Animal Cognition: Bring Me My Spear

Chimpanzees regularly hunt mammals, but use only their hands and teeth: for the first time, chimpanzees have now been found to make tools in order to spear mammalian prey.

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How much like us were our ancestors of 5–6 million years ago, the last ancestors we share with any other living animals on Earth? The main way to find out is by comparing our own behaviour with that of our closest non-human relatives, the two species of chimpanzee. Any human traits they share can be attributed to the last common ancestors, as chimpanzees too descend from that same ancestral population. For this reason, the last 30 years have seen excitement generated each time a new report is made of a chimpanzee showing a behaviour previously thought to be ‘uniquely human’. These behaviours have included: tool making, hunting of large mammals, recognizing one’s face in a mirror, lethal campaigns of ‘warfare’ with neighbouring communities, understanding ‘theory of mind’, displaying cooperative action, carrying out control of predators that present no immediate threat, functionally referential communication, culture… As the list grows in length, one might be forgiven for wondering what there is left separating us from the beasts: has the idea of a behavioural Rubicon marking out humanity passed into history?

True, some of these characteristics are slippery ones to detect in non-verbal animals: particularly warm controversy surrounds the claims of chimpanzee culture, cooperation and theory of mind [1–4]. And some of the undeniable traits of chimpanzees might be remarkable to find among apes but are actually shared with quite distantly related species: thus cooperation has also been demonstrated in dolphins and other social carnivores [5], mirror self-recognition has recently been reported for elephants [6], and functionally referential communication is shown by several primate and bird species [7]. But all the same, the list of characteristics and abilities found in chimpanzees adds up to a pretty human-like identikit.

A more fundamental issue lurks in the use of that verb ‘adds up’. Human achievements are not just additive: they are often multiplicative. Thus, it is not just that all human groups make tools, hunt animals and show cooperative action: rather, they make tools and they cooperate in order to hunt better. It is not just that all human groups show occasional intercommunity violence, cultural differences and use of referential communication: critically, their intercommunity violence is based on cultural differences to which they make frequent reference. Chimpanzees use tools to collect social insects and break hard nuts, but they hunt mammals with their bare hands and jaws [8]; many chimpanzees may go hunting at once, but convincing evidence of cooperative hunting has been hard to find [9]. And those behavioural differences ascribed to chimpanzee culture do not motivate any discrimination [10], even though chimpanzees can show xenophobic attacks on neighbours. A sceptic might therefore still wonder whether the accumulation of apparently human characteristics is any more than one might expect when a highly social, large brained mammal is studied as exhaustively as the chimpanzees has been. Perhaps the resemblance to our own culturally based technological progress is, after all, superficial?

But now, for the first time, chimpanzees have been seen making tools in order to hunt. As they report in this issue of Current Biology, Jill Pruetz and Paco Bertolani [11] watched chimpanzees at Fongoli, Senegal, hunting for lesser bushbabies or galagos Galago senegalensis: small, agile and strictly nocturnal prosimian primates that spend their day hidden in tree holes. Systematically, chimpanzees fashioned sharp stick tools before trying to catch galagos. Typically, a chimpanzee would break off a living branch, trim off its leaves and side-branches and often the ends as well; and sometimes it would sharpen the stick with one or many bites of the incisors. The result was a sharp stick of 50–100 cm length, with which it could probe into tree cavities. When chimpanzees make probe tools to extract insect prey, like Campanotus ants or Macrotermes termites, the tool is designed to enter holes too narrow for a chimpanzee’s finger or hand. But in the case of galago hunting, the tree cavities were wide enough to admit a whole arm. Here the function of the tool seems to be to spear the resting animal, presumably to immobilise it for capture.

A chimpanzee would forcibly jab a stick into the hole once or several times, sniffing or licking the stick when pulled out. Pruetz and Bertolani [11] reckoned that no galago prodded with such force could escape injury, but galagos are evidently thin on the ground as only one actual capture was seen in 22 attempts; and even then spearing was not actually witnessed, although the galago in question made no attempt to escape. In this and several other cases, the chimpanzee opened up the cavity by breaking off a large branch, but only after prior use of the tool, so it seems clear that the point of tool-using is to prevent escape by first killing or injuring the animal. Lesser galagos are small...
animals and they travel in great leaps from tree to tree: capture of an uninjured individual would certainly be problematic for a chimpanzee, once the galago had left its daytime cavity.

Skewering a defenceless 200 g bushbaby may not be quite the romantic image conjured up by those Man the Hunter scenarios, but it is perhaps a start. Archaeological evidence of javelin-like throwing spears only goes back to 400 thousand years ago, attributable to one of the group of Homo species that share a common ancestor with sapiens at about 600 thousand years ago. Between 6 million and 600 thousand years ago, our ancestors may have hunted with no more dramatic use of tools than Fongoli chimpanzees. Pruetz and Bertolani’s [11] discovery also supports the suggestion that tool using may not have originated with ‘man’ at all, but in female behaviour. Galago hunting is largely the province of female and immature chimpanzees at Fongoli; males do hunt mammals, but go for larger species like monkeys, without use of tools. Bill McGrew [12] has suggested, on the basis of the bias towards tool-assisted insect feeding by female chimpanzees and group hunting of mammals by males, that skilled tool making and tool use in humans began as a largely female role. Tool-use in hunting by female chimpanzees is entirely in accord with that idea. Moreover, the fact that living chimpanzees are capable of employing a spearing technique to obtain hard-to-catch mammalian prey shows that the transition — in human evolution — to big game hunting with spears did not depend on a conceptual advance. Much more likely, spearing animals that could fight back requires combining power with throwing accuracy well beyond that of a chimpanzee [13], and relies on neural developments of the larger hominin brain.

References

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Meiotic Pairing: A Place to Hook up

At one end of each Caenorhabditis elegans chromosome is a locus required for meiotic crossing over. Recent studies have shown that these sites mediate chromosome pairing and synapsis during meiosis, and that each site contains binding sites for a non-canonical C2H2 zinc finger protein.

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One of the most impressive activities of chromosomes during meiosis is their ability to form pairs, each with its homolog. This process, which at first occurs seemingly without the homologs touching, culminates with the formation of the synaptonemal complex — synapsis — which appears like a polymer formed into railroad tracks that holds each pair of homologs together along their entire length [1]. Although ubiquitous, pairing and synapsis have proven to be complex and often difficult processes to study. The alignment of homologs can depend on the simultaneous interaction of many sites on each chromosome, associations of telomeres with the nuclear envelope and genetic recombination [2]. Perhaps because all these factors combine to promote pairing and synapsis, we still do not have a clear picture of how homologs find each other and the mechanism for initiating synapsis.

The link between meiotic recombination and pairing or synapsis has been most firmly established. Recombination initiates with a double-strand break and the subsequent repair reactions (for example [3]) result in either of two products, a crossover and a noncrossover (gene conversion without crossing over). The crossover is important because it links homologs together, allowing for their orientation on the metaphase I spindle and reductional segregation at anaphase I. In addition to this role,