome that the subject anticipated (Rescorla & Wagner, 1972). Thus, conditioning could be blocked if the presentation of one stimuli was not *contingent* upon the presentation of another (even though the two were strongly correlated) or if conditioning were attempted in the presence of another stimulus that already

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strongly predicted the occurrence of the reinforcer. The most serious blow to a domain-general view of the conditioning process was dealt by the oft-replicated Garcia effect which showed species-specific "preparedness" to learn associations between certain stimuli and not others (Garcia & Koelling, 1966; Seligman, 1970; Seligman & Hager, 1972). For example, rats will readily learn to avoid drinking water when lights are flashing if this experience is paired with electric shock. They will also readily learn to avoid drinking saccharine-tainted water if this experience is paired with nausea-inducing irradiation. Conditioning is much more difficult to achieve, however, if taste and shock are to be associated or flashing lights and nausea. Phobias among humans also show this "preparedness to associate"; people are far more likely to develop phobias to spiders and snakes than to spatulas or trees (Cook & Menetka, 1989; McNally, 1987; Sigelman, 1971). Investigation of even so simple a process as conditioning ended up revealing a complex relationship between external events and species-specific structure of mind, or, as Hilgard and Bower (1975, p. 574) put it: "One might say that the animal is innately preprogrammed to see certain cues and responses as 'naturally fitting' together, so that they are readily learned".

A similar transition from a purely empiricist, domain-general view of cognition to a domain-specific one that respects the influence of innate constraints is very much in evidence in contemporary theories of cognitive development. Historically, the most influential domain-general theory was proposed by Jean Piaget, who envisioned the development of cognition as a process in which interactive experience with the world shaped the infant's unstructured and incomprehensible sense data into a coherent world view replete with permanent objects and logical concepts (Piaget, 1952 and 1972). But contemporary investigations of infant cognition using the habituation technique have produced a very different picture of infant cognition. In this technique, infants are repeatedly shown a stimulus event until they become habituated to it, that is, until they become bored and decrease their looking time. Then the display is changed in some theoretically important way, and the researchers record whether or not the child dishabituates, that is, shows renewed interest in terms of a significant rebound in looking time. Using this technique, infants as young as two and one-half months of age have been found to dishabituate to stimulus changes that appear to violate basic physical principles such as object permanence, the continuity of object trajectories, causality (no action at a distance), and the principle that two physical objects cannot occupy the same place at the same time, (Baillargeon, 1987 and 1994; Leslie & Keeble, 1987; Spelke, 1994). Using similar techniques, infants have also been found to show an appreciation of the abstract concept of number (Starkey *et al.*, 1983), distinguish between animate and inanimate objects (Campos & Stenberg, 1981), and respond appropriately to a variety of emotional facial expressions (Vandell & Wilson, 1987). Within the first few months of life, we seem to be prepared to interpret and respond to objects and certain socio-emotional stimuli in particular ways.