Sociality, trust, kinship and cultural evolution ☆

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ABSTRACT

Pre-history human economic development, it will be argued, was the result of significant increases in sociality, that itself was a product of the evolution of a human temperament associated with much more interpersonal tolerance and trust which facilitated kinship recognition and significantly expanded social network size. All this made possible in humans, an ongoing cultural evolutionary processes not seen in other animals. Though our close cousins the chimpanzees and some other animals display forms of culture, there is little evidence of significant ongoing cultural evolution in nonhuman animals. The expansion of human social networks increased the rate of cultural evolution, in part, by increasing the fixation rate of new components of culture.

1. Introduction—the evolution of big brains and language and culture

Homo sapiens' cognition and culture did not come about independently, but rather they evolved jointly via a complex process of gene-culture co-evolution (Richerson and Boyd, 2005). Interestingly, recent evidence from primatologists and anthropologists supports the proposition that the evolution of big brains, language, and ongoing cultural evolution was a product of spontaneous order, that can be explained by significant increases in human sociality. This increase in sociality was itself a product of increases in trust, social capital and institutions, and kinship recognition. In modern development studies, a comparison between developed countries and an under-developed one can shed light on the factors that resulted in the difference in outcomes. Similarly, an examination of the different evolutionary pathways of primates and, in particular, chimpanzees and *Homo* can contribute to an explanation of why *Homo* evolution resulted in big brains relative to chimpanzees as well as in ongoing cultural evolution that is not seen in nonhuman primates (Whiten et al., 1999; Tomasello, 1999; Tennie et al., 2009). Important *Homo* versus chimp differences in evolutionary outcomes that will help explain the differences in brain size and culture include the evolution of a human temperament associated with much more interpersonal tolerance and trust, pair bonding and biparental provisioning of the young, and significantly increased sexual specialization in provisioning activities. Further important *Homo*/chimp evolutionary differences that will be examined include significantly enhanced kin recognition, an egalitarian

social structure,[1] intergroup pacification, leading to significantly expanded social networks and human life history changes, including, a long pre-adult development period, longer maximum life expectancy coupled with lower mortality rates, higher fertility rates and significantly more complex learned behavior.

The products of cultural innovation in small isolated groups are often lost; the significant expansion of human social network size helped to increase the fixation rate of new components of culture and thereby increased the rate of cultural evolution. Further, both biological and cultural evolution can be thought of as trial and error/experimental learning processes; over time, *Homo* has come to rely more and more on cultural learning processes rather than biological ones. Failure of a biological experiment—in the form of a harmful mutation—often results in the death of the individual carrying that mutation, failure of a cultural experiment usually does not result in the death of the cultural innovator. In other words, failure of biological experiments can result in the death of individuals, failure of cultural experiments usually only results in the death of ideas. Importantly, in our human ancestor's large social networks, information, coordination and governance proceeded from the bottom up, from the individual and the family up to the more aggregated social units, which facilitated taking advantage of the Hayekian notion that knowledge is widely dispersed and local. It also helped preserve individual autonomy and freedom necessary for the maintenance of interpersonal trust.

Seemingly, smarter is better, but the problem is that the big brains necessary to make us smarter are extremely costly. "[T]he energy consumed by the brain forms roughly 65% of a baby's total

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[1] Where egalitarian in this context means, equal opportunity, not equal outcome and both political and economic individual autonomy and freedom.

consumption and no less than 20–25% of an adult's, even though brain tissue accounts for only 2% of adult body mass" (Potts, 2011, p. 43). The benefits of being smarter must exceed these high energy costs, so an explanation of the evolution of our large brains is found in detailed examination of the benefits of big brains.

Commonly, our large brains, language and culture are claimed to be a product of the evolutionary pressures of living in social groups because social animals must develop complex forms of social knowledge to predict the behavior of other members of their social group, manipulate that behavior, and ultimately foster the complex cooperation that makes our culture and complex social networks possible. This idea is often referred to as the Machiavellian intelligence hypothesis (MI) (Byrne and Whiten, 1988; Whiten and Byrne, 1997). In fact, our large brains evolved because they enabled our ancestors to suppress their Machiavellian tendencies by facilitating solutions to the various problems associated with social living. The evolution of three capacities that are necessary for complex cooperation and culture drove increases in human brain size over that of our social but less cooperative cousins the chimpanzees. These closely related capacities are theory of mind, the sharing of attention, and the sharing of intentions: they helped allow our ancestors to contain their Machiavellian tendencies.

As we will see, complex cooperation requires tight social bonding, which requires trust. For trust to evolve our ancestors must have (1) overcome the incentive to defect when involved in cooperative activity, and (2) suppressed the proclivity to use violence to take resources from conspecifics, as is seen in nonhuman primates. Large brains and language were, in part, necessary for the evolution of mechanisms that suppressed our Machiavellian tendencies, and by doing so they greatly facilitated cooperation. Given all this, it seems that *Homo sapiens*' cognitive capacity evolved to deal with the free-rider problem. Our enhanced cognitive capacity facilitated a level of cooperation not seen in non-human contexts, and this is what made complex culture and its ongoing evolution possible. Greater cognitive capacity fostered the evolution of social rules of governance and implicit institutions that suppressed free riding, provided rules of orderly behavior that increased cooperation by making individual behavior predictable, and also protected the property rights of individuals. Though the social living hypothesis suggests that our big brains were not a product of the advantages of producing and using complex tools or an ability to exploit hard-to-acquire and varied food resources, these abilities were an important byproduct of the evolution of language, big brains, hyper-cooperation and ongoing cultural evolution. In the next few sections, we will examine some of the various evolved mechanisms and capacities that allowed our ancestors to overcome their Machiavellian tendencies.

2. The evolution of cooperation and the transitivity of trust[2]

The evolution of other-regarding preferences coevolved with the solution to the MI problem. Explaining the evolution of other-regarding preferences and cooperation in biology usually starts with reciprocal altruism, or direct reciprocity (DR), to explain cooperation between non-kin (Trivers, 1971) and kin selection, i.e., nepotism or inclusive fitness to explain cooperation among kin (Hamilton, 1964). Reciprocal altruism coupled with tit-for-tat strategies involves a group of individuals in long-term social relationships where a sacrifice made to benefit another individual today will be more than made up for by a benefit provided by that individual in the future. A key requirement for this strategy

to work is that the players have sufficient brainpower to remember the past performance of those they have cooperated with in the past. Consequently, tit-for-tat can be considered a reputation model, where individuals cooperate with those who have cooperated with them in the past.[3] With kin selection, an individual may make sacrifices that benefit another if the following inequality (Hamilton's rule) holds: $Br > C$, where B is the reproductive benefit to the other individual, r is the average degree of relatedness between the two individuals, and C is the reproductive cost to the individual performing the altruistic act. For example: for sexually produced siblings, where $r = .5$, if an individual performs an altruistic act that yields a benefit to a full sibling or siblings that exceeds twice the cost it bears in performing that act, its net fitness increases. This, of course, could be considered selfish behavior from a gene perspective, since it tends to increase the number of copies of the gene that promotes the altruistic behavior that are passed on to the next generation.

Alexander (1987) has suggested that a much more extensive system of cooperation can be facilitated by indirect reciprocity. With DR, an individual cooperates with a conspecific that has cooperated with it in the past. Indirect reciprocity (IDR) includes cooperating with those that the individual knows have cooperated with others in the past. "Indirect reciprocity develops because interactions are repeated, or flow among society's members, and because information about subsequent interactions can be gleaned from observing the reciprocal interactions of others" (Alexander, 1987, p. 77). Social relationships are much more complex when indirect reciprocity takes place compared to direct reciprocity. With DR, the individual need only keep track of its obligations to each of the other individuals in the group and theirs to it. With IDR, the individual must not only keep track of these, but the behavior of all of the other group members in transactions involving all the others. The complexity of the cognitive task is several orders of magnitude greater with IDR than with DR, but more importantly, the very nature of the problem is different. Indirect reciprocity has been studied from both a theoretical and an experimental perspective using the concept of image scoring (Nowak and Sigmund, 1998; Wedekind and Manfred, 2000). Each individual has an image score that measures the degree to which the individual cooperated with other group members in the past, which we may assume is known by all players, though not perfectly. The image score reflects the reputation and status of the individual within a social network and it requires joint intentionality—we all recognize that we are in this social network together and that reputations are subject to continual group assessment and reevaluation. Cooperation occurs in the context of repeated nonsimultaneous exchange, for example, as with meat sharing, which was an important component of the hunter-gatherer (H-G) social order. Nowak and Sigmund find that "[c]ooperation wins in a computer simulation of indirect reciprocity" (Nowak and Sigmund, 1998, p. 573), but that individual cooperation "depends crucially on the ability of a player to estimate the image score of the opponent" (Nowak and Sigmund, 1998, p. 575). The evolution of reciprocal altruism—direct reciprocity—requires that individuals have sufficient cognitive capacity to recognize other members of their group, distinguish between defectors and cooperators by keeping track of the outcomes of past interactions and by maintaining appropriate mental accounting that reflects its obligations to each of the others and theirs to it. A mental account based on an image score used with IDR is much more cognitively sophisticated than the accounts

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[2] Portions of this section are based upon Gifford (2002).

[3] This is not to deny that some mammals, including primates and carnivores such as wolves and lions, hunt in groups larger than two. However, in these situations the payoff to all is the immediate product of a successful hunt. Here I am primarily concerned with non-simultaneous exchange situations that play out over time.