

Feature

Chimpanzees, our cultured cousins

Recent research shows that a large number of behavioural elements in chimpanzees are specific to each community. These are passed on through social learning and can thus be described as cultural. As both chimpanzee and bonobo are endangered in the wild, the opportunity to study such cultures in our nearest relatives in their natural habitat is also under threat. **Michael Gross** reports.

As a species, we humans take great pride in our cultural achievements, which were traditionally thought to set us apart from all animal species, often assumed to be operating purely by instinct and innate behaviours. This traditional view is linked to a religiously tinged idea of *Homo sapiens* as the crowning glory of creation. Scientific findings from Darwin through to the genome sequences of humans and apes have undermined this claim to uniqueness, demonstrating that — phylogenetically, at least — our species is, as Jared Diamond put it, “the third chimpanzee”. This realisation has even led to calls to merge the genera of *Homo* and *Pan* (*Curr. Biol.* (2003), 13, R464–R465).

Animal rights campaigners have long argued that the level of consciousness in great apes and their similarity to humans should be sufficient reason to give them fundamental rights and exclude them from invasive experimentation. Protective legislation inspired by the similarity of apes and humans has been passed in New Zealand, Austria, the Netherlands and Sweden.

Now even our claim to culture as a unique selling point is losing its shine to some extent, if we look beyond opera and Ovid and define culture broadly as socially learned behaviour patterns that are not inherited genetically. Research has uncovered cultural traditions of this kind in a wide range of species from chimpanzees to hairy-nosed wombats and even in whales and bumblebees, as was discussed at a recent ASAB meeting on ‘Social Learning and Culture’ held in London in December (bit.ly/1NtPcTP), following directly after a similar meeting focusing on primates.

If the aim is to assess and understand the relationship of our species to our mammalian relatives, such issues are most meaningfully

studied in our closest relatives, the chimpanzee (*Pan troglodytes*) and the bonobo (*Pan paniscus*). This research is all the more important as both our simian cousins are endangered, suffering from a multitude of threats from habitat loss through to poaching.

Chimpanzee cultures

The group of Christophe Boesch at the Max Planck Institute for Evolutionary Anthropology at Leipzig, Germany, has been studying socially learned behaviours like tool use in chimpanzees for many years. Working in the Tai National Park in Côte d’Ivoire, Boesch and colleagues have studied three separate communities with adjacent territories in a continuous stretch of primary rainforest.

One of the groups has been habituated to human observers since 1989, the second since 2000 and the third since 2007. Their close proximity enables the comparative study of behaviour in an ecological context that is virtually identical.

Boesch and colleagues have over the years studied several behaviours that display cultural differences between groups, such as the choice of tools for cracking *Coula edulis* nuts. One of the groups will always prefer stones for this task, while the two others increasingly use wooden hammers as the nuts dry out and are easier to open.

In a recent study aiming to comprehensively catalogue the suspected cultural traits in these three groups, Lydia Luncz and Christophe Boesch identified a total of 27 behavioural elements that differ between the groups (*Am. J. Phys. Anthropol.* (2015) 156, 67–75). These differences affect tool use, foraging technique, social interactions and communication within the group, and the hunting strategy and division of meat.



Dipping in: Chimpanzees in the Tai National Park in Côte d’Ivoire harvest ants by plunging their arms into the colony, or by using sticks, but there are cultural differences between groups as to how they proceed. (Photo: C. Boesch/MPI EVA.)



Cracking tools: Chimpanzees in the wild are known to use both stones and wooden hammers to crack nuts. Groups differ in the patterns of tool choice for this task. (Photo: C. Boesch/MPI EVA.)

In the foraging behaviour, the researchers specifically investigated any differences in the populations of the prey species, the *Dorylus* ant and the *Thoracotermes* termite, to ensure that the observed differences are really due to social transmission rather than ecological context. For instance, different groups have different techniques of raiding ant nests by inserting either a hand or the whole arm into the nest, but the researchers established experimentally that this is not related to different behaviour of the ants in the territories of the groups.

Further feeding habits that differed between the groups include the use of leaves or bark as sponges to drink water from, the use of containers for drinking, and the above-mentioned nut-cracking techniques. Hunting behaviour differed in the use of vocalisation, the presence of females, the prey selection, and the processing and sharing of the prey.

Beyond food-related behaviour, the researchers also observed differences

in social behaviours and courtship routines. Anthropologists might still argue that the cultures of prehistoric humans were defined by a broader range of behaviours, including languages, oral traditions, and music. However, the observed distinctions in dozens of learned behaviours are beginning to add up to a picture that is coming closer to what we would recognise as a group culture, and Boesch believes that this is still only a part of the cultural tradition of a chimpanzee community. Apart from the manifold food-related behaviours, Boesch comments, “we see cultural differences in chimpanzees also in the social as well as in the symbolic domain.” An example of the latter kind of difference is that the leaf-clipping behaviour means different things in different groups, but the group members understand the specific meaning, Boesch explains, adding: “Furthermore, the more we study chimpanzees, either known populations for longer, or new

populations, the more new cultural differences we uncover. Therefore, I think our understanding of their cultural abilities is still only in its infancy.”

Migrants adapt

As female chimpanzees move to a different group once they reach maturity, the specific cultures can only be upheld if the females adapt to the community they move into. Luncz, Boesch and Roman Wittig have recently reported observations based on an unusual influx of seven females joining the South Group in Tai National Park within two years. As the presumed community of origin, located south of the South Group, is not habituated to human observation, the researchers could not directly compare the cultural behaviours. However, they used archaeological methods to study tool use in nut cracking in both groups, and combined this with observations of the migrant females in their new community. This enabled the team to investigate how the females adapted to the nut-cracking customs of the group they joined (Phil. Trans. R. Soc. B (2015) 370, 201403840).

Members of the South Group consistently used stones to crack nuts 85% of the time, throughout the nut harvest season, as the researchers established through observation in accord with the collection of tools left behind at nut-cracking sites. By contrast, the other group uses wooden tools more often, possibly depending on the hardness of the nut shells. The researchers observed that the migrant females very quickly switched their tool selection to the pattern of their new community. As foraging for and cracking of nuts is carried out socially within the group, the authors conclude that the new group members rapidly copied what the established members were doing, notwithstanding their previous experience with different nut-cracking methods.

Beyond chimpanzees

Similar social learning and cultural tradition is likely to exist in other primate species. The bonobo would be of interest for comparative studies with chimps and humans, given that it is just as closely related to us as the chimpanzee and displays a remarkable

level of empathy between juveniles, which is of interest to consciousness research (Curr. Biol. (2013) 23, R981–R983). As Frans de Waal has noted in his books about apes and people, however, the bonobo is much less studied than the chimpanzee. Apart from their late discovery (in 1929) and more limited range, the free-loving lifestyle of the bonobos, who rub their genitals as often as humans in Western societies shake hands, may have something to do with this.

While there is work on bonobos in captivity, there are only a few groups that can be studied in the wild, some of which have only recently become habituated to human observers, so comparative cultural studies in the wild, as done for chimpanzees, have only recently become feasible. Bonobos in the wild use tools less frequently than chimpanzees, Frans de Waal notes, although observations in captivity show that they are equally capable of tool use. Thus, field studies of cultural differences would have to focus on other kinds of behaviours, such as food preferences, social customs, and possibly their vocalisations. “For example, studies seem to show that bonobo have more complex communication, especially multi-modal (vocal, face, hand), than perhaps any primate, so there could be cultural variation there,” De Waal concludes. “There is not nearly enough work on this.”

As the group structure in bonobos is matriarchal and conflict between groups is less common than in chimps, it would be interesting to have comparable information from both species, to complete the picture of the three chimpanzee-like species.

Among the more distantly related primates, there are further examples of cultural behaviour elements. These have been studied particularly well in Japanese macaques and in capuchin monkeys. For instance, recent work from Elisabetta Visalberghi from the Institute of Cognitive Sciences and Technologies at Rome, Italy, in collaboration with Boesch and others, compares the nut-cracking cultures of chimpanzees to those of bearded capuchin monkeys (*Sapajus libidinosus*, formerly *Cebus libidinosus*) at Fazenda Boa Vista in the southern Parnaíba Basin in Piauí

in Brazil (Phil. Trans. R. Soc. B (2015) 370, 20140351). These capuchins were the first non-ape primates to be observed using stone tools in the wild. As their lineage diverged from *Homo* and *Pan* some 35 million years ago, the researchers reckon that their tool use emerged independently from the similar habits of chimpanzees.

Habitat lost

Chimpanzees inhabit shrinking patches of rainforest in West and Central Africa, separated from their bonobo cousins by the Congo river, of which the latter very fittingly inhabit the left bank. Both species have been listed as ‘endangered’ on the IUCN Red List since 1996. Both are threatened by habitat loss and poaching. Infectious diseases transferring from human settlements are adding to the dangers.

“The combination of slow reproductive rate typical for chimpanzees and the destruction of the forest habitats in Africa, which are needed for chimpanzees to survive, is already leading to many local extinctions of populations in many regions of the continent,” Boesch comments. “This is badly threatening their long-term survival.”

Protected areas have been established within the ranges of both species, but given the various crises that have afflicted Equatorial Africa in recent years, from civil wars to the Ebola epidemic, it is not surprising that existing conservation laws have not always been enforced as well as they should be. The Wild Chimpanzee Foundation (<http://www.wildchimps.org>), which Boesch founded in 2000, supports education, conservation and research in West Africa with the aim of safeguarding the remaining populations.

While there are many other species more imminently threatened with extinction, one could argue that we carry a special responsibility for our two closest relatives in the tree of life. As a bonus, chimpanzees and bonobos may offer us a unique window to understand how our own, more ape-like ancestors began to pass on learning and culture.

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Q & A

Liam Dolan

Liam Dolan is the Sherardian Professor of Botany and Head of the Department of Plant Sciences at Oxford University. He grew up in Ireland, received his undergraduate degrees from University College Dublin in botany before moving to the University of Pennsylvania to study for a PhD, where he started his work on cellular development in plants. He spent 18 years at the John Innes Centre in Norwich, first as a post doc and then as a project leader before moving to the University of Oxford in 2009. He has worked on the mechanisms controlling plant cell growth and how gene regulatory networks that control the differentiation of rooting cells have evolved since plants colonized land over 470 million years ago.

Why are plants important? Plants and other photosynthetic organisms are the transformers that convert the sun’s radiant energy into the chemical energy that powers most life on the planet. Not only are plants the energy inputs into the terrestrial environment, but humans are entirely dependent on plants for calories, nutrition and the ecosystem services they provide (e.g., productive soils, clean air and water). Breakthroughs in domestication and plant breeding have been central to the evolution and economic development of human cultures since soon after the last ice age. Despite their pivotal role in the Earth system and human wellbeing, they are relatively poorly understood. Unfortunately, this limits what human ingenuity can do with plants to address global challenges as we, as a species, get too big for our planet.

What turned you on to biology in the first place? I have been interested in biology since I was very young. I spent my summers with my grandmother in the West of Ireland and she taught me a lot about the wild plants — their characteristics and medicinal uses. I grew up in Dublin city between the Royal Canal and the Phoenix Park — places teeming with urban wildlife. When old enough to use public transport on my own, I would visit the Bull Island in Dublin Bay — bird watching, botanizing and getting up to no good. This might