Why curiosity didn't kill the primate

CSRP 547

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September 2002

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Abstract

This paper considers the complex problem of why societies in many species, with special reference to chimpanzees and humans, are socially conservative, even when this prevents apparently adaptive behaviours from being adopted by social groups. Several theories are presented, with a focus on the benefits of social cohesion and social learning, and the likelihood that a heavily conservative society will reinforce such processes while also reducing individual experimentation. The difficulties of addressing such theories empirically are considered and some suggestions for further observations that would clarify matters are put forward. Finally the relevance of chimpanzee behaviour to understanding human society is argued for.

1. Introduction

When human researchers started to study the primate species that are generally agreed to be most closely related to us, they were impressed by the extent of reasoning and problem solving skills exhibited by these animals. There is a great deal of documentation about chimpanzees' use of tools, both in an imitative way (as shown in countless nature documentaries) and inventively (e.g. Kohler, 1927). There is a vast range of problems which chimps can be set and solve more or less efficiently in a lab setting (Russon et. al., 1996).

Surprisingly, wild chimpanzees actually show far less inventiveness in their problem solving and use of tools than in labs. Boesch (1996) summarised studies in different parts of Africa, which found that the social groups of the same species of chimp used different techniques for the same task (fishing ants out of their nest being the clearest example). What makes this a strange finding is that of the two ant-dipping techniques described one is substantially more efficient than the other, and this is true in the ranges of all of the chimp troops studied. Given the willingness of solitary lab chimpanzees to experiment and apparently reason about problems, one would expect the animals of every troop in the wild to have discovered the optimal ant-dipping system, and for the use of the best system to quickly spread through a troop. Given the general principle of the survival of the fittest, one would also expect troops that fail to discover the best ways of gathering food to gradually be pushed out of the environment by the technologically superior troops, just as physically weaker individuals are selected out in favour of stronger ones. A counter-intuitive finding like this demands explanation.

This phenomenon, like so many findings in primatology, also needs to be explained for another reason: its parallels with human behaviour. All human societies exhibit a strong tendency of social conservatism, with a general desire to do things the way they have always been done, for no reason other than that things have always been so. This is even the case in technologically advanced workplaces – Hammer (2001) summarises various case studies of change resistance, and while there are particular explanations given for each example, the common theme is that people just don't like learning new techniques for existing tasks, even when management put forward a convincing case that the new way will be better.

2. Adaptive value of social conservatism

There are various explanations of the possible adaptive benefits of social conservatism over unrestrained experimentation. These fall naturally into two groups: those that focus on costs of experimentation, and those that focus on the benefits of conservatism for other reasons.

2.1. Costs of experimentation

One possible drawback of unrestrained experimentation is the potential danger involved. This has been studied in detail for Norway rats, which face the problem of choosing what to eat in an environment that presents a range of foods, some of which are toxic. Experimental studies have shown that rats do not simply sample every available food, but share information with each other about what is safe to eat (Lore & Flanelly, 1977). Rats are relatively unlikely to try a novel food unless they have smelt that food on the breath of one of their conspecifics, a simple mechanism whereby young rats learn from the older rats what food is safe to eat.

Tuci et. al. (1999) investigated this phenomenon in simulation, and found that the likelihood of simulated rats to try novel foods was directly related to the proportion of food in the environment that was lethally toxic. Where relatively few foods kill the rat, there is a high probability that any novel food will be sampled, but as the lethality rate increases there is a phase transition to rats showing almost no tendency to try novel foods at all. This was an evolutionary simulation, and demonstrates conditions under which social conformity becomes selected for, as a protection from a dangerous world.

It is not possible to find a similar risk/adventurousness trade-off for every sort of behaviour, but that does not necessarily weaken this argument. If the conditions exist in which experimentation can be dangerous, it is likely that a general tendency not to experiment will evolve, and apply to all sorts of behaviour, rather than just those for which risks can easily be foreseen. This explanation does have a significant weakness though – it does not predict a *total absence* of experimentation.

In Tuci et.al.s' (1999) work, although the probability of eating novel foods drops sharply with increasing risk of fatal poisoning, it never actually reaches zero. Thus while it explains why a particular animal at a particular time is highly unlikely to try something new, it does not explain why an entire troop, throughout its history, will all fail to discover an improvement on a technique they use. Following this theory through, the day one rebellious chimp discovered a faster ant-dipping technique it should quickly have been copied by the rest of the troop.

An alternative possible explanation of this social conservatism is that experimenting with new techniques has a cost in terms of time and effort. In Kohler's (1927) study, apes would reflect on their situation and try out novel ways of using tools only after the most obvious methods failed. It may simply be that apes are not inclined to experiment when they have a reasonably effectively technique for something, because most alternatives they try will not be an improvement.

This suffers from the same problem as the risk theory outlined above, in that it provides a reasonable explanation for a general unwillingness to experiment, but not for the total absence of experimentation. It is very hard to see how one could explain the complete failure of a population to discover a particular technique, so it may be more fruitful to consider why a technique might be discovered but not become socially canalised, even though it is a significant improvement on the current norm.

Another possible explanation of this social conservatism is that there is a specifically social cost to experimenting, or to the particular technique that is being looked for. Boesch (1996) also found that similar signs have different meanings in geographically separated chimp populations, such as leaf-clipping, which in some troops is used to initiate courtship, and in others is just a play behaviour. It is conceivable that the more efficient ant-dipping technique happens to resemble a gesture of defiance to the alpha male in the vernacular of a particular troop (Di Paolo, personal communication). Alpha males maintain their privileged status precisely by not allowing such defiance among the troop, so an action which is really super-efficient foraging but happens to look like a challenge will be responded to aggressively. This will probably not be dangerous to the chimp that discovers the new technique, as chimps are rather good at resolving intra-group conflicts without lethal fights (Aureli & de Waal, 2000), but it will probably stop the behaviour from continuing, and will certainly stop others from imitating it, having seen it bring swift retribution from the alpha male.

The problem with this sort of explanation is that while it is plausible, it will have the status of an evolutionary 'just so story' until an example can actually be observed. It is possible that an effective tool-using technique has this sort of hidden cost attached in some populations, but it is also likely that it does not, and very difficult to test the hypothesis either way.

What this hypothesis does usefully do is demonstrate the importance of the social context in considering the adaptive value of a particular behaviour. It has long been accepted that some features which worsen the chance that an individual will live a long life can be adaptively useful if they attract mates (Andersson, 1982). Though it is more controversial, there is also a body of research supporting the idea that primates have evolved large brains in order to deal with their complex societies (Dunbar, 1999). If physiology can be influenced by the responses of conspecifics to an individual, then it follows that behaviour also can, and it is in the effect of behaviour on the social environment that positive benefits of conservatism may be seen.

2.2. Benefits of social conservatism

Social learning – learning about the world and appropriate behaviour from the example set by conspecifics – is clearly a useful process in many species, ranging from rats (Lore & Flanelly, 1977) through primates (Boesch 1991) to humans (Patterson & Reid, 1984). It has the benefits of allowing infants to avoid risks and to learn useful behaviours far quicker than by solitary exploration, encouraging co-operative behaviour (Di Paolo, 1998) and allowing a group to establish a culture, which in turn allows the accumulation of collective knowledge that has advanced the survival, dispersion and reproduction of the human species far further than physical adaptations could.

In the context of the striking benefits of social learning, any behaviour pattern that promotes social learning can be considered adaptive. Indeed, Di Paolo's (1998) study allowed evolution (in a simulation) to select the sort of developmental strategy used by agents, as opposed to directly specifying adult behaviour, and demonstrated that under the right conditions imitation of parents is strongly selected for. Bearing this in mind, the interaction between individual experimentation and social learning may well be relevant to the prevalence of both behaviours.

Social learning is constrained by a number of factors, including the prevalence of individual learning. While it is clearly possible for individuals to learn both by experimentation and imitation, these processes must occur at each others' expense, partly in terms of available time, but also because each process requires its own skill set.

Individual experimentation that consists purely of trying out every possibly is highly inefficient, and does not seem to be prevalent among primates. Instead, analytical skills are used, as highlighted by Kohler's (1927) observations of apes that after initial failure would spend some time not visibly doing anything (presumably considering options) and then suddenly try a radically different approach.

Social learning, on the other hand, requires the ability to selectively attend to stimuli that the teacher is drawing attention to (which in turn depends on abilities such as eye-direction detection), picking the salient features in a task, and understanding positive and negative feedback in order to respond to it. These abilities are prominent in young chimpanzees (Povinelli, 1996) and humans, but if for some reason they are impaired (as in autistic children – Baron-Cohen, 1995) the result is a far-reaching learning impairment. What is particularly striking about autism sufferers is that given the right sort of treatment they usually prove to be intellectually normal, but the normal process of social learning, with all its advantages, is useless to them.

A societal taboo against individual experimentation will naturally increase the amount of time spent performing social learning, which will also help the young develop the skills required to support this important process. A side-effect of this will be that the individual analytical skills required to support exploratory learning will be under-developed, which may serve to make experimentation less productive (by increasing the cost in terms of wasted time of experimentation). It may even be that in the absence of such a socially mediated process, lab-reared chimps are better explorers of problem spaces than chimps reared with the benefit of a natural social organisation.

Unfortunately this account still fails in one respect – like those in section 2.1 above it neither postulates a *complete* absence of experimentation nor explains why when one lucky individual discovers an optimal technique the troop don't all follow.

This difficult question may be partly answered with reference to yet another benefit of social learning over individual discovery. Further to the enhanced learning in a social setting, the actual process of learning from each other serves to bond a troop, while individuals wandering off and experiment would weaken bonds. This means that discouraging individual learning has the additional benefit of increasing group cohesiveness, which leads on to a final possible explanation of the curtailing of curiosity.

In almost all social animals there is some sort of in-group/out-group prejudice, which makes it very important for individuals to be able to recognise the members of their own social unit. Primates are unusual among social animals in that their vision is relatively well developed, while the sense of smell is relatively poor. This of necessity changes the means of recognising associates. Where cats and dogs (for example) use scent to mark territory and recognise each other, primates have to rely on more visual cues. Because appearance itself varies as much within as between neighbouring groups, it is not a very useful delimiter, so behaviour becomes the criterion for whether an individual is one of 'us' or 'them' (van der Dennen, 1995).

This also has a significant parallel with human societies – while black/white racism focuses on clear appearance differences, the mutual xenophobia between (among countless examples) French and British people is based on behavioural and linguistic differences between people with a common genetic heritage. Even between groups with obvious physical differences a difference in customs causes more tension between groups – witness the current controversy over dog-eating in Korea (Saletan, 2002).

Chimpanzees are in fact highly xenophobic, to the extent of going to war with neighbouring troops (Goodall, 2001). In this context not only is it very important that each troop has a coherent and distinctive set of customs by which to identify their own, but it also becomes highly risky to diverge from these accepted norms. Thus social conservatism in both apes and humans may serve as a form of social bonding; reinforcing in-group ties by making it easy to distinguish those who do and do not belong.

3. Methodological issues and clarifying studies

The accounts above are each appealing for various reasons, but ultimately each account taken alone is no better than a 'just so story'. To be able to evaluate such theories clearly, more empirical work is needed both in chimpanzees and humans. Of particular interest is the question of whether novelty is automatically rejected, or whether this is affected by the social status of the introducer of a new behaviour. This could provide evidence to support or refute the 'group identity' theory presented in 2.2 above.

Though chimps are generally xenophobic, the response of a troop to an 'immigrant' actually depends on who the immigrant is. Most will be chased out of the troop's territory, but if an adolescent female wanders in, they will be allowed into both the territory and the social structure of the group (Goodall, 2001). It would be useful to observe what happens when an adolescent female joins a troop whose customs are easily distinguishable from hers.

In humans there is a range of responses to the equivalent situation – some immigrants assimilate the local culture to the extent of losing their distinctiveness, while others make as few changes as possible from their old ways. The degree of acceptance that newcomers find in a society seems to be strongly related to the degree with which they adapt to local customs. At the same time many societies do exhibit a gradual assimilation of new customs brought by successive waves of immigration; the diversification of British food and the relatively recent British obsession with curry being an obvious example.

If acceptance of a new female into a chimpanzee troop proves to be conditional on some sort of behavioural convergence (whether it is the newcomer, the troop or both who change) the 'group identity' theory would be strongly supported. If on the other hand newcomers are able to become accepted even in spite of their behavioural repertoires marking them as outsiders the theory would become incoherent, as the value of distinctive behaviours as a source of group identity would be destroyed.

These sorts of experiments will not be productive to carry out in a lab setting, as it is clear that the natural social organisation of chimpanzees exerts considerable influence over the ways in which chimps solve problems. This means that the necessary events must be observed in the wild to be sure that what is seen is representative and not an artefact of the lab situation.

4. Conclusion

It is extremely difficult to anchor a discussion of a topic as complex as social conservatism in empirical findings, rather than simply discussing attractive possibilities. The combination of field observations, lab studies and simulations with a range of species has provided pointers to various explanations, which collectively are sufficient to explain the phenomena, but more information needs to be gathered to establish which are *necessary*. Both the hazards and costs of individual learning probably play some role in reducing its prevalence among social species, but it seems likely that only the positive advantages of social learning actually explain why it is so strongly preferred to individual exploration that some groups of animals continuously fail to discover improved food gathering techniques which other groups of the same species use.

An important theme of these theories is that it is extremely unhelpful to ignore the social context of a behaviour; what appears sub-optimal if an organism is looked at as an individual may well be ideal within its social context. Given that the social context is clearly an important determinant of survival and of mating chances it must also shape adaptive behaviours, and therefore be necessary for the understanding of such things.

Finally, such animal observations are not only interesting in their own right, but they also have implications for understanding and manipulation of human behaviour. If we could develop a strong theory of xenophobia and social acceptance among chimpanzees it might serve to inform the ongoing heated national debate about exactly the same phenomena in our own society (BBC, 2001). If this helps us to understand the shortcomings of our society and thereby begin remedy them, it can not come a moment too soon.

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