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Effect of Status on Social Reasoning (Cummins 1998)

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Synonyms

[Domain-specific reasoning about dominance hierarchies](#)

Definition

The effect of social hierarchy and status position on the evolution and implementation of social reasoning abilities.

Introduction

Sociality, the formation of social groups by a species, is often seen as an evolved solution to some of life's most basic problems, such as how to obtain food, how to successfully reproduce and care for young, and how to avoid predation long enough for these prior concerns to be issues at all. While helping to solve many of these problems, sociality also presents a unique challenge: how are limited resources, such as food, to be distributed among group members? In response, many social

species, including humans, developed social hierarchies wherein higher-status individuals typically have priority access to resources. Therefore, while sociality and social hierarchy helped solve some evolutionary problems, they themselves produced unique evolutionary pressures. In this context, Cummins (1998) hypothesized that key components of reasoning developed in response to the demands of competing and cooperating within social groups and social hierarchies. More precisely, she argued that domain-specific reasoning capacities (e.g., cheater detection) evolved to recognize and respond to the social rules concerning necessary (obligatory or prohibited) and permissible behaviors found in social hierarchies. Evolutionary, behavioral, and neuroimaging evidence in support of these claims is reviewed as well as investigations and literature suggesting the need for further research.

Hierarchies, Evolution, and Social Reasoning

Put simply, a social hierarchy means that in social groups certain individuals maintain regular and priority access to key resources, such as food and mates (Cummins 2006). In turn, these high-status individuals are more likely to survive and are more likely to have offspring (Ellis 1995). Importantly, in many species, most notably primates, social hierarchy is not stable, nor is it simply a matter of pure physical dominance (i.e.,

physical size or strength) (Harcourt and de Waal 1992). In this context, survival and reproductive success depends on the amount of time one is able to spend in positions of relatively higher status, which in turn depends on a number of nonphysical factors (Altman et al. 1996). In this regard, it is likely that natural selection would favor psychological and neurological mechanisms to effectively navigate status hierarchies. Evidence in primates suggests that key among these mechanisms are a collection of social reasoning abilities, including the capacity (i) to learn the rules around necessary (obligatory or prohibited) and permissible behaviors, (ii) to detect and remember those who violate these rules (cheaters), (iii) to form and monitor reciprocal relationships (cooperation and reciprocity), and (iv) to read and understand the intentions of others (theory of mind) (for a review see Cummins 2000). In other words, the better you are at these abilities, the more likely you are to successfully navigate the social hierarchy, achieve and maintain high-status, and thus survive and reproduce. In this way, sociality and status hierarchies are seen to provide evolutionary pressures and context for the development of foundational social reasoning capacities in many social species.

Hierarchies and Social Reasoning in Humans

Far from being a primitive feature of nonhuman social species, social status and hierarchy appear to be universal across human cultures (Brown 1991). Indeed, while the signs and impact of status and hierarchy are easily identified in many cultures (e.g., income inequality, caste systems), hierarchy and status also appear to be among the first and most stable characteristics seen in human peer groups (Strayer and Trudel 1984). For example, the development and recognition of status hierarchies are found in children as young as two and continue to play a major role in social structure throughout the life-span (Frankel and Arbel 1980). Moreover, the ability to understand and report on the structure of a social hierarchy appears to develop in children well before the

ability to describe similarly complex content in nonsocial domains (Smith 1988). This developmental trajectory may suggest that humans are predisposed to attend to and develop social skills in reference to social hierarchies. This sensitivity to social status is even found at the neuroendocrine (e.g., cortisol, adrenalin, testosterone) and physiological levels (e.g., heart rate, blood pressure; Knight and Mehta 2014). For example, when allowed to retaliate against an aggressor of lower status, heart rate, blood pressure, and cortisol indices, initially elevated by the frustration of the situation, return to baseline levels. In contrast, if the aggressor is a higher-status individual, these stress indices remain at their original, frustration-induced, levels (Hokanson and Shetler 1961). In other words, social hierarchy appears to be an integral part of human societal structure, developing early and impacting not only our cognition but our physiology as well.

While humans and nonhuman primates differ in many regards, it is clear that human social structures were, and are, subject to many of the same hierarchy pressures seen in nonhuman primates. In this context, it is unsurprising that many of the same social reasoning abilities used by primates to successfully navigate hierarchical social structures are seen, and expanded upon, in humans. Indeed, decades of research demonstrates that, just like nonhuman primates, human's success at navigating social structures depends on the capacity (i) to learn the rules around necessary (obligatory or prohibited) and permissible behaviors, (ii) to detect and remember those who violate these rules (cheaters), (iii) to form and monitor reciprocal relationships (cooperation and reciprocity), and (iv) to read and understand the intentions of others (theory of mind) (see Cummins 2000 for review). While each of these skillsets is seen as important, much research has focused on people's ability to (i) learn social rules and (ii) detect cheaters, as these skills are not only seen as foundational for more advanced social reasoning skills (e.g., reciprocity, and theory of mind) but also appear to be intimately linked to one another.

In countless studies across numerous disciplines, researchers have consistently

demonstrated that humans appear to be more effective at reasoning in some domains than others, with one of the largest and most well-established differences being seen in social reasoning. Most often this difference is studied in regard to the deontic-indicative distinction. Deontic reasoning is concerned with social rules or what is permitted, obligated, and forbidden. When engaged in deontic reasoning, individuals appear to spontaneously look for and identify violations of these social rules. Importantly, in both functional and cognitive terms, social hierarchies can be conceptualized as a collection of specific social rules imposed on lower-status individuals by those of higher status. In this way, deontic reasoning is directly tied to many of the social constraints (rules) seen in social hierarchies. Indicative reasoning, in contrast, is concerned with what is true or false and triggers a confirmation-seeking strategy. Importantly, although indicative reasoning can be related to social content, it is not related to social rules. Notably, humans consistently perform significantly better on deontic tasks (60–90% correct on deontic tasks vs 10–30% correct on indicative versions of the same tasks; Cummins 2000). In other words, people perform consistently and systematically better on social reasoning tasks when they entail social rules concerning what is permitted, obligated, or forbidden. While abundantly clear in adulthood, this difference also appears to be present in early development. For example, by age 3, children appear to preferentially check for and determine whether a social rule has been violated and are able give specific reasons why a behavior represents a rule violation (Cummins 1996; Harris and Nuñez 1996). Importantly, mirroring what is seen in adults, this skill does not appear to transfer to nonsocial problems of similar complexity. This advantage for social rule-based reasoning is seen at even younger ages as well. At 16 months, children are already preferentially noticing and attending to violations of social rules (Cummins 1999a), and by 24 months, they use social rules to justify their behavior (Dunn 1988). Overall, these results seem to indicate that humans are uniquely skilled at social rule-based reasoning, that this advantage develops

early, and that it continues to impact reasoning throughout the life-span.

Importantly, the broader literature on this social reasoning advantage, and more specifically the deontic effect, is not without controversy (see Cummins 2000 for a brief review). Indeed, over the years, numerous theories have been developed to explain the deontic effect, with some arguing in-line with the domain-specific process already introduced, while others advocate a more domain-general approach. For example, some argue that the deontic effect is simply due to familiarity with social content rather than any unique or evolved advantage for social reasoning. Despite decades of inquiry, consensus around the best-fitting theory is still lacking.

Regardless of this debate, a crucial component seen in the potential social reasoning advantage is the tendency to spontaneously check for rule violations when considering social rules. While violation-detection is equally appropriate of other types of reasoning, such as evaluating whether a statement is true, it appears to be rarely used outside of situations focused on social rules. In this regard, detecting and remembering those who (intentionally) violate rules, cheaters, is seen as a crucial component to forming and enforcing the rules necessary for even a basic level of sociality. While cheater detection is obviously important for social rules in general, this bias may be particularly important in reference to status hierarchies. Specifically, in order to maintain priority access to resources, high-status individuals often need to maintain the status quo, which entails checking for, remembering, and penalizing cheaters. While there is a wealth of examples to support the impact of status on cheater detection in nonhuman primates, evidence is currently equivocal in humans. Specifically, while there is some evidence to suggest that individuals are more likely to check for and remember cheaters of relatively lower status (Cummins 1999b; Mealey et al. 1996), more recent studies have failed to replicate these results (Barclay and Lalumière 2006; Mehl and Buchner 2008; Buchner et al. 2009). In this regard, two aspects are important to note. First, in all of these studies, status was manipulated in a relatively narrow

fashion focused on occupation or income. In contrast to this, literature and research on social status in humans indicate that an individual position in the social hierarchy is determined by a variety of connected, yet independent, constructs, such as power, socioeconomic status, dominance, prestige, influence, and leadership (Blader and Chen 2014). Further complicating this picture, while social status is often discussed as a dispositional attribute, it is also highly situational, such that an individual may be of high status in one environment (e.g., friend group or family) but low status in another (e.g., occupation). Second, numerous studies indicate that cheater detection is influenced by a host of individual and situational variables, such as subjective importance of detecting cheaters (Chiappe et al. 2004) and the relative number of cheaters (Barclay 2008), meaning that cheater detection is not a static phenomenon. Thus, more research is needed to untangle the potential impact of status on cheater detection in humans, with a special focus on the numerous ways human status can be determined and conceptualized.

Evolution of a Neural Architecture for Social Reasoning

A key concept in Cummins proposal is that evolutionary pressures not only helped to shape key aspects of social reasoning but that a similar and mirrored development occurred in neuroanatomy. In her original manuscript, four points were addressed to support this idea. First, the development and role of the neocortex compared to the evolutionarily older structures found in the limbic system. In general, the limbic system is responsible for relatively basic socio-emotional functions, such sexual behavior, aggression, and emotion. In contrast, the neocortex, is responsible for higher-level cognitive and social functions, such as thought and language. The variation in function and the later development of the neocortex are seen as evidence that higher-level social functions evolved in a commensurate fashion with specific and evolutionarily newer neural architectures.

Second, prefrontal lobe syndrome in humans and bilateral prefrontal ablations in primates suggest that there are specific neural substrates responsible for crucial components of social reasoning. In prefrontal lobe syndrome, bilateral damage to the ventromedial prefrontal cortex produces impairment in socio-emotional stimuli, typically without producing similar impairments in broader intellectual functioning (Damasio 1994). In primates, bilateral prefrontal ablations of the ventromedial or dorsolateral prefrontal cortices result in similarly dramatic changes in social functioning, with these changes not typically seen from damage to other cortical areas (Cummins 1998).

Third, autism, a neurodevelopmental disorder, is characterized by selective impairment in the social domain. Specifically, individuals with autism find it difficult or impossible to reason, especially automatically, about the mental states or beliefs of other individual's, which makes it exceedingly difficult for them to engage in cooperative or reciprocal social interactions (Baron-Cohen 1995). Despite this, however, individuals with autism typically do not display impairments in other nonsocial domains of cognitive functioning. Mirroring prefrontal lobe syndrome and the bilateral prefrontal ablations, this selective impairment of social reasoning suggests a unique and separable neural architecture for social reasoning.

Lastly, in primates, the neocortex ratio, the relative volume of the neocortex to the rest of the brain, correlates positively with social group size (Dunbar 1993). This suggests that larger groups, and thus more complex forms of sociality (due to the increased number of relationships), require greater cognitive resources. Moreover, given the evolutionary trajectory of the neocortex, this suggests that more complex forms of sociality developed alongside the necessary neural architecture (i.e., larger neocortex).

More recent advances in neuroimaging also appear to detail a neural architecture adapted for social reasoning (Barbey et al. 2009). Indeed, converging results from numerous studies suggest that the lateral prefrontal cortex enables the representation of evolutionarily adaptive social rules, with each of its three major subsections supporting particular types of reasoning necessary

for various degrees of sociality. Specifically, the ventrolateral prefrontal cortex is tied to reasoning about necessary actions (rules about obligatory or prohibited behavior), the dorsolateral prefrontal cortex is involved in reasoning about possible (permissible) actions, and the anterolateral prefrontal cortex is recruited for higher-order reasoning that incorporates both necessary and possible actions. Importantly, research also demonstrates that the lateral prefrontal cortex initially evolved from the ventrolateral prefrontal cortex, followed by the dorsolateral and then the anterolateral regions. Given the functional significance of each area, this developmental trajectory makes evolutionary sense. The foundation for basic sociality is being able to create, understand, and enforce necessary (obligatory and prohibited) social rules, which are instantiated in the ventrolateral prefrontal cortex, which evolved first. Following this, social rules around permissible behaviors enable a greater range in possible behaviors and thus more complex social relationships. Mirroring this trajectory, these abilities are found in the dorsolateral prefrontal cortex, which developed second, after the ventrolateral regions. Finally, representing and reflecting on rules governing both necessary and permissible behaviors foster even more complex social relationships, with these abilities being facilitated by the dorsolateral prefrontal cortex, which developed last. Thus, current data suggests that social reasoning around rules may have evolved in a commensurate fashion with specific neural architectures supporting particular abilities.

Recent data also suggests that social status may play an important role in the development and function of this architecture. In a hierarchy, rules created and enforced by members of a higher social status represent necessary rules that an individual of lower rank must follow. Given this it is not surprising that areas for identifying others' social status are anatomically connected to ventrolateral prefrontal regions, which are crucial for reasoning about necessary rules. This link between status and necessary rules was supported by a recent study by Marsh et al. (2009), which demonstrated selective recruitment of the ventrolateral prefrontal cortex when processing status

poses for high-status individuals. Future studies leveraging various conceptualizations of human status hierarchies could provide further clarity about the role of social status on the development and function of social reasoning neural architecture.

Importantly, however, it must be noted that advances in neuroimaging also demonstrate that social reasoning and status hierarchies are not exclusively dependent on areas in the lateral prefrontal cortex. Indeed, countless studies have implicated a host of diverse areas in social reasoning and social hierarchy, including the parahippocampal cortex, the ventral striatum, the sensorimotor cortex, the supplementary motor area, the amygdala, the anterior insula, the anterior cingulate, the inferior parietal lobe, and the inferior parietal sulcus (Pornpattananangkul et al. 2014). Moreover, the lateral prefrontal cortex and its subsections are not solely implicated in reasoning about social concepts. For example, the ventrolateral prefrontal cortex is implicated in motor activity, such as walking, as well as the ability to detect and retain spatial information from visual cues. Thus, while there is strong evidence to suggest a neural architecture for social reasoning, it remains unclear whether this network was evolutionarily adapted specifically and uniquely for reasoning about social content such as status hierarchies and cheating.

Conclusion

Evidence to date provides equivocal support for much of Cummins' (1998) hypothesis that key components of reasoning developed in response to the demands of competing and cooperating within social groups and social hierarchies. While there are certainly results and data from evolutionary, behavioral, and neuroimaging contexts supporting key aspects of this hypothesis, questions remain. Indeed, there are inconsistencies in and failures to replicate key results, an important debate around the interpretation of the deontic effect, and a need for more nuanced and detailed investigation into the neural architectures supporting social reasoning. Future research can

provide clarity in many of these areas through continued replication attempts, acknowledgement and investigation into the numerous ways social status is determined in human hierarchies, and continued consideration of competing theories.

Cross-References

- ▶ [Domain-Specific Reasoning About Dominance Hierarchies](#)
- ▶ [Dominance and Status in Nonhumans](#)
- ▶ [Dominance Hierarchies](#)
- ▶ [Dominance in Humans](#)
- ▶ [Emergence of Deontic Reasoning](#)
- ▶ [Emergence of Dominance Hierarchy](#)
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- ▶ [Evolutionary Theories of Status, Dominance, and Prestige](#)
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- ▶ [Rule Violations Check if High Status](#)
- ▶ [Rule Violations Not Checked if Low Status](#)
- ▶ [Status and Redistribution of Resources](#)
- ▶ [Status Competition](#)
- ▶ [Status Competition and Peer Relationships in Childhood](#)
- ▶ [Status of Cheater Status and Dominance Hierarchies](#)

References

- Altmann, J., Alberts, S. C., Haines, S. A., Dubach, J., Muruth, P., Coote, T., Geffen, E., Cheesman, D. J., Mututua, R. A., Saiyalel, S. N., Wayne, R. K., Lacy, R. C., & Bruford, M. W. (1996). Behavior predicts genetic structure in a wild primate group. *Proceedings of the National Academy of Sciences*, *93*, 5795–5801.
- Barbey, A. K., Krueger, F., & Grafman, J. (2009). An evolutionarily adaptive neural architecture for social reasoning. *Trends in Neurosciences*, *32*(12), 603–610. doi:10.1016/j.tins.2009.09.001.
- Barclay, P. (2008). Enhanced recognition of defectors depends on their rarity. *Cognition*, *107*(3), 817–828. doi:10.1016/j.cognition.2007.11.013.
- Barclay, P., & Lalumière, M. (2006). Do people differentially remember cheaters? *Human Nature*, *17*(1), 98–113.
- Baron-Cohen, S. (1995). *Mindblindness: An essay on autism and theory of mind*. Cambridge, MA: MIT Press.
- Blader, S. L., & Chen, Y. R. (2014). What's in a name? Status, power, and other forms of social hierarchy. In *The psychology of social status* (pp. 71–95). New York: Springer.
- Brown, D. E. (1991). *Human universals*. Temple University Press. New York: McGraw-Hill.
- Buchner, A., Bell, R., Mehl, B., & Musch, J. (2009). No enhanced recognition memory, but better source memory for faces of cheaters. *Evolution and Human Behavior*, *30*(3), 212–224. doi:10.1016/j.evolhumbehav.2009.01.004.
- Chiappe, D., Dow, B., Koontz, J., Rodriguez, M., & McCulloch, K. (2004). Cheaters are looked at longer and remembered better than cooperators in social exchange situations. *Evolutionary Psychology*, *2*, 108–120. doi:10.1177/147470490400200117.
- Cummins, D. D. (1996). Evidence of deontic reasoning in 3- and 4-year-olds. *Memory & Cognition*, *24*, 823–829.
- Cummins, D. D. (1998). Social norms and other minds: The evolutionary roots of higher cognition. In D. D. Cummins & C. A. Allen (Eds.), *The evolution of mind* (pp. 30–50). New York: Oxford University Press.
- Cummins, D. D. (1999a). Early emergence of cheater detection in human development. Presented at the 11th Annual Meeting of the Human Behavior and Evolution Society, Salt Lake City, Utah, June 8, 1999.
- Cummins, D. D. (1999b). Cheater detection is modified by social rank: The impact of dominance on the evolution of cognitive functions. *Evolution and Human Behavior*, *20*(4), 229–248.
- Cummins, D. (2000). How the social environment shaped the evolution of mind. *Synthese*, *122*(1), 3–28.
- Cummins, D. (2006). Dominance, status, and social hierarchies. In D. M. Buss (Ed.), *Handbook of evolutionary psychology* (pp. 676–697). Hoboken: Wiley.
- Damasio, A. R. (1994). *Descartes error: Emotion, reason, and the human brain*. New York: Grosset/Putnam.
- Dunbar, R. I. M. (1993). Coevolution of neocortical size, group size, and language in humans. *Behavioral and Brain Sciences*, *16*, 681–735.
- Dunn, J. (1988). *The beginnings of social understanding*. Oxford: Basil Blackwell.
- Ellis, L. (1995). Dominance and reproductive success among nonhuman animals: A cross-species comparison. *Ethology & Sociobiology*, *16*, 257–333.
- Frankel, D. G., & Arbel, T. (1980). Group formation by two-year-olds. *International Journal of Behavioral Development*, *3*, 287–298.
- Harcourt, A. H., & De Waal, F. B. M. (Eds.). (1992). *Coalitions and alliances in humans and other animals*. Oxford: Oxford University Press.
- Harris, P. L., & Nuñez, M. (1996). Understanding of permission rules by preschool children. *Child Development*, *67*, 1572–1591.

- Hokanson, J. E., & Shetler, S. (1961). The effect of overt aggression on physiological arousal. *Journal of Abnormal and Social Psychology*, *63*, 446–448.
- Knight, E. L., & Mehta, P. H. (2014). Hormones and hierarchies. In *The psychology of social status* (pp. 269–301). New York: Springer.
- Marsh, A. A., Blair, K. S., Jones, M. M., Soliman, N., & Blair, R. J. (2009). Dominance and submission: The ventrolateral prefrontal cortex and responses to status cues. *Journal of Cognitive Neuroscience*, *21*, 713–724. doi:10.1162/jocn.2009.21052.
- Mealey, L., Daood, C., & Krage, M. (1996). Enhanced memory for faces of cheaters. *Ethology and Sociobiology*, *17*(2), 119–128. doi:10.1016/0162-3095(95)00131-X.
- Mehl, B., & Buchner, A. (2008). No enhanced memory for faces of cheaters. *Evolution and Human Behavior*, *29*(1), 35–41. doi:10.1016/j.evolhumbehav.2007.08.001.
- Pornpattananangkul, N., Zink, C. F., & Chiao, J. Y. (2014). Neural basis of social status hierarchy. In *The psychology of social status* (pp. 303–323). New York: Springer.
- Smith, P. K. (1988). The cognitive demands of children's social interactions with peers. In R. W. Byrne & A. Whiten (Eds.), *Machiavellian intelligence: Social expertise and the evolution of intellect in monkeys apes and humans* (pp. 94–110). Oxford: Oxford University Press.
- Strayer, F. F., & Trudel, M. (1984). Developmental changes in the nature and function of social dominance among young children. *Ethology and Sociobiology*, *5*, 279–295.