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Cooperation and Conflict, Large-scale Human

Advanced article

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CONTENTS
Introduction
Difficulties accounting for human ultra-sociality in Darwinian terms
Kin selection
Reciprocity

Cultural group selection
Within-group cooperation and between-group conflicts
Ideology, symbols, and ingroup marking
Conclusion

Along with a few other animals such as bees, termites, ants and wasps, humans live in societies that cooperate for a common goal. Serving the greater good seems to go against basic Darwinian theory, so the question is, how and why have complex, cooperative societies developed in some species? In spite of so much cooperation, why do human societies remain so conflict ridden?

INTRODUCTION

Suppose you stroll to the corner restaurant for breakfast: eggs, bacon, and a glass of orange juice. A simple activity? No. Mind-numbing complexity is more like it. A farmer in Virginia produced your egg, another in Florida your orange juice, and yet another in the Midwest your bacon. Different truckers brought each of these to a supermarket. The restaurateur then bought them there and had them prepared for you. Seven people are involved in your 'simple' activity? Well, no. This is a caricature. Just for starters, the egg farmer/capitalist hires several workers to operate considerable equipment, all of which was purchased from other companies, made up of capitalists and workers, who in turn bought their parts from yet other companies, which…(the mind reels). Your day has barely begun, and a few dollars' worth of breakfast has already brought an army of considerable size to your service.

Only a select few animal species have societies with extensive cooperation, fine coordination, and massive division of labor: the social insects (bees, termites, ants, and wasps), possibly naked mole rats (but their level of complexity is far below that of the advanced social insects, as is the scale of their societies) and us. This form of social organization is clearly evolutionarily successful; social insects are diverse and abundant, especially in the tropics, and human populations grow so fast that our rapid and energy-expensive expansion into every conceivable niche is a considerable threat to other species and the climate. Given this, one might be naturally inclined to ask: why is this adaptation not more common among the species of the world? After all, beneficial adaptations should proliferate, shouldn't they?

Actually, for modern students of evolutionary theory – trained as they are in the framework of what has been called the 'modern synthesis' and 'neo-Darwinism' – the puzzle is rather different. Modern biologists are trained to be surprised not by the rarity of this dramatic adaptation but by the fact that it is possible at all. How could something this strange evolve? Darwin himself worried that the self-sacrificial altruism of the social insects might be fatal to his theory. To see the problem his way, we must briefly develop the theoretical instincts of a modern evolutionary theorist.

DIFFICULTIES ACCOUNTING FOR HUMAN ULTRA-SOCIALITY IN DARWINIAN TERMS

Individuals attempt to reproduce before they die, and some do better than others. If the features of an individual are passed on to the offspring, then good reproducers will beget good reproducers, who in turn will beget good reproducers once again. And so on. Each time, good reproducers leave more descendants than other types, so after a number of generations the entire population will become of the type that reproduces best (with the exception of frequency-dependent effects, when selection will maintain several types at equilibrium). This is the basic Darwinian insight of 'natural selection'.

The mechanism responsible for stable similarities between parent and offspring is genetic inheritance. Mere individuals live and die, but genes can potentially keep going forever. Modern Darwinism focuses on changing genes in order to understand the processes responsible for historical change in organic populations.

The analytical focus of a modern Darwinian is the 'gene's eye view' heuristic, which relegates individual organisms to the status of temporary 'vehicles' conveying the potentially immortal genes from one generation to the next. Genes that have a better chance of proliferating are those that increase the reproductive success of their vehicles in competition with other vehicles. Finding 'unselfish' genes that cause their vehicles to suffer sacrifices to benefit another vehicle's reproduction is thus a major puzzle. But nothing in these arguments really depends upon there being a single gene for altruism; this is just a convenient way to strip the problem to its bare essentials. Darwin was right to worry.

This brings us to the social insects. Massive division of labor is impressive, but the reason it is possible in the first place is the truly big puzzle. Although many ants in a colony will famously give up their lives protecting it, for example, this is only because they have already given up their reproduction. The latter is, to a Darwinian, the really dramatic fact. How could they give up their reproduction? In human ultra-sociality, on the other hand, defense is the most dramatic puzzle because those who risk and often give their lives to defend their society are indeed capable of reproducing and by fighting give up some or all of this capacity.

For non-human altruism, twentieth-century evolutionary theory has provided two elegant and very successful explanations: kin selection and reciprocity. Before examining them, notice that the fundamental issue for any explanation in this domain is the problem of assortment. The gene's eye view allows us to state the obvious: since the gene is trapped inside its vehicle, the vehicle must reproduce if the gene is to proliferate. So how can a gene proliferate more than competing genes if it makes its vehicle transfer reproductively useful resources to other vehicles? At first glance this would seem impossible, and for most kinds of resource transfers it will be. But if the vehicle is making resource transfers to other vehicles also containing copies of that same gene, then the gene promotes its own proliferation at one remove.

The question therefore is: what could cause vehicles with altruistic genes to assort with one another?

KIN SELECTION

Green Beards

Imagine a gene – 'G' – producing two effects: (1) it gives you a green beard, and (2) it makes you help

those with green beards (Dawkins, 1989, pp. 88–89). G's twin effects solve the problem of assortment: if you help those with green beards, then, because those individuals also have G (hence their beard), G is making you help other copies of itself. Copies of G can 'find each other' thanks to the beards, and therefore when G causes its vehicle to transfer resources to other vehicles it is nevertheless promoting the spread of G.

It is virtually impossible that the same gene will cause a discriminatorily altruistic behavior and also the cue used to discriminate, unless altruism itself is the cue. Theoretical considerations suggest that it is also highly improbably that "green beard" genes can arise as a result of two tightly linked loci where the gene at one locus would code for the green beard, and the gene at the other for the altruistic behavior. But the thought experiment brings the problem of assortment into sharp focus: if an 'altruistic' gene is to prosper, its vehicle must confer benefits disproportionately on other vehicles containing copies of the same gene. Something like a green beard must facilitate this nonrandom assortment for altruistic genes to evolve.

In one proposal (Hirshliefer, 1987; Frank, 1988), if altruism is mediated by emotions, and if emotions result inevitably in facial expressions and other bodily manifestations, and if such manifestations are hard to fake, then altruists can assort with each other by examining each other's expressions of emotion. In other words, those who 'look' altruistic probably are, so altruists can find and prefer each other for mutual benefit. Genes coding for altruistic emotion/displays will be favored.

But the problem with this kind of 'green beard' argument is that, once the signal is common, selection will favor selfish individuals who pretend to be altruists but don't help. Actors and confidence artists can fake emotions well enough to fool us. Darwinians indeed expect that the evolution of clever, green-beard-exploiting sociopaths will undermine the evolution of emotional signals. This theoretical embarrassment to the green beard argument is accompanied by an empirical one: emotions that appear very similar to ours occur in other mammals (as Darwin himself wrote in his book *The Expression of Emotions in Animals and Man*). Thus, if nonhumans can produce emotions and signal them, why can't they use this to assort for altruism and build ultra-social communities? Human emotions are no doubt involved in motivating and signaling cooperation in humans, but this is likely to be a secondary effect of other evolutionary processes, not something that can be shaped directly by natural selection to favor the original emergence of altruism. If it could, many nonhuman mammals should have it.

Kinship as a 'Green Beard' Substitute

If not emotional green beards, then what? Suppose that if you have the altruistic gene, then you can use an observable cue X to guess with some probability p that somebody else also has the gene. If so, then the altruistic gene – call it gene 'K' – will be helping itself so long as it specifies 'to individuals with cue X give a benefit size b, where b satisfies the following:

$$bp > c,$$

where c is the cost to the altruist of transferring the benefit. In other words, out of a large population of individuals bearing cue X and therefore receiving my help, only a proportion p will actually carry gene K. Thus – on average – the benefit that K's vehicle (me) confers on other copies of K is not b but the scaled down benefit bp. If this weighted payoff is greater than what it costs me to help, then K is giving itself a net benefit.

In 1964 William Hamilton argued persuasively that kinship can play the role of cue X. Consider two siblings, Higley and Bob. Bob carries a gene K that makes him an altruist. What is the probability that Higley also has gene K? Well, Bob's father passed down half of his genes to each sibling, who get the other half from their mother. These samples are subject to independent random assortment, so that Bob and Higley share a quarter of their father's genes and a quarter of their mother's. Thus, the probability that Bob and Higley share gene K is at least $p = \frac{1}{2}$. The probability may be higher if the gene is common in the population, but the critical value is the chance that siblings share the identical gene by common descent. This is the same as the probability of sharing the gene when it is rare. So suppose that K specifies a behavior that makes Bob give 5 units of benefit to siblings like Higley, for a cost to the actor of 2 units. Will K spread? Yes.

$$\frac{5}{2} = 2.5 > 2$$

On the other hand, if at the cost of 2 units K confers only 3 units of benefit to these recipients, then K will not spread.

What have we shown? That if a gene makes its vehicle assist its close kin, then it has found a way for its vehicle to assort (a fair amount of the time) with other vehicles carrying copies of the same gene. This assortment is what makes it possible

for altruistic genes – within benefit/cost limitations – to evolve. This is, of course, far short of the perfect assortment that green beards would make possible, but it is what nature uses because green beards or their equivalents are usually impossible. This 'kin selection' argument explains the widespread observation of nepotistic altruism in humans and many other species. In particular, it explains the ultra-sociality of the social insects, for in, say, an ant colony, everybody is a close relative due to the fact that everybody is a child of the queen.

Washburn's Fallacy

The above insight is usually expressed as Hamilton's famous rule: $br > c$. Here r replaces p, and stands for 'coefficient of relatedness': the probability that two individuals have identical copies of the same gene, descended from the same, recent ancestor gene. Thus, recall that for Higley we calculated the probability that he has an identical gene to Bob's that is in fact descended from their father's or mother's copy.

The r in Hamilton's rule is often misinterpreted as 'the probability or proportion of genes shared in common between two individuals'. This is commonly referred to as 'Washburn's fallacy' because the anthropologist Sherwood Washburn used to argue – in critical fashion – that Hamilton's rule would imply altruism towards everybody and only slightly more altruism towards kin. Why? Because any of us shares about 80 percent of our genetic alleles with any other randomly chosen member of the human species, and 80 percent is a lot. If true, this argument would appear to solve the puzzle of human ultra-sociality, but it would create an even bigger puzzle: why aren't many more species ultra-social?

But Washburn's argument follows only if the r is interpreted as the proportion of genes shared in common, rather than as the probability of sharing identical copies of a gene descended from the same, recent ancestor.

Why is Washburn wrong? Even if 80 percent of the people in the population have the altruistic gene (and the others have a selfish alternative), since Washburn's altruistic gene says 'help anybody', having an altruistic gene will not make a vehicle disproportionately likely to get help. The 20 percent of people not sharing the altruistic gene will get the same benefit as the 80 percent that do, and since they don't pay the costs of helping others, they have higher fitness. Selfish genes will increase in frequency and drive out the altruistic genes. An altruistic gene that said 'help close kin', on the

other hand, would make altruistic genes disproportionately likely to get help. Individuals with the altruistic gene are more likely than randomly chosen members of the population to have close relatives with copies of this gene, and are therefore more likely to get helped, than individuals with the selfish gene.

Washburn could have avoided his fallacy simply by imagining how his 'help anybody' gene could have become common in the first place. Here things become crystal clear: unless a gene codes for a behavior promoting its spread when it is a new and therefore rare mutation, the gene will wink out of existence as quickly as it appeared. When the 'help anybody' gene first appears virtually no other vehicles have copies of it, so 'helping anybody' confers no benefits on the gene's spread and the gene quickly goes extinct. A new mutant gene is, by definition, rare, and thus only close kin of its vehicle are likely to carry copies. An altruistic gene therefore has a chance of spreading from low frequency only if it discriminates in favor of close kin. Why not distant relatives? When the gene is rare, distant relatives are about as unlikely to have copies of the gene as a randomly chosen member of the population – in fact, at the limit, these are the same, because all members of a population are (very) distant relatives.

Kin selection can explain nepotism in many species, most spectacularly in the case of eusocial ants, bees, and termites, where huge numbers of close relatives cooperate. But in human social systems, even at their most simple, average r is so low that we may well say members are not, in fact, related. As Campbell (1983) rightly observed, human societies, unlike the social insects, exhibit cooperation among reproductive competitors. If kin selection can cause ultra-sociality with human levels of average r, then many more animal species should have such complex societies. Humans are probably a special case requiring a special explanation.

RECIPROCITY

In the logic of reciprocity (first explored by Robert Trivers (1971)) an 'actor' suffers a cost to benefit a 'recipient', expecting a return benefit at some other time (I'll scratch your back if you scratch mine). The time delay distinguishes this from 'trade' as commonly understood, for trade lacks the risk of no payback. Perhaps this explains the unfortunate popularity of Trivers's coinage 'reciprocal altruism', which has caused much confusion. If we stick to the gene's eye view, however, the

terminological tangles quickly evaporate. When will a gene specify a transfer of reproductively relevant resources from its own to other vehicles? Kin selection can lead to this, as we have seen. Reciprocity can too, but it differs from kin selection in that, so long as the recipient pays back the favor, it matters little whether the recipient's motivation arises from a gene identical by recent descent (or indeed from some entirely different gene). Reciprocity may even occur between species, as in mutualisms. What matters is that there be some reasonable probability that the favor will be returned and a method for assessing this probability. If favors are made when they are relatively cheap for the actor but beneficial for the recipient, and if they are returned, then a gene making its vehicle do such favors will prosper.

How well will a rare reciprocity gene do? When it is rare, a vehicle carrying the gene is very unlikely to meet another such vehicle that will reciprocate its good turns. Thus, the evolution of reciprocity requires some initial assistance from kin selection. For example, since the individuals carrying a new and rare mutation will be close relatives, vehicles carrying the reciprocity gene will be likely to meet other such vehicles – even when rare – if individuals are organized in local kin groups. Once the gene for reciprocity becomes a little more common, such kin-biased population structure is unnecessary for the success of the reciprocity gene.

Even when reciprocators are common, it is important to ensure assortment to prevent 'cooperators' from being exploited by 'defectors', and this brings us to the question of the cognitive mechanisms involved. Theoretical considerations suggest that nice-but-not-gullible strategies like 'tit for tat' (if you cooperated with me last time, I will cooperate this time; if you didn't, I won't) are at the heart of our reciprocating psychology (Axelrod and Hamilton, 1981; Axelrod, 1984), but the actual mechanisms are complex and subtle.

The logic of reciprocity can easily explain cooperation in very small groups, especially dyads. However, reciprocity cannot so easily explain cooperation in larger groups (Boyd and Richerson, 1988). In a dyad, my help is a private benefit directed to one individual; if the partner does not reciprocate, I can ignore this individual in the future and direct my help towards another who *will* pay back my assistance. But when my benefit is consumed not by one partner but by two or more simultaneously (say, for example, that I build a wall which protects everybody who lives inside of it), the structure of the problem changes. (Notice, by definition, if the benefit is being consumed by a

group, this means I cannot selectively withdraw the benefit from nonreciprocators, and am therefore producing a 'public good'. If I can discriminate, then we don't really have a 'group', but are back to dyadic interactions.) When everybody in the group returns my favor we all benefit, but if some don't return my favor, they create a dilemma for me: either (1) I can cooperate, and reward the defector (who gets the benefit without paying the cost of returning my favor); or (2) I can defect, giving up the benefits of reciprocity with those in the group who *are* reciprocators. The larger a group is, the less likely that just by chance it will have disproportionately large numbers of cooperators, so genes supporting (2) will do better with increasing group sizes. In particular, when the gene for reciprocity is new and therefore rare, the chances of having many reciprocators in a large group are vanishingly small. As groups get larger, then, kin selection is less and less effective at helping group-based reciprocity get started. For groups as small as 10, the potential to get group-based reciprocity off the ground becomes very small.

Some have considered the indirect benefits of reciprocity as a possible explanation for human ultra-sociality that sidesteps the public goods problem. Trivers (1971) speculated that given widespread dyadic reciprocity, selection would favor a strategy that used altruism towards third parties as a gauge of trustworthiness. Richard Alexander (1987) argued that the resulting structured webs could solve the problem of reciprocity in large groups. The argument is that humans are smart enough that each individual can keep track of who reciprocates with third parties; a strategy that prefers such reciprocators as partners will do well because it is better at picking low-risk partners. The resulting large webs of 'indirect reciprocity' can build much more complex societies of nonrelatives than in other species.

More recent models (Nowak and Sigmund, 1998a, b) challenge Boyd and Richerson's (1988) conclusion that large-group reciprocity cannot evolve. However, as Leimar and Hammerstein (2001) argue, the Nowak and Sigmund model makes a very unrealistic assumption: interactants never make mistakes. (see also Panchanathan, 2001). They show that when mistakes are allowed to occur, indirect reciprocity does not easily evolve because one needs information about people's intentions, not just their behavior (e.g., did Bob not reciprocate because he was punishing a nonreciprocator or because he himself is a nonreciprocator?). Indeed this is true even of dyadic reciprocity: if people make mistakes, we need to distinguish

between honest mistakes and defections, and for that we need a gauge of people's intentions (Sugden, 1986; Boyd, 1989; Boerlijst *et al.*, 1997). Panchanathan (2001) concludes that language (in the form of gossip) can furnish people with very good information about the reputations of others, where reputation (based on the person's known record of interactions) works as a gauge of someone's probability of defection. Indirect reciprocity may thus help explain why a language-endowed social mammal was capable of organization on the scale of hunter–gatherer bands, which are larger and considerably more complex than other mammalian societies but small enough that people can keep track of reputation through gossip. Whether indirect reciprocity is a sufficient explanation for organization on the level of tribes, chiefdoms, and states is unclear.

Undoubtedly, dyadic and indirect reciprocity are importantly involved in the evolution of cognitive mechanisms such as guilt and shame, and their associated signals. For example, Fessler (1999) provides a detailed analysis of the situations that elicit shame. The purpose of the emotion/display is apparently to signal one's recognition of having made a 'mistake', with the implication that one is not really challenging the social norms. The importance of signaling contrition is evidence that people care about intentions, not merely behaviors.

Signaling

If large-scale organization does depend on generating public goods altruism, perhaps such behaviors can emerge through signaling. If I benefit from advertising my qualities to others, I will want a signal that cannot be faked by lower-quality competitors. This may explain the provision of expensive public goods as a form of signaling the quality of one's genes (Smith and Bliege-Bird, 2000). Male hunters, for example, may share difficult to catch prey items with everybody because they index the hunter's skill. Attention-getting sharing thus might ensure a strong broadcast of the 'hunting quality' signal. The benefits to such hunters would be things such as being preferred in the market for mates and greater political leverage.

The first benefit is obvious, as those who make themselves known as good hunters will be perceived, on average, as better providers, and their popularity in the marriage market will allow them to choose the most desirable (e.g., rich, healthy, hardworking, fertile) partners. This translates into healthier and more abundant progeny. The second benefit requires that there be a reason for other

people to defer to the political interests of the hunter (and thus entails a form of trade or reciprocity, even if not a straightforward one). Since the prey is being shared collectively, one will not get more meat by deferring to the hunter, so why do it? Hawkes (1990) argues: in order to keep the hunter in the group (although she refers to the benefit that the hunter gets as 'social attention'). But this explanation does not solve the problem of selfishness, it merely places it elsewhere, as Smith and Bliege-Bird (2000) argue. Henrich and Gil-White (2001) suggest a reciprocal altruism hypothesis to explain deference to good hunters: sycophants who defer to the political interests of a hunter are buying access in order better to acquire the very skills the hunter has advertised.

The signaling hypothesis probably explains some altruism. However, it suffers from the same general problems as 'green beard' explanations. Why can't the selfish use the signals of altruists as a cue for whom to exploit selfishly? Why doesn't the signaling of qualities support complex societies in other species? Costly displays of good genes occur in many species, yet in no other species is aid to the group used to signal value as a mate. Emotional commitments to an altruistic moral order no doubt are a proximate explanation for such behaviors, but such emotions in turn have to be explained. The real puzzle is explaining how we came to be equipped with such emotional attachments to norms, and for that we probably need an explanation in terms of group selection generating the emergence of punishment for deviance, as argued below.

CULTURAL GROUP SELECTION

The Problem of Genetic Group Selection

Suppose we have two groups of the same species, one full of individuals with generalized altruism genes, and the other full of individuals with selfish genes. Which gene will do better evolutionarily? The fitness of a gene is equal to the average fitness of the vehicles carrying it, so here an average altruistic vehicle has higher fitness because it is surrounded by other such vehicles (which results in profitable mutual assistance). A selfish vehicle, on the other hand, has relatively lower fitness because it is surrounded by other selfish vehicles.

So the altruistic gene will win? The problem is maintaining sufficient variation between groups for group selection to be a potent force. Two forces erode variation in altruism between groups: the

relative success of selfish individuals within groups and the migration of selfish individuals from group to group. Group selection can favor altruistic genes so long as (1) migration is sufficiently low; and (2) the fitness benefits of being in a group of mostly altruists is so large that new groups of altruists which competitively displace selfish groups are generated at a pace fast enough to more than compensate for the dilution of altruists by within-group processes and the arrival of selfish migrants.

Some students of altruism (Sober and Wilson, 1998) like to think of kin selection as a form of group selection in which relatedness creates sufficient variation between groups for group selection to operate. Terminological disputes aside, the kin selection view of groups illustrates the problem with large-scale group selection; if kin groups are reasonably outbred, relatedness falls dramatically with genealogical distance and the evolution of altruism is restricted to close kin. Outbreeding is equivalent to migration into the kin group. Observed rates of migration are generally too large to allow relatedness to build up in large groups, hence making group selection in them implausible. Ever since Williams's (1966) criticism of early attempts to explain adaptations as group selected, many evolutionists reject group selection as a plausible explanation almost as a matter of principle.

A Cultural Solution

Despite the problems with large-scale group selection explanations in outbred organisms, many, starting with Darwin, have speculated that some form of group selection is important in the special case of humans (Sober and Wilson, 1998). Humans certainly do compete as groups, and organized warfare is a spectacular example. But our groups are so porous (e.g., successful groups often induce a flow of mates from less successful ones) that one is brought back to the problem of migration. If some process could minimize the effects of migration – something quintessentially human – this would give us an elegant explanation simultaneously accounting for human ultra-sociality and also for the fact that other animal societies are restricted to forms of altruism derived from kin selection. That something might be culture, defined here as the intergenerationally stable, high fidelity, social transmission of information (socially transmissible packets of information are often referred to as 'memes', after Dawkins (1989, chap. 11)).

Theoretical models show that, given a capacity for acquiring information directly from others

(which appears to be uniquely hypertrophied in humans), a bias for conformity will evolve. Conformity is adaptive because it helps individuals pick up useful memes that others have already converged upon (Boyd and Richerson, 1985; Henrich and Boyd, 1998). It is also advantageous to the degree that human societies often involve games of coordination in which direct advantages stem from doing what others do, such as driving on the agreed-upon side of the road (Gil-White, 2001). When in Rome, do as the Romans do. Many psychological studies have documented this cognitive bias (Miller and McFarland, 1991; Kuran, 1995; Asch, 1956, 1963). Conformity reduces the problem of migration (Boyd and Richerson, 1985; Henrich and Boyd, 1998) because when migrants absorb the memes in their host community they tend not to affect the local equilibrium. Rather the local equilibrium tends to convert *them*. Thus, selfish migrants arriving in an altruistic group will – if they are conformists – absorb the local altruistic norms even as their own are discriminated against, thus preserving rather than diluting the altruistic character of the group. This allows cultural group selection to generate new altruistic groups fast enough to overcome the rate at which spontaneous (cultural) mutations of individuals from altruistic to selfish erode altruism within groups (cf. Soltis, Boyd, Richerson, 1995). If cultural group selection operated over sufficiently long periods of time in the late Pleistocene, gene-culture coevolution might have resulted in the evolution of innate predispositions and skills adapted to participation in group selected social units (Richerson and Boyd, 2001).

WITHIN-GROUP COOPERATION AND BETWEEN-GROUP CONFLICTS

A complementary explanation maintains that if a norm for punishing deviations is adhered to by most members of a group, it can stabilize anything, including a norm for altruism (Boyd and Richerson, 1992). If much group competition is active rather than passive (e.g., violent combat for land), then within-group altruistic norms maintained by punishment will confer dramatic advantages. This could make the production of new altruistic groups faster than the processes which dilute altruism within the group (Boyd *et al.*, unpublished). The result would be a panhuman selection pressure for cognitive adaptations reducing the likelihood of 'mistakes' in order to avoid costly punishment (prosocial emotions such as duty, patriotism, moral outrage, etc. that commit us to predominant social

norms even in the absence of coercion). These could easily form the basis for large-scale ultra-social organization, including dramatic cultural adaptations for collective defense. Such emotions could help explain why humans often engage in altruistic acts even in the absence of monitoring or reputational benefits and why they die anonymously in battlefields.

Clearly, the other side of the coin of group cooperation is group conflict. Groups that develop norms that channel their within-group cooperation towards outward bellicosity will force other groups to develop the same (or better) or become extinct. This process selects for ever stronger forms of within-group cooperation and outward aggression and is likely to be an important force responsible for the creation of ever larger and more complex social human groups.

IDEOLOGY, SYMBOLS, AND INGROUP MARKING

No society can exist without the acquiescence of its members to the roles they must play in the maintenance and reproduction of the social whole. Historically, anthropology and sociology were both centrally interested in the question of the functional organization of individuals into such roles (both disciplines owe much to the pioneering sociology of Emile Durkheim and pioneering anthropology of Bronislaw Malinowski), but these days the topic itself has fallen out of favor with the rise of 'methodological individualism' and 'rational choice' perspectives that insist on a picture of human nature as driven by selfish, individualistic considerations. Rational choice theorists, however, can account for high-cost altruism, such as soldiers being willing to die in battle, only by including in the concept of self-interest rewards and punishments that are in turn hard to explain on individual selection grounds. A soldier may not fight out of altruistic feelings (though at least a few undoubtedly do). But whatever the personal motives (glory, duty, shame, need for recognition from others, blind respect for authority), his behavior is more likely the result of adhering to a particular ideology, and the emotions which are inculcated as part of it, than a narrow calculation of the relative material costs and benefits to himself in the evolutionist's reproductive fitness sense. (The reader should note that group selected altruism is not saintly self-sacrifice. When the final tally is completed, altruists must do better at reproducing their genes or their culture than those adopting the selfish alternatives. One target of group selection may be systems of

reward and punishment, especially culturally transmitted social institutions in the human case, that indeed motivate even the highly self-interested individual to cooperate. A relatively low frequency of altruistic moralistic punishers may be all that is necessary to keep reluctant cooperators cooperating.) If so, this means we must understand the cognitive processes by means of which ideas are acquired through social learning and emotions are attached to them. We must also understand why and how rendering ideas in the forms of reified symbols makes these ideas so attractive. Such work has barely begun.

In the domain of ethnic-group cognition, some first steps are being taken. It appears that the human brain is predisposed to essentialize ethnic and racial groups. One approach argues that essentialized 'human kinds' can be created out of any social category (Hirschfeld, 1996), depending on local cultural and historical circumstances.

Another approach argues that only those categories – such as, say, ethnic groups and castes – that superficially resemble biological species will tend to be essentialized (Gil-White, 2001). The salient resemblances to species categories are (1) normative endogamy; (2) descent-based membership; (3) characteristic marking (in ethnic groups this is outward marking in the form of dress, scarification, etc.); (4) a distinctive local social adaptation (in ethnic groups this is a local norm equilibrium). These surface resemblances fool the brain into thinking that it is looking at a species category, and the essentialism normally applied to biological kinds is activated. Features 1 and 2 are caused by 4 because interaction – especially in marriage – with outsiders who have different coordination norms is costly. A recent model shows that feature 3 also follows from 4 (McElreath *et al.*, in press). The model shows that everybody benefits from broadcasting the community of origin – if such communities differ in their norms – because in this way costly interactions between partners who will likely fail to coordinate properly will be avoided.

It is important to note that the above is insufficient for an explanation of, say, racial conflict. For most of history the antagonistic political units have often not been maximal ethnic units but smaller (e.g., subethnic tribes, clans) or larger (e.g., multiethnic chiefdoms, empires) units. Only with the recent advent of ethnonationalism – an ideology maintaining that political and ethnic boundaries should coincide – do we get a proliferation of conflicts where the antagonistic units are maximal ethnic groups. These conflicts appear especially difficult to contain and negotiate precisely because

the groups in conflict perceive themselves as un-alterably 'natural' groups. Smaller groups often recognize their 'inherent' similarities with co-ethnics, and larger ones usually find it impractical to motivate emotional adherence based on belonging to the same imperial system. We are still very far from understanding how and why ideologies such as ethnonationalism spread and remain stable and why they are so easily exportable into vastly different cultures. An understanding of the cognitive processes that make certain ideologies attractive in particular circumstances (i.e., become cultural selection pressures), and which commit us emotionally to such ideologies, is sorely needed.

CONCLUSION

Explanations that don't go beyond the mechanisms responsible for cooperation in nonhuman species fail to account in a satisfactory manner for the vast aggregations of cooperating nonrelatives that constitute human societies. Kin selection and reciprocity arguably need to be complemented by cultural group selection as the main driving force. While some work has been done to elucidate the formal properties of cultural group selection, the task of understanding the cognitive mechanisms that such processes have shaped, and their interactions, have only begun. As a result, we don't yet have a good theoretical handle on how the social brain creates selection pressures that affect the distribution and maintenance of ideologies central to large-scale human cooperation and conflict. However, we can now at least begin to ask the questions in a Darwinian framework, applied to culture as a system of inheritance in its own right.

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Cooperative and Collaborative Learning

Intermediate article

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CONTENTS

Theoretical approaches to cooperation and collaboration
Social psychological approaches
Developmental psychological approaches

Information-processing approaches
Distributed-cognition approaches
Common ground among approaches

Forms of cooperative or collaborative learning have been used for centuries and a variety of peer learning techniques have emerged. The underlying premise of these techniques is that learning is enhanced by peer interaction.

THEORETICAL APPROACHES TO COOPERATION AND COLLABORATION

Cooperative/collaborative learning refers to a variety of instructional arrangements that have the common characteristic of students working together to help one another learn. The term 'cooperative learning' is often used to describe particular techniques such as Slavin's *Student Teams Achievement Divisions* or the Johnsons' *Learning Together*. However, cooperative learning is also a process involving collaboration.

'Collaboration' is a term generally used to describe the process of shared learning and understanding. Because of the close relationship of the two terms, they will be used interchangeably in this article. Cooperative and collaborative learning techniques have been used for instructional purposes for centuries and constitute some of the oldest forms of instruction. The most recent meta-analysis of cooperative learning studies included five hundred studies (Johnson and Johnson, 1989) and provides strong support for the positive benefits of working with peers, including positive effects on achievement, self-confidence, peer relationships, and the inclusion of children with special needs. Although a great deal of work has