



Review Article

Primate Cognition and the Origins of Human Culture

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Abstract

The concept of culture is central to cross cultural psychology. This paper examines the evolutionary roots of human culture through examining the similarities and differences between human and non-human primates. After discussion of the meaning of the term culture, I present evidence that it is to be found in non-human primates with a focus upon chimpanzees. I then discuss how human culture differs from that of its non-human cousins. I consider several factors which might account for the relative sophistication of human culture: Learning, the ratchet effect, conformity, collaboration, meta-representation, and imagination.

Introduction

As Chasiotis [1] has argued, cross-cultural psychology aims to look for and account for similarities and differences in the behaviour of individuals in diverse cultural groups. It links human behaviour to its cultural context [2]. Poortinga [3] notes that research in cross-cultural psychology focuses upon differences rather than similarities in psychological functioning. Consequently, stereotyped views of 'them' versus 'us' are promoted. Furthermore Keller, Poortinga, & Schölmerich [4] bemoan the fact that the cross cultural psychological literature pays sparse attention to evolutionary approaches. Evolutionary aspects are rarely mentioned in the cross-cultural literature despite the fact that they have direct relevance for cultural psychology.

A pressing question for anthropologists is: What differentiates humans from other primate species? To what degree do nonhumans share other capacities still thought to be exclusively human? Answers to these questions have focused on diverse areas including, but not exclusively, cognition, styles of cooperation, tool use, influence on the surrounding environment, and niche construction. While much progress has been made in defining uniquely human cognitive aspects, much less understanding exists of the evolutionary processes involved in generating these differences [5]. To this extent Heyes [6] notes that evolutionary research on human cognition asks what types of cognition make humans unique, and how they arise through evolutionary pathways.

Laboratory-based studies of primate cognition are somewhat problematic to the extent that captive populations of a species are not always comparable, and it may not be possible to generalize to natural populations. Field studies of primate cognition can pose significant difficulties in that that replications are costly and difficult to conduct, and similarly different populations cannot be easily compared. In an attempt to resolve these issues, Tomasello and Call [7] propose

the creation of data banks for the deposition of primary data and videotapes so as to facilitate cross-examination, replication, and, eventually, the grouping together of data across investigative groups.

The study of nonhuman primate culture may provide significant understandings into the development of human culture, since it is likely that evolutionary continuities link human and nonhuman primate cognitive processes. Thus examination of our closest living relatives, the chimpanzees, can provide information about the cognitive abilities of the common primate ancestor and thus establish which aspects of human cultural cognition are shared with other primates and what aspects have evolved more recently in human groups. As shall be discussed below, recent research indicates both important commonalities, as well significant differences, between human and non-human cognitive abilities, indicating that human cognitive evolution has been a more gradual and incremental process than was previously assumed.

Do Primates Have Culture?

Whether primates have culture has been a topic of long-standing debate among biologists and biological anthropologists and rests on the definition of the term 'culture' [8]. As Sahlins [9] argues in *The Uses and Abuses of Biology*, social scientists have been reluctant to compare humans with animals and to use the term culture for non-human species for fear of threatening human beings in their humanity [10]. In

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terms of culture, many scholars assert that some animal behaviors are 'cultural' to the extent that they are socially transmitted inter-generationally. They fulfill the widely accepted definition of animal traditions as 'a distinctive behavior pattern shared by two or more individuals in a social unit, which persists over time and that new practitioners acquire in part through socially aided learning' [11].

Evidence is rapidly accumulating that non-human primates indeed do have culture. This evidence questions the longstanding premise among sociocultural anthropologists that it is only humans who have culture. Not only do chimpanzees as a species demonstrate a wide range of traditions, but, significantly, each community possesses its own set of cultural traditions. These cultural traits involve not only feeding patterns but also exist in the communicative and social domains. Such diversity has been found in various contexts: Sexual, social, demographic, tool-use, and hunting. Chimpanzees are skilled in tool use with different groups deploying diverse tools to resolve identical problems [12,13]. These behavioural differences cannot be accounted for genetically [14]. The first indication that non-human primates have culture derives from fieldwork among macaques in the 1950s in Japan [15]. A female monkey on Koshima Island was observed rinsing sweet potatoes prior to eating them. This behaviour was subsequently transmitted throughout the troop.

Food Processing and Tool Use

Information pertaining to primate culture may be elicited through examination of tool construction and use. A tool may be defined as an implement which facilitates a specific purpose. It is important to distinguish between tool *use* and tool *making*, the latter involves deliberately modifying some material for its intentional use. Tool use is generally considered to signify complex cognitive abilities and at one time was indeed considered to be unique to humans. However non-human primates and birds also deploy tools for gathering food. The sophistication of human tools and the degree of reliance upon them is unique among humans and is what differentiates this group from other species.

Primates are recognized for using tools in a range of activities like hunting and foraging for food and water, finding shelter, and self-defence. Whiten [16] argues that chimp tool use helps the community survive through seasonal nutritional bottlenecks. Chimpanzees (*Pan troglodytes*) and bonobos (*Pan paniscus*) are our closest living relatives. Strong genetic similarities exist between both species but they differ in a number of important ways relating to their deployment of technology. While chimpanzees demonstrate a diverse range of tool use, bonobos rarely use tools and never in these cases for foraging for food.

Chimps alter objects so as to make them fit for specific purposes. They can make objects for future use at some distant location, and they demonstrate some creative ability in terms of using objects as tools to solve novel problems. Such actions indicate a degree of planning and forethought and interest in the shape and size of the raw material, reflecting some preconceived ideas of what the end product should be. One significant feat among chimps is that they

learn to use a tool set. Eastern and West African chimpanzees sequentially deploy four tools to extract honey. These are gathered together specifically for this purpose. They begin with a battering stick, followed by a chisel-like stick, then a hard-pointed stick, and finally they end by using a long slender flexible dip stick to extract the honey.

Tool use traditions differ in different geographical areas. As one illustrative example, two groups of chimpanzees in Uganda, the Sonso community of the Budongo Forest and the Kanyawara community of the Kibale Forest, were exposed to an identical problem involving the extraction of honey trapped inside a cavity of a large tree trunk [17]. There are negligible genetic differences between these communities and both are very similar ecologically.

The two communities differed in terms of their use of sticks as foraging tools. Group-specific techniques were deployed by each community reflecting their cultural backgrounds, i.e., stick use in Kanyawara and leaf-sponging in Sonso. Hence, the chimpanzees adapted previously acquired tool use behavior to solve a novel foraging problem. Importantly, despite the fact that all Kanyawara chimpanzees were able to manufacture leaf-sponges, no individuals used this technique to solve this particular problem. The Kanyawara chimpanzees regularly make use of sticks to obtain food from inside cavities, but the use of sticks has not been observed in the Sonso community after two decades of repeated observations [17,18]. The findings demonstrate that after controlling for genetic and environmental influences, wild chimpanzees depend upon their culture specific information for solving a novel task.

As another example Preutz, et al. [19] observed Savannah chimps at Fongoli, Senegal. The authors found that these primates consistently deployed tools-pointed spears-to hunt for prey-usually bush babies. After tearing off the bark from a branch they bite it to fashion a spear which they use to jab their prey. Of great interest it was predominantly females who used tools. This research raises interesting questions related to tool use in early hominids and especially the role of females in hunting.

Cognition in Human and Non-Human Primates

As Boesch [10] notes, the central question pertaining to primate culture concerns what distinguishes the cultural practices in different species, rather than whether culture is a uniquely human ability. The focus of research has now changed from whether primates have culture to how their culture differs from that of humans. However, some [20], have argued contra this position that only humans have a completely developed symbolic activity through evolution that integrates all the intelligence modules of the human mind. Furthermore, it is unknown whether chimpanzees have a form of internal subjectivity and to what extent they ascribe symbolic meanings to their behaviours. Finally, as Gruber, et al. [21] assert, for some authors culture is more than a collection of socially acquired behaviors, arguing instead that it should be defined as an integrated set of norms which individuals vigorously defend [22,23].

While humans and other great apes share many cognitive abilities (including symbolic communication), the main differences involve complex cognitive skills in humans including reasoning about relationships, causation, time, and other minds. Whiten and Erdal [24] identify five dimensions of the human socio-cognitive niche on which humans excel compared to non-human primates - cooperation, egalitarianism, theory of mind, language, and culture. They cite several illustrative examples. Chimpanzees cooperate during hunting and raiding parties on other troops; are egalitarian in sharing food, form coalitions to oppose dominant males; can attribute perceptions and goals, and perhaps even beliefs and desires, to other chimpanzees; and, in addition to possessing large repertoires of communicative gestures, they deploy vocalizations in a flexible, context-dependent way to communicate information about food, the environment and social roles. Whiten and Erdal note the vast differences between the cultural abilities of chimpanzees and humans, but even here signs of continuity are to be found. Field studies indicate over 40 chimpanzee traditions - food processing, tool use, and various social behaviours - and many of the social learning processes existing in humans can be observed in other animals, including chimpanzees.

Significant differences exist in social learning processes between humans and non-human primates, however. Humans deploy shared intentionality to an extent not found in other primate groups for collaborative living, social learning, and information exchanges in groups. Furthermore, there is accumulating evidence that our lineage underwent significant physical changes, behavior, and ecological environments during the Pleistocene resulting in the development of a specifically human niche. As Fuentes [25] argues, no other species expresses such marked ecological diversity as humans. While human niches are material, they are simultaneously shaped by perceptions, beliefs, hopes, and practices, and our ideologies have impacted the evolutionary process. He underscores the fact that human culture is distinct from primate culture in that it encompasses innumerable variations, spans an immense diversity of behaviour, technology, ideas, and many other aspects. No other species comes remotely close to this. Fuentes [25] arguing for the distinctiveness of human culture writes:

‘For humans, cultural elements include massive extrasomatic material creation, manipulation, and use (tools, weapons, clothes, buildings, towns, etc.) and extensive ratcheting up (expansion and augmentation of cultural processes based on accumulation and innovation) on scales and with a level of structural and material complexity greater than in other organisms’.

How can we explain the significant differences between human and non-human primate cultures? Below some aspects that differentiate between human and non-human primates and may account for the superior cultural abilities of human primates will be examined. These include learning; cumulative culture; conformity, meta-representation, collaboration, and imagination beginning with learning. While they are examined separately they are interrelated. For instance as shall be discussed below human learning is dependent

upon meta-representational ability. The capacity for the development of cumulative culture is underpinned by the human propensity to learn.

Learning in Human and Non-Human Primates

One difference between human and animal culture pertains to the nature of the underlying processes of social learning. Musgrove, et al. [26] define teaching as a form of high-fidelity social learning that supports human cumulative culture. Arguably, only human culture derives from imitation and teaching, while animal cultures on the other hand originate from ‘lower-level’ social learning involving stimulus enhancement or emulation [27-31]. It is of note that human children are especially attuned to adults imparting knowledge about various aspects of their environments [32]. This adult instruction is trusted implicitly based on their cooperative motives. There is generally little supporting evidence for teaching in non-human primates. This contrasts markedly with the habitual natural teaching practices which are found universally across human societies (but see for some evidence of the existence of teaching in non-primate species) [33,34].

Csibra and Gergely [35] argue that the types of knowledge transmitted across generations in human groups are significantly different from the more restricted range of socially transmitted cultures that are to be found in non-human primates. These authors argue that during hominid evolution a new type of specialized social learning system was selected to ensure that cognitively opaque cultural contents were efficiently transmitted inter-generationally from knowledgeable individuals to conspecifics lacking such knowledge. Human communication enables individuals to impart knowledge with opaque content to others through a single demonstration. This occurs not only because recipients are already attuned to view such actions as communicative demonstrations, but also because they maintain the default expectation that the content of the demonstration involves some aspect of shared cultural knowledge which can be generalized along some relevant dimension to other objects, other occasions or other individuals. They ie Csibra and Gergely [35]: ‘First, human cultures are unique in that they involve the transmission of *cognitively opaque* cultural knowledge that is not (or not fully) comprehensible for the naïve observational learner in terms of their relevant causal and/or teleological properties. Second, human cultures involve the transmission of *generic* (or semantic) knowledge of properties that specify and generalize to *kinds*. Third, human cultures involve conveying *shared* cultural knowledge that is presumed to be equally accessible to all members of one’s cultural group’.

Cumulative Culture and The Ratchet Effect

‘Cumulative culture’ originates from individuals’ abilities to ‘ratchet’ existing culturally transmitted achievements, that is to “...add an existing technique used in a different context, or an entirely novel technique, to an existing technique, and integrate them functionally” [36]. As Tomasello [37] notes, human beings are biologically adapted for culture in significant ways compared to other primates. This is evidenced most clearly by the fact that only human cultural traditions accumulate modifications over historical time (referred to as

the ratchet effect). Human culture is dependent upon evolutionary processes in which material and symbolic artefacts and social practices slowly acquire increasing numbers of modifications (ratchet up in complexity), upon which other group members can build [38].

However while some authors assert that humans possess cumulative culture on account of the fact that they have both teaching and imitation [22,29,39] others argue that human-animal differences in social learning mechanisms may be insufficient sufficient to explain the emergence of cumulative culture [40].

Conformity

In terms of conformity - aligning one's attitude with a majority position-recent studies point to the fact that conformity may also be found in animals, even to the extent of rejecting pre-existing individual preference for the majority's preference [41-44]. However, little is known about the cognitive processes underpinning these behaviors. More specifically are animals simply biased to select the majority choice (*informational conformity*) or does this conformity derive from social awareness and the desire to conform to the group (*normative conformity*) [43,45,46]. Some suggestive evidence for informational conformity can be seen among vervet monkeys. Immigrating males who developed a strong likeness for one type of novel food (artificially colored blue or pink maize of identical taste) in their group of origin quickly altered their food preferences soon after immigrating in a group where the majority of individuals demonstrated a preference for the other colour [47]. Given that normativity requires some representation of norms and its more complex expression, the existence of informational conformity in non-human groups remains controversial [48].

Meta-Representation and Culture

While humans and other great apes hold many cognitive skills in common, the former also developed a unique assemblage of cognitive abilities and motivations - collectively known as shared intentionality - to facilitate collaboration, social learning, and information exchange within cultural groups. Tomasello [38] suggests that the capacity for theory of mind among humans enabled them to view their peers as intentional beings who possess similar minds. For Tomasello, et al. [49], this cultural capacity is dependent upon this enhanced social cognition, particularly the ability to perceive the mental states of other individuals, and this ability is also closely aligned to language which may itself enable the formation of categories of mental states but may also facilitate conscious awareness of their existence [50]. Chimpanzees appear to comprehend others' goals and derive basic inferences, but there is no supporting evidence that they can consciously reflect upon their own mental states or even understand others' beliefs, abilities that in contrast are found in human infants [51,52]. We find no evidence for meta-representations of cultural knowledge in other primate groups: apes may not understand that they themselves, or others, maintain cultural beliefs.

Differences in meta-representational ability may thus account for the key differences between human and non-human cultures, more specifically relating to limitations in cumulative behavior and normative conformity as discussed above [21]. Tomasello [37] in a similar vein argues that meta-representation is a key adaptation enabling humans to understand other individuals as intentional agents like themselves and can engender cultural learning from a very young age. He argues that this ability emerges in young human infants around one year of age and enabling the acquisition of language and tool use practices. Finally, echoing the prominent role of metacognition in humans) [53] assert that the distinctively human cumulative cultural evolution is attributable to capacities for explicit metacognition.

An awareness of others' mental states, however, is necessary for successful pedagogy and the transmission of cultural information. Csibra and Gergely [54] argue for the universality of natural pedagogy among human groups. Despite the vast differences cross-culturally in child-upbringing practices, all human cultures directly depend on communication, both verbal and non-verbal, to transmit to novices diverse types of cultural knowledge including information about types of artefact, conventional behaviours, symbolisation, and cognitively opaque skills. Data pertaining to early hominin technological culture support the assertion that natural pedagogy was an independently selected adaptive cognitive system, rather than arising as a by-product of another human-specific adaptation like language. In line with Csibra and Gergely, Heyes [55] states that human primates are born pupils. She argues that human infants genetically inherit a conglomeration of psychological adaptations that enhance their receptivity to teaching.

Collaboration

Tomasello and Hermann [56] argue that one major distinction between human and non-human primates involves their ability to function in cultural groups. The highest cognitive achievements in humans do not derive from individuals acting by themselves, but rather through individuals collaborating in groups. Great apes, particularly chimpanzees, coordinate their actions with other members of their groups in myriad ways - for example, they capture small animals and construct coalitions and alliances in intragroup conflicts [57]. Humans in contrast collaborate and communicate with each other in especially complex and elaborate ways. Their complex social institutions reflect joint goals, division of labour, and communicative symbols. In comparison to non-human apes who exploit others' perspectives for their own purposes, human infants make use of their perspective-taking skills to facilitate information sharing with others and for cooperative communication with them. Finally, some data suggest that chimpanzees and humans might differ in their underlying motivation to engage in a cooperative activity. There is some evidence that human infants demonstrate greater motivation to collaborate than chimpanzees. For example Reckers, Haun, and Tomasello [58] have found that human infants, but not chimpanzees, favour collaborative over individual food acquisition and these authors make a case for motivation being one key element underlying the evolution of human-like cooperation.

Imagination

Agustín Fuentes [59] argues that creativity and an ability to cooperate at an unprecedented scale were the major forces involved in human evolution. Deploying recent findings from evolution, biology, and archaeology, he proposes that human progress has been driven by creativity and cooperation. Furthermore, in his view the human capacity to move backwards and forwards between *what is* and *what could be*, and to share that information with others, is responsible for our lineage's success [59]. For him humans are a unique type of mammal, primate, and hominoid that observe the world, see it as it is, imagine novel possibilities, and reshape material reality. Fuentes [25] argues that much evidence exists that humans possess substantial ability to transform the shape of ecosystems, but this requires substantial efforts of collaboration and creativity.

But do other non-human primates possess imagination? According to Mithen [60] it remains clear that chimpanzees do not possess a creative imagination. This ability is found only in humans and sets them apart from their hominid ancestors. For this author creative imagination pertains to the capacity to unite different forms of knowledge and ways of thinking to develop creative and new ideas. This ability is not observed in chimpanzees and humans are uniquely creative. Unlike chimpanzees, humans have deployed their imagination to construct complex material and social networks.

Conclusion

Both humans and apes are members a group of primates known as the Hominoidea and as such both groups share similar characteristics like complex social relationships, large brains, and the capability for tool use. While humans and non-human primates, particularly chimpanzees, exhibit some similarities in terms of psychological ability, human culture is significantly more sophisticated than its non-human primate counterpart. In this respect primatologist Frans de Waal [61] points out that: 'Emotionally and socially, the psychology of chimps is very similar to humans'. For him the main difference is in the use of symbols and the use of language. Finally, Fuentes [25] argues that humans are distinctive and the complex social lives in humans exist because of the very fact that *humans are primates*. He proposes that humans are distinct in terms of their marked ability to significantly transform ecosystems: 'The human baseline of creative cooperation, the ability to think, communicate, and collaborate with increasing prowess, transformed us into beings who invented the technologies that support domestication, economies, large-scale societies, warfare, and broad-scale peace. This collaborative and imaginative capacity for creativity also drove the development of religious beliefs and ethical systems, and even the production of artwork. Such capacities fueled and facilitated our ability to compete in more deadly ways. Today humans deploy many of the same capacities that enabled our success as a species to kill/control other humans and manipulate the planet to the brink of ecological devastation'.

However, it is necessary to remain cautious in relation to evolutionary insights. The assumption is often made that

chimpanzees and humans share similar evolutionary pathways, but this assertion has been criticized [25]. In order to draw evolutionary conclusions through the comparison of species, we must ensure that we are comparing the same underlying evolutionary processes and that "similar" patterns are indeed similar. It is significant, therefore, that most of chimpanzee and human behaviour today is not directly comparable on account of the fact that human and non-human primates have evolved independently for millions of years.

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