### Definitions

#### Fundamental: Bottom Line

Black’s Law Dictionary (No Date) <[The Law Dictionary](http://thelawdictionary.org/) Featuring Black's Law Dictionary Free Online Legal Dictionary 2nd Ed., http://thelawdictionary.org/fundamental/>#SPS

What is FUNDAMENTAL? Foundational; bottom-line component; vital point; without this item, nothing [constructive](http://thelawdictionary.org/constructive/) can be built; a core or key aspect of something bigger.

#### Fundamental: essential

Dictionary.com No Date <http://www.dictionary.com/browse/fundamentally>#SPS

Fundamental [fuhn-duh-men-tl]

adjective

1. serving as, or being an essential part of, a foundation or basis; basic;underlying:

fundamental principles; the fundamental structure.

2. of, relating to, or affecting the foundation or basis: a fundamental revision.

3. being an original or primary source: a fundamental idea.

4. Music. (of a chord) having its root as its lowest note.

#### Fundamentally: central, or primary

Oxford English Dictionary No Date <<https://en.oxforddictionaries.com/definition/fundamentally>>#SPS

fundamentally

ADVERB

1 often as submodifier In central or primary respects. ‘two fundamentally different concepts of democracy’

* 1. sentence adverb Used to make an emphatic statement about the basic truth of something. ‘fundamentally, this is a matter for doctors’

## Affirmative

### Cooperation

#### Specialization and exchange prove that human cooperation is fundamentally different from pseudo-cooperation observed in non-human animals

Boyd 16 <Robert, Arizona State University, “The Evolution of Human Uniqueness,” The Spanish Journal of Psychology, Volume 19, January 2016 , E97>#SPS

Specialization and exchange play a vital role in modern human society. Virtually every aspect of your life—your clothes, shelter, food, and transportation—depends on a complex worldwide web of specialization and exchange. As societies become smaller, the opportunity for specialization and exchange is reduced. Nonetheless, exchange plays a crucial role in even the simplest foraging societies. In virtually every foraging group that has been carefully studied, food is shared widely in the band. In a landmark study of two South American foraging groups, Kaplan and their collaborators measured the contributions to subsistence made by men and women of different ages (Kaplan et al., [2000](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref27)). Young men and older men consume more than they produce, while middle-aged men produce large surpluses. Young women also consume more than they produce while middle-aged and older women about break even. Thus, the foraging economy of these groups is rooted in specialization and exchange. Specialization and exchange are fundamentally cooperative. Specialization allows increases in the efficiency in the production of good and services and exchange allows these benefits to be shared. However exchange also creates opportunities for free riding. Except for the simplest exchanges, there is a time lag. You produce something now, and I compensate you later. In many exchanges there are information asymmetries, the seller often knows more about the product than the buyer. As a result, exchange requires cooperation. Public goods are another crucial form of cooperation. Things like roads, public education, public order, and collective defense create very large benefits that are shared by all members of a modern society independent of how much they contributed to the costs of producing these goods. As we all know, this motivates people to free-ride, to take the benefits without contributing. For some goods like roads, education, and collective defense, modern states have institutions, such as taxes backed by criminal penalties, designed to motivate people to contribute, but for others like public radio people contribute voluntarily. The existence of all modern societies depends completely on the production of public goods. Public goods also play an important role in small-scale hunter-gatherer societies. People in many foraging societies undertake activities aimed at increasing the productivity the local habitat. A simple and very widespread example is the use of fire to create more productive plant communities, a public good. The individuals who manage the burning experience costs, and everybody benefits. Foragers make many other more costly investments in habitat improvement (Smith, [2011](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref39)). Perhaps the most spectacular example comes from the Owens Valley Paiute in California who built canals, some more than 6km long, whose construction required the cooperative effort of virtually the entire local population. Foragers also invested in large scale constructions to aid in the capture of game and fish. Drive lines, fence-like constructions that concentrate animals like caribou and pronghorn so that they can be killed more easily, were widely used in western North America (Wilke, [2013](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref46)). For example, the Whiskey Flat pronghorn trap in Nevada (Wilke, [2013](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref46)) includes a 2.3 km long fence built from about 5000 juniper posts. The labor necessary to fell these trees, dig post holes, collect and place bracing stones must have been immense. Coastal and riverine foragers all over the world constructed weirs to harvest fish. These varied in size from small fish traps to large constructions that spanned substantial rivers. For example, the Yurok build a weir across the Klamath River in Northern California (Swezey & Heizer, [1977](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref43)) that required the coordinated effort of more than 150 men. There is disagreement about whether intergroup conflict creates important public goods in foraging societies. The key problem is that size matters. There is no doubt that hunter-gatherers engage in intergroup conflict, and that the resulting mortality rates are high (Gat, [2015](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref17)). However, some authors think that forager conflict is limited to ambushes and raids in which war parties are small, and conflict is avoided unless one side has substantial numerical superiority (e.g., Fry, [2006](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref16)). I believe that historical accounts strongly suggest that under the right circumstances foragers did engage in large scale conflict in which individual costs were substantial. The best data comes from Australia, a continent of foragers until the arrival of Europeans at the beginning of the 19th century. A review of scholarly accounts of Aboriginal life (Gat, [2015](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref17)) indicates that war was common, war parties were sometimes large, and death rates were substantial throughout Aboriginal Australia. Historical accounts of peoples in Western North America tell a similar story. Linguistic evidence suggests that Numic speakers had spread across the Great Basin during the last millennium, and at contact groups on the periphery engaged in large scale infantry combat with their Great Plains neighbors (Sutton, [2014](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref42)). Later one of these groups, the Comanche, acquired horses and mounted large scale cavalry raids on their neighbors both Indian and white (Hamalainen, [2008](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref20); Smith, [1938](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref40)). In the western Arctic people belonging to different Inupiaq ethnolinguistic groups conducted regular large scale warfare against members of other groups (Darwent & Darwent, [2014](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref15)). The puzzle of human cooperation We have seen that humans are highly cooperative. Every human society depends on division of labor and delayed exchange and the production of public goods. This includes nomadic foraging societies that are likely similar to the societies of modern humans over the last few hundred thousand years. Many other animal species also have specialization and exchange and produce public goods. These include a few vertebrates like naked mole rats and banded mongoose, and many other species including social insects like ants, bees, termites, and social spiders and many microorganisms. Non-human cooperation differs from human cooperation because it occurs among relatives, often quite close relatives. Natural selection can be thought of as maximizing “inclusive fitness” which weights the effect of a marginal change in a focal individual’s phenotype on a second individual by the degree of relatedness between the focal and the second individual. So selection acts as if actors place a positive value on the fitness of others. The societies of most of the highly cooperative species are composed of close kin and so the evolution of cooperation is easy to understand. There are species of social insects in which relatedness is low, but there is good evidence that when extensive cooperation originally evolved in these lineages, social groups were composed of closely related individuals (Boomsma et al., [2011](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref6)). So, the bottom line is that specialization and production of public goods is widespread in nature and it evolved because interacting individuals were closely related. Humans are a big exception to this rule because they cooperate with large numbers of unrelated people. This is obviously true in modern societies. Think of the vast number of people across the globe who cooperate to provide you with food, clothing and tools—all unrelated to you. The same goes for public good production. The half a million Russians who perished at the Battle of Stalingrad were unrelated. Contemporary human societies are testimony to the human ability to cooperate with very large numbers of unrelated people. The same goes for human hunter-gatherers. People often picture hunter-gatherers cooperating in small bands mainly made up of closely related individuals. However, two recent papers by Hill and colleagues make it clear that this picture is wrong for ethnographically well-studied foragers. First, band members are not particularly closely related. Hill et al. ([2011](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref25)) found that the average relatedness within 60 Aché bands was 0.054 which means benefits have to be about 20 times cost for altruistic behaviors to be favored by natural selection. Second, mutually beneficially social interactions are not limited to band members, but extend to virtually all members of the ethnolinguistic group typically numbering between 500 and 2000 people. We have already seen that hunter-gatherers can mobilize people from many different bands to construct drive lines, fish weirs, and irrigation works, and they can muster war parties of hundreds of fighters. Detailed quantitative data on inter-band cooperation among two contemporary foraging groups the Aché and the Hadza support this claim (Hill, Wood, Baggio, Hurtado, & Boyd, [2014](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref26)). So here’s the puzzle: Three or four million years ago our ancestors lived in ape-like societies. Males were much bigger than females and there was probably little specialization or exchange. Groups were small, relations between members of different groups were hostile, and there was no production of public goods. By the time that modern human behavior emerged, probably between 100,000 and 200,000 years ago, people were committed to cooperative exchange and the production of public goods within ethnolinguistic groups of roughly 1000 people, and today people cooperate in gigantic numbers. The changes in human psychology that make this possible must have been created by natural selection.

#### Human cooperation is fundamentally different than cooperation observed elsewhere – our cognitive abilities allow us to share intentionality, or work towards a common goal even without unique benefit to ourselves –no other species does this

Tomasello et al. 05 <Michael Tomasello, Malinda Carpenter, Josep Call, Tanya Behne, and Henrike Moll, Max Planck Institute for Evolutionary Anthropology, D-04103 Leipzig, “Understanding and sharing intentions: The origins of cultural cognition,” BEHAVIORAL AND BRAIN SCIENCES (2005) 28, 675–735>#SPS

Human cognition sticks out like an elephant’s trunk, a giraffe’s neck, a peacock’s tail. It is one form of primate cognition, but it seems totally unique as people go around talking and writing and playing symphonies and doing math and building buildings and engaging in rituals and paying bills and surfing the web and creating governments and on and on. Also unique in the animal kingdom, human cognition is highly variable across populations, as some cultures have complex foraging and navigational techniques whereas others have very few of these, and some do algebra and calculus whereas others have very little need for complex mathematics. And so the biological adaptation we are looking for is one that is rooted in primate cognition but then provides humans with the cognitive tools and motivations to create artifacts and practices collectively with members of their social group – that then structure their and their offspring’s cognitive interactions with the world. We are thus looking for a small difference that, by creating the possibility of culture and cultural evolution, made a big difference in human cognition. Our proposal for this “small difference that made a big difference” is an adaptation for participating in collaborative activities involving shared intentionality – which requires selection during human evolution for powerful skills of intention reading as well as for a motivation to share psychological states with others. In ontogeny, these two components – the understanding of intentional action and the motivation to share psychological states with others – intermingle from the beginning to produce a unique developmental pathway for human cultural cognition, involving unique forms of social engagement, symbolic communication, and cognitive representation. Dialogic cognitive representations, as we have called them, enable older children to participate fully in the social-institutional-collective reality that is human cognition. There are two other main theoretical contenders for what makes human cognition unique in the animal kingdom. First, of course, many theorists point to language, and without a doubt language must play a central role in all discussions of the evolution of human cognition. But saying that only humans have language is like saying that only humans build skyscrapers, when the fact is that only humans (among primates) build freestanding shelters at all. Language is not basic; it is derived. It rests on the same underlying cognitive and social skills that lead infants to point to things and show things to other people declaratively and informatively, in a way that other primates do not do, and that lead them to engage in collaborative and joint attentional activities with others of a kind that are also unique among primates. The general question is What is language if not a set of coordination devices for directing the attention of others? What could it mean to say that language is responsible for understanding and sharing intentions, when in fact the idea of linguistic communication without these underlying skills is incoherent. And so, while it is true that language represents a major difference between humans and other primates, we believe that it actually derives from the uniquely human abilities to read and share intentions with other people – which also underwrite other uniquely human skills that emerge along with language such as declarative gestures, collaboration, pretense, and imitative learning (Tomasello 2003). Of course, later in ontogeny, there may be some cognitive achievements possible only with the support of the linguistic version of dialogic cognitive representations, which embody in special ways the different perspectives and construals that people may take on things (Lohmann et al., 2005). The other major contender for what makes human cognition unique is theory of mind. Our proposal is of course one variant of this, and indeed we would argue that the full understanding of intentional action, including its rational and normative dimensions, involves some understanding of things mental. But when most people use the term theory of mind they mean the belief-desire psychology with which school-age children and adults operate. But this form of theory of mind is clearly derivative of more basic social-cognitive skills. Thus, Tomasello and Rakoczy (2003) argue and present evidence that while the understanding and sharing of intentions emerges ontogenetically in all cultural settings at around 1 year of age – with no known individual differences due to environmental factors – the understanding of beliefs emerges some years later at somewhat different ages in different cultural settings, and there is very good evidence that participating in linguistic communication with other persons (especially some forms of perspective-shifting discourse) is a crucial, perhaps even necessary, condition for its normal development. And so again, while the understanding of beliefs and desires is clearly a critical component in uniquely human cognition and culture, we do not believe it is basic, but rather it, too, is derived from the understanding and sharing of intentions. Having argued that an adaptation for shared intentionality is more basic than other theoretical contenders such as language and theory of mind, we must also acknowledge that there could be other hypotheses about the origins of uniquely human cognition that are more basic still. For example, one could hypothesize that humans simply evolved larger brains with more computing power than other primates – maybe specifically a larger working memory that enables them to hold more things in mind simultaneously (e.g., see Olson & Kawamar 1999) – and that this was sufficient to create all the differences we see today between humans and other primates. Also, one could hypothesize a very simple difference in sociality between humans and other animals, such as the tendency to be responsive to the rewards, punishments, and direction of others in the social group (e.g., see Wilson 1999 on consilience). But in these cases we would argue that such nonspecific adaptations are not sufficient to get the job done. To get from primate social groups to human cultures and the collective cognition they embody, something like an adaptation for participation in collaborative activity is required – leading to selection for motivations and skills of shared intentionality and the cultural-historical processes these engender. There is of course still much we do not know about all of this. We do not know with much precision the degree to which humans and other apes differ in their understanding of how others choose plans – the rational aspects of intentional action – since most of the studies done with infants cannot be so easily done with apes. We have very little specific knowledge about humans’ motivation to share things psychologically with others, in this case because the most telling experiments (e.g., isolation experiments) would be unethical. We do not know exactly how much of an understanding of intentional action is necessary for children to participate in collaborative activities. And conversely, we do not know whether the kinds of collaborative activities that exist in cultures before children are born are a necessary or only a facilitative component in the ontogenetic process – or whether they play no effective role at all at the outset (though clearly they play a crucial role later). Our view is that to make progress on these and related questions we must focus our research efforts both on the individual cognitive skills required to understand intentional action, in all its many dimensions, and also, in equal measure, on the social motivations and dialogic representations that underlie the collaborative activities and collective artifacts that structure human culture and cognition.

### Culture

#### Humanity is much better at learning than other species – this allows us to create culture that no other animal can match

Boyd 16 <Robert, Arizona State University, “The Evolution of Human Uniqueness,” The Spanish Journal of Psychology, Volume 19, January 2016 , E97>#SPS

Cultural adaptation Most people studying human evolution aren’t very clear about exactly how intelligence translates into behavior and what intelligence really means in evolutionary terms. The simplest idea would be that we adapt to our environments like other species, just better. To a first approximation, in other species each individual learns what it needs to learn on its own, not from others. True, lots of vertebrate species have traditions maintained by social learning mechanisms. However in every case, the traditions involve behaviors that individuals can and do acquire on their own. Social information is helpful, but not essential. There is no doubt that individual learning can produce highly adaptive behavior including the production of artifacts. Hand-raised woodpecker finches use tools to extract grubs from under bark—exposure to competent adults is completely unnecessary. Maybe people are just an extreme outlier of a similar process. However, people do not adapt in the same way as other animals. The package of tools, foraging techniques, ecological knowledge, and social arrangements used by even the simplest foraging groups is far, far too complex for any individual to create on his or her own. People are able to learn all of the things they need to know in the vast range of environments in which they live because they acquire information from others. **We are much better at learning from others than other species**, and equally important, we are motivated to learn from others even when we do not understand why our teachers are doing what they are doing. **This psychology allows human populations to accumulate pools of adaptive information that far exceed the inventive capacities of individuals.** This claim is supported by what I call the “lost European explorer experiment.” This natural experiment has been repeated many times during the past several centuries with similar results. A small group of European explorers get stranded in an unfamiliar habitat in which an indigenous population is flourishing. Despite desperate efforts, and ample learning time, the lost explorers cannot figure out how to feed themselves. They often die, and if they do survive, it’s frequently due to the hospitality of the indigenous population. The Burke-Wills expedition provides a good example (Cathcart, [2014](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref12)). In 1860, the worthies of the city of Melbourne organized an expedition to explore Australia’s interior. They recruited Robert Burke, a dashing former military man, as the leader and 18 others including William Wills, a scientist and cartographer. On August 20, the expedition set off with 26 camels, 23 horses, enough food for two years, and much Victorian impedimenta. The lead elements of the party, including both Burke and Wills, reached Cooper’s Creek, a long string of ephemeral ponds about a third of the away across Australia, by November 11 and waited there for the rest of the party. By mid-December they still hadn’t arrived and Burke, Wills and two others set off hoping to reach the Gulf of Carpentaria. Burke ordered the remainder of the party to wait for them until March 15. Unfortunately Burke and his companions didn’t return to Cooper’s Creek until mid-April where they found the camp abandoned. They were exhausted and low on provisions, and knew that they had no chance of getting back to Melbourne. After a couple of weeks, they encountered a group of Yandruwandha, a local tribe, and accepted an invitation to their camp where they were provided with fish and cakes made from the seeds (technically sporocarps) of an aquatic fern called nardoo. The three white men really liked the cakes, and decided that if they were to survive they must learn how to make nardoo flour. However, they had no idea what plant the seeds came from, and by then Yandruwandha were nowhere to be found. After two weeks of desperate searching, Wills discovered the source of the nardoo seeds and the three men began to collect and grind the seeds to make nardoo flour in quantity. However, despite having plenty of nardoo to eat, they gradually weakened and by early July both Burke and Wills were dead. King was found by a Yandruwandha band and they fed and cared for him for several months until a relief party arrived in September. So why did Burke and Wills starve in what for the Yandruwandha was a land of plenty? The white men would probably never have discovered nardoo on their own, but after seeing the Yandruwandha process the nardoo seeds into flour they were able to do the same. What they did not know is that nardoo contains an enzyme that degrades vitamin B1 in the intestine, and even though they were getting plenty of calories, they were dying of B1 deficiency disease. The Yandruwandha processed the nardoo by rinsing it in large amounts of water. Many plants contain toxins of this kind, and people living on plant-rich diets have detoxification methods to deal with them. Burke and Wills were as smart as you and me, but learning that nardoo is toxic and how to detoxify it is a hard problem, and without access to this culturally transmitted knowledge, nardoo was worse than useless—it was poison. Unlike other vertebrates, people in every human group depend on a diverse set of foraging skills. The large predators, the other type of creature with large ranges, hunt a small number of species using one of two methods: they wait in ambush, or combine stealthy approach and fast pursuit. Once the prey is captured, it is processed with tooth and claw. In contrast, human hunters use a vast number of methods to capture and process a huge range of prey species. For example, the Aché, a group of foragers who live in Paraguay take 78 different species of mammals, 21 species of reptiles, 14 species of fish, and over 150 species of birds using a large number of techniques depending on the prey, the season, the weather, and many other factors. Some animals are tracked, a difficult skill that entails a great deal of ecological and environmental knowledge. Others are called by imitating the prey’s mating or distress calls. Still others are trapped with snares or smoked out of burrows. Animals are captured and killed by hand, shot with arrows, clubbed, or speared (Kaplan, Hill, Lancaster, & Hurtado, [2000](https://www.cambridge.org/core/journals/spanish-journal-of-psychology/article/evolution-of-human-uniqueness/D53EFF062565B24B62E47007E1370110/core-reader#ref27)). For the Yandruwandha the land around Cooper’s Creek was a land of plenty because they had a rich trove of culturally transmitted knowledge about how to make a living there. A Yandruwandha “Natural History Handbook” would run to hundreds of pages with sections on the habits of game, efficient hunting techniques, how to find water, how to process toxic yams and cycads, and so on. Australian aborigines are famous among archaeologists for the simplicity of their technology. Nonetheless, an “Instruction Manual for Technology” would have to cover the manufacture and proper use of nets, baskets, houses, boomerangs, fire drills, spears and spear throwers, shields, bark boats, ground stone tools, and much more. Plus, as we’ll see later, cooperation plays a crucial role in human subsistence. To become a competent Yandruwandha you’d also need to master the “Social Policies and Procedures”, “Grammar and Dictionary”, and “Beliefs, Stories, and Songs”, volumes of comparable length.

#### Only human beings create culture through direct imitation as opposed to emulation

Hill, Barton and Hurtado 09 <Kim, Professor in the School of Human Evolution and Social Change, and the Institute for Human Origins at Arizona State University, C. Michael Barton is a Professor in the School of Human Evolution and Social Change, and Director of the Center for Social Dynamics and Complexity at Arizona State University, A. Magdalena Hurtado is Director of the Global Health Program and Professor in the School of Human Evolution and Social Change at Arizona State University, “The Emergenc e of Human Uniqueness: Characters Underlying Behavioral Modernity,” Evolutionary Anthropology 18:187-200 (2009)>#SPS

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Culture is information (beliefs) stored in brains, institutions, and material goods that is transmitted socially and inﬂuences behavior. Because cultural variants, like genes, are units of information that inﬂuence their own transmission, their frequencies change through time and culture evolves. This means that both genetic alleles and cultural variants interact with environment and each other to produce observed behavioral phenotypes. Important theoretical work on the cultural system of inheritance began in the 1970s with Cav-alli-Sforza and Feldman,17and was subsequently infused with formal population modeling by Boyd and Richerson.18 Because social learning mechanisms are shaped by genetic evolution, but also inﬂuence the relative advantage of alternative genotypes, genes and culture co-evolve. It has become clear that dual inheritance theory is requisite for a complete understanding of human behav-ior.1,8,9Recently, studies of dual in-heritance theory have undergone tremendous growth in sophistication and complexity as a greater under-standing of the biological nature of culture has emerged.19,20 Dozens of animal species are known to transmit behavioral patterns by social learning. These include tool use and food extraction techniques, as well as variety of social behaviors.21,22 Some biologists refer to these socially learned behaviors as animal ‘‘culture’’ and have classiﬁed different regional variant combinations of learned traits as different "cultures." 23 The great apes, especially chimpanzees and orangutans, are notable in this regard, With over thirty different regional traditions distinguishing localized populations. 2425 However, Other researchers argue that animal "traditions" should not be equated with human culture and point to important differences in mechanisms of social learning, the accumulation of learned traits, and the content Of what is transmitted as differentiating 10.26 28 humans from Other animals. Cumulative Cultural Adaptation Many animals acquire socially learned traditions, but none display increasingly complex behavioral patterns built on prior socially transmitted behavior, a phenomenon that Tomaselli 029 has called the "ratchet effect." Research in experimental psychology is beginning to elucidate differences in learning mechanisms that may explain why only human social learning is cumulative. 30 For example, many animals transmit behaviors mainly through repeated exposure to a context that increases their chances of acquiring a behavior through individual learning. Indeed, only fifteen years ago Galef suggested that all known cases of animal traditions could be explained by such "enhancement." In contrast, humans engage in imitation: learning by watching it done. Researchers were initially uncertain if other animals could learn by imitation, but evidence now shows that apes, marmosets, dolphins, rats, and many species of birds also learn through imitation. Although learning by imitation is critical to cumulative culture, chimpanzees, too, learn by watching a model, yet do not have cumulative culture. Experiments suggest that chimpanzees are more inclined to emulation, or learning to get the desired result, rather than imitation, copying the precise means. For example, Horner and Whiten33 conducted experiments showing that human children copy unrewarded actions presented by an adult model, whereas chimpanzees quickly eliminate actions that superfluous to obtaining the reward. Further studies have shown that this is a consistent difference in human versus chimpanzee social learning. Indeed, the human proclivity for "unrewarded imitation" is very rare in nature (see McGregor's for an example in pigeons). Further- more, experiments show that children readily imitate altruistic and "other regarding" behaviors as well something never observed in apes. Children not only copy model actions precisely , but simultaneously incorporate an emotional reaction that to do things otherwise is "wrong. " 36 Tomasello concludes that human social learning includes an exceptional focus on actions rather than just goals. Nevertheless, chimpanzee "emulation" results in transmission of behavior with notable fidelity a chain of individuals within a social group and between social groups that observe each other.R7 This allows some traditions to spread through space and time. However, follow-up experiments have shed additional light on critical differences between chimpanzees and humans. For example, chimpanzees imitate behaviors that provide immediate rewards but reluctant to adopt subsequent new behaviors that can provide even higher rewards. Careful analyses of social learning in humans and apes will almost certainly uncover other critical distinctions. For example, humans regularly engage in "teaching" but none of the apes have been observed to do so. Unlike other animals, humans teach not only offspring, but other adults and even nonkin (Fig. 2)\_ Human imitation also includes multiple transmission biases, such as conformity bias, success and prestige bias, and similarity bias, which may be critical to cumulative culture in our species. 'Theoretical modeling has also provided important insights into why cumulative culture is rare among nonhumans. 26 For example, Boyd and Richardson demonstrated that the selection force on social learning depends on the amount of previously existing useful culture to copy. Copying is most favored in groups that already have many copiers who have already produced adaptive culture. If imitation capacity is mainly adaptive when present at a high frequency, how would it get started? Social Norms, Ethnicity, and Language Despite considerable research on cultural transmission mechanisms, less work has been done on the con- tent of social transmission and whether humans show uniqueness in this realm. We propose that language and social norms are evolving informational systems not observed in other primates. Hill proposed that human "culture" is conceptually distinct from animal traditions because it consists of three components universally present in all human societies: socially learned techniques and technologies; socially learned regulation of behavior (norms, conventions, rules, laws) achieved through third-party rewards and punishments; and symbolic and emotional reinforcement of, and signaling adherence to, a specific rule system (ritual, morality, religion, ethnicity). The second and third components on this list have not been described in nonhuman animals. The transmission of these components may rely on unique cognitive adaptations for transmission by teaching. Members of human societies continuously negotiate conventions that limit within-group competition and promote within-group cooperation. The learning of such conventions may rely on teaching, as well as conformist and success-biased transmission, and may result in the spread of group-beneficial norms through a process of cultural group selection something that is unknown for any other species. The uniqueness of this cultural process is evident in hunter-gatherer societies, where socially learned norms regulate competition over valuable biological and promote cooperation. Indeed, all hunter-gatherer societies develop regulations2S that control access to things such as mates, food patches, already-acquired foods, signaling opportunities, kin and allies, and political power. Such regulations also govern acceptable expression of conflict (Fig. 3), age-sex- structured behavioral patterns, and public health hazards. These regulations constrain the competitive game of life for ethnic in-group members. Cultural norms reaffirmed and reinforced symbolically through ritual and, because interaction with others "playing by the same rules" is advantageous, ethnic signaling is universal in human societies (Fig. s When people become experts at playing the game of life by a specific set of they internalize a commitment to those rules (morality) and react emotionally against any violations that threaten to bring change. It has long been argued that language is what makes us human and sets us apart from other animals. But language appears to be a cognitive offshoot of social learning. Evolutionary linguists suggest that language consists of three central cognitive abilities that must be accounted for in order to explain why humans alone have language, These cognitive abilities are communicative intentions, capacity for reference, and production and interpretation of structured sequences" The first of these may be derived from cooperative breeding, while the second and third components part of the high-fidelity social leaning mechanisms that humans apply to all cultural transmission

nt ‘‘cultures.’’

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### Language

#### Animals have not formulated language so much as codes – only we have grammar and abstract thought

Suddendorf 13 <Thomas, Professor of Psychology at the University of Queensland, Australia “The Gap : The Science of What Separates Us from Other Animals, Basic Books, 2013. ProQuest Ebook Central”>#SPS

In sum, **there are indeed some characteristics of language that appear to be uniquely human.** On current evidence, it is fair to say neither in their natural communications, nor in our attempts at teaching them human linguistic systems, have animals provided evidence for a full-fledged language. Animals do have communication systems, and they do form concepts. They can learn humans’ arbitrary symbols, and some appreciate the fundamental attribute that a symbol can inform about another object or event. Some species, like parrots, can produce speech sounds, though many lack adequate multitasking capacities and voluntary control of face and vocal tract to establish vocal conversations. However, sensory-motor skills may not constitute an absolute barrier, given that a language faculty could be expressed in other ways. What appears to be lacking, even in great apes, is a motivation to find means to exchange what is on each other’s minds. **Animals have not demonstrated the capacities required to invent and agree on arbitrary symbols for concepts or on grammar rules that allow for efficient combination of such symbols.** They have not developed an open-ended, generative communication system comparable to a human language, nor have they been able to learn one of ours. It looks increasingly likely that humans do not have an innate universal grammar that enables language; instead, we culturally inherit a specific language from people who, based on more general capacities for embedded thinking, manage to establish such symbols and rules for the practical purpose of exchanging the matters on their minds— minds filled with thoughts about past and future, about others’ minds, about problems and opportunities, about cooperation and morality. Without such complex mental content there would be little use for an open-ended communication system like ours. To these mental contents, therefore, we turn next.

### Mental Time Travel

#### Humans uniquely have access to mental time travel – the ability to long-term forecast based off of long term memory – planning by other animals does not compare to the unique human ability to see ourselves in future scenarios

Suddendorf 13 <Thomas, Professor of Psychology at the University of Queensland, Australia “The Gap : The Science of What Separates Us from Other Animals, Basic Books, 2013. ProQuest Ebook Central”>#SPS

ANIMALS HAVE NOT TAMED FIRE , nor have they mastered the arts of civilization. There is no obvious evidence that animals have ever agreed on a five-year plan. Although children’s films often feature animals solving a whodunit or thwarting the bad guys’ evil plot, Lassie, Flipper, and Babe have no real-life counterparts. Their behavior is the product of careful conditioning by trainers who use immediate rewards to get the animals to act as if they understood the narrative. On the farm or in the zoo there is little to suggest that real animals plot to take control. There is no evidence animals have invented bags to carry a variety of tools in case they might need them. They do not choose a career path and do not seem to deliberately practice in preparation for anticipated events. 5 They do not show the same diversity of expertise as humans. But just because they do not act the way we do does not necessarily mean they cannot think about past and future events. Animals are by no means insensitive to temporal matters. There is evidence that some of them detect the time of day (some dogs will get ready for the mail carrier to arrive) and can track short time intervals (if you feed a dog every half an hour, it will start to salivate just before the next feeding). Yet, as the psychologist William Roberts showed, these competencies can be achieved through basic mechanisms, such as simple associations with states of the natural body cycle, rather than anything akin to mental time travel. Our most direct evidence for episodic memory in humans comes from people’s verbal reports. As already discussed, some apes have been trained to communicate using human symbol systems, but they have so far not acquired tense and have not told stories about the past or visions of the future. These projects have provided some compelling evidence of semantic knowledge, however. After all, these animals have learned which symbols go with which objects or actions. The chimpanzee Panzee has even used a symbol board to announce what food was hidden outside her enclosure and pointed to get a human to retrieve it for her. This shows she knew where the food was hidden, but it does not necessarily mean she remembered the hiding event itself. One can know things without knowing how one has come to know them. For instance, you may know that Mount Kilimanjaro is the highest mountain in Africa but probably not the occasion on which you learned that fact— unless you learned it just now. Although it is safe to conclude that animals have procedural and semantic memory systems, there is no obvious demonstration that they have **episodic memory.** Rats appear to use their hippocampus to create cognitive maps of their environment. Most species, even insects, demonstrate sophisticated navigational skills. But do they mentally reconstruct the particular events that shaped their knowledge? Do they reminisce about days of yore? \*\*\* R ECENTLY , RESEARCHERS HAVE MADE THE case for certain animals having something like episodic memory. Psychologists Nicola Clayton, Anthony Dickinson, and their colleagues at the University of Cambridge have produced some intriguing results that they say may reflect mental time travel in animals. Scrub jays hide food for later consumption. Clever experiments on caching and retrieval capacities indicate that these birds know what was cached where and when. For example, they adjust their search differently for cached worms, which rot quickly, and peanuts, which keep fresh longer, depending on how long ago they had stored them. They do not bother searching for the worms if they had been stored a long time ago because they would be rotten. Jays show this search pattern even when there are no cues, such as smell, to guide them. The researchers conclude that the birds have memory for the past occasion on which they stored these foods. They refer to this as “episodic-like” memory, leaving open the question whether the birds are conscious of the past. This approach has stimulated headlines, debates, and a profusion of such studies on other animals. Although several species have failed to pass similar tests, some species, such as mice, rats, and chimpanzees, have passed them. These successful species are therefore also said to have a capacity for episodic-like memory. But how like episodic memory is episodic-like memory? Despite the cautious terminology, romantic proponents of the what-where-when approach often imply if it walks like a duck and quacks like a duck, then it probably is a duck. In other words, these species probably can travel mentally into the past. But is this really a duck hunt or a wild goose chase? I have argued that **evidence for episodic-like memory is neither necessary nor sufficient for mental time travel.** You can know that something happened and yet not remember the event at all. For instance, I know what happened on November 24, 1967, in Vreden, Germany. I was born. Yet I have, of course, absolutely no recollection of the event. Conversely, you may recall a particular episode and yet be factually wrong about what precisely happened where and when. Recall (if you can) that episodic memory is notoriously unreliable. Thus evidence that animals can draw on accurate information about the what, where, and when of a particular event does not show that they travel mentally in time. How then to explain the scrub jays’ clever retrieval behavior? It is possible, and quite plausible I think, that scrub jays know what food is where and whether it is still good to eat without having to remember the caching episode itself. Here is a simple alternative explanation. As time passes, memories fade. Scrub jays may learn when it is still worthwhile to search for a particular type of food by associating the strength of their memory of the food location with whether it is still good to eat on recovery. They then simply apply a rule along the lines of: worms aren’t worth searching for once the memory of their location has weakened beyond a certain point. The experience with nuts leads to a rule that they are worth searching for even when memory is much weaker. Such rules can effectively provide use-by dates for different types of stored food (without requiring conscious recollection of the caching event). If this what-where-when approach does not demonstrate episodic memory, how could one show animals have episodic memory, if indeed they have it? Without language they cannot tell us about their time travel. As we saw, humans can also express past episodes through mime or dance. However, there is no suggestion that animals do this too. If evolution selected for episodic memory in animals, then this capacity must have benefitted survival and reproduction. Evolution could not have selected for it as a private indulgence without a tangible effect. Given the evidence of close links between episodic memory and foresight, and the fact that foresight offers clear fitness benefits, one would expect that animals that have mental time travel capacities should be able to control their future prudently. They should hatch plans and plot their way to future happiness. \*\*\* . . . is something Long-term planning —RICHARD DAWKINS utterly new on the planet, even alien. It exists only in human brains. The future is a new invention in evolution. R ICHARD D AWKINS AGREES THAT THERE is something unique about the human capacity to think about the future. Human long-term planning appears to have no obvious rivals in the animal kingdom. Yet many species act in ways that improve their future: animals construct nests for breeding, they migrate at the right time to warmer climates, and they search for food where it is likely to become available. Learning about recurring patterns in the context of mating, food, and predation has obvious evolutionary benefits. Over long periods species have acquired ways of taking advantage of what is regularly recurring. Even bacteria demonstrate future-directed capacities in this sense. Right now, Esherichia coli are moving through your digestive tract from an environment rich in lactose to one rich in maltose— and they have prepared for this by turning on genes necessary for digesting maltose. This does not mean each individual bacterium looks ahead and decides to prepare as it goes down your gut. Evolution has selected for this order of events over many generations of bacteria: E. coli that happened to show this pattern of preparatory gene activation survived and reproduced better than those that did not. Many species have evolved innate mechanisms that take advantage of long-term regularities. These innate behaviors look clever, but the lack of foresight involved becomes clear when circumstances change. A classic example is the digger wasp. The wasp always inspects the nest before dragging its prey inside to feed its larvae. If in the meantime a mischievous human moves the food a few centimeters, then the wasp will regather the food, and repeat the sequence again by dropping it at the entrance and inspecting the nest. This can be repeated again and again, without the wasp breaking out of its behavioral program. Although provisioning the young appears to be a complex, future-directed behavior, the wasp executes it without any apparent thoughts about seeing them grow up. If the entrance is destroyed, the wasp will not feed its larvae but trample over them in its frantic search for the entrance. Similarly, various animals hoard food for the winter without necessarily understanding why they do it. Young squirrels, for instance, will hoard nuts even if they have never experienced a winter. These behavioral solutions to recurring seasonal changes may not be all that different from physical adaptations to the same problem— such as storing food for winter in body fat. Innate mechanisms are reliable but not very flexible. **Memory, by contrast, enables an individual, rather than a species, to learn about potentially recurring events during its lifetime.** All memory, you may recall, is in a sense future-oriented, allowing an individual to adapt to its environment. If a stimulus reliably predicts a situation, like the bell predicted food for Pavlov’s dog, animals can learn to take advantage of this association. A pigeon, for example, may learn to peck on a button for food only when a light indicates food is available. Associative learning can account for some complex-looking behavior, as we saw in the case of Clever Hans. Behaviorists have documented the rules that govern such learning, and one of their main findings has been that two things have to happen together or nearly together if they are to be associated. The link between an action and a consequence is typically learned only if they are separated by no more than a few seconds. There are rare exceptions. Perhaps the most extreme is that rats can learn to associate the taste of food with feeling nauseous some hours later. Given that rats keenly explore novel food sources, learning to avoid foods that will make them sick has obvious survival value. So this appears to be a special capacity. The rats learn only that a taste predicts later sickness; they cannot learn that a sound or a sight has the same predictive relationship. Yet instinct and learning may combine to create sophisticated future-directed behaviors, some of which are not yet well understood. For example, how do gray squirrels learn to bite out the seeds of white oak (though not red oak) acorns before storing them, thereby preventing their germination? Curious though they are, in these cases, as in the food-caching scrub jays, the future-direct competences seem limited to a particular type of problem and show none of the open-ended flexibility evident in humans. We saw in Chapter 3 that our closest animal relatives have a basic capacity to imagine other possible worlds. Can they use their minds to plot future actions? Maybe they can for some problems that lie in the immediate future. For example, when presented with a treat that is out of reach, great apes can go around the corner, where the treat can no longer be seen, and select a stick of the appropriate length to solve the problem. I had to learn this the hard way, when the chimpanzee Ockie noted that a stick at one side of his enclosure could be used to reach a TV I had put up earlier on the other side— with smashing consequences. They also carry tools over short distances in the wild. One of the most impressive examples of apparent forethought comes from chimpanzees in the Tai forest of the Ivory Coast. These apes use stones to crack open nuts and sometimes carry stones for a hundred yards or so to the site of the nuts. Presumably they pick up the rocks as a result of developing an appetite for nuts and a plan of where to get them. In spite of these signs of short-term foresight, animal mental access to the future may be restricted in several important ways. Recall the range of processes involved in a theater production of the future. Shortcomings in any of them may limit capacity. Chimpanzees may have some capacity to imagine alternatives, but they may be fundamentally restricted by other requirements. One possibility is a limited understanding of one’s self as an actor in a future scenario. The psychologists Norbert Bischof and Doris Bischof-Köhler have claimed that animals may not be able to imagine drives and wants they do not currently experience. You can easily imagine being thirsty even when quenched, and hence may want to secure future sources of drink. Recall the comparison between full-bellied lions and humans— we often try to get things we do not (currently) need. Such a limitation could explain various curious animal behaviors. Take the case of laboratory monkeys that were fed biscuits only once a day. William Roberts recounts how in the 1970s the cebus monkeys in Michael D’Amato’s laboratory would hungrily eat until they were full and then throw the remaining biscuits out of their cages. To their dismay, they would find themselves hungry again some hours later. You might wonder why they did not learn to guard their food to satisfy their future hunger. If you cannot imagine being hungry again, then perhaps biscuits’ utility may lie in their quality as fine projectiles. There is no point in acting now to secure a future need you cannot conceive of. This Bischof-Köhler hypothesis is much debated. In some sense it cannot be quite right, because any hoarding of food is behavior that secures future needs. What we don’t know is whether hoarding animals are thinking about future hunger and burying their treats in anticipation of satisfying those future cravings. Despite several attempts to disprove the hypothesis, 6 it still has currency. Animals do not seem to keep and refine their tools for repeated use, and there is no evidence of the kind of greed present in humans. Another essential capacity for foresight is the ability to forego current temptation in pursuit of a more desirable future outcome. When monkeys are given the choice between a small reward now and a larger reward later, they, like most other animals, find it extremely difficult to wait if the delay is more than a few seconds. Great apes can do better and have been shown to delay gratification for several minutes. For a reward forty times larger than the immediate reward option, chimpanzees may wait up to eight minutes. This is impressive, but it is considerably less dramatic than humans delaying gratification for months, years, or even a lifetime. Still, our closest relatives are much better at waiting for something than other animals. Perhaps the most prominent case for ape foresight comes from a study in which three bonobos and three orangutans were trained to use a tool to obtain a treat from a feeder apparatus. The animals were then ushered into a waiting room, and the experimenter removed all remaining tools left in the experimental room. After an hour’s wait, the apes were allowed back into the experimental room. On almost half of the trials the apes carried a tool with them from one room to the other and back— so they could use it to get more treats. Some apes did a lot better than others, and two animals even succeeded to hang on to their tools when they returned to the experimental room after an overnight delay. Unfortunately, because it was always the same tool the apes had to select on all trials, it remains unclear here, as in subsequent studies, whether the apes anticipated a specific future situation or had merely learned to associate the tool with rewards. In another study ten chimpanzees were taught that they could exchange a token for a food reward and were then given the opportunity to collect these tokens in anticipation of an exchange session an hour later. Over several experiments the chimpanzees failed to take tokens more often than other useless objects. They just did not think ahead. An unusual report made headlines in 2009 when it suggested that a chimpanzee at a Swedish zoo may have spontaneously planned its projectile attacks for hours in advance. Three zookeepers reported that in the late 1990s a male chimpanzee tended to collect rocks and concrete into piles early in the morning so he could excitedly hurl this ammunition at zoo visitors a few hours later. Nothing quite like such planning has yet been reported from the wild or, for that matter, from any other captive chimpanzees. If chimpanzees have this kind of foresight, one would perhaps expect to hear about many more such examples— it’s possible that this is what the future will bring. So what are we to conclude? Although some research suggests that our closest relatives may have some, albeit limited, capacity for foresight, we have seen that other studies suggest they are profoundly shortsighted. Animals clearly share with humans some procedural and semantic memory capacities. However, there is little evidence that they have episodic memory. The best evidence for episodic memory should come from signs of episodic foresight, given that mental time travel in both directions is intimately linked. Yet animals do not overtly express any of the obvious manifestations of such a capacity. Only in Orwell and other fiction do they conspire to rebel. Animals can learn that one thing predicts another if the events are separated by only a few seconds. Many species have also evolved instincts that equip them to act in preparation for the future. However, evidence for flexibility in such future-directed behavior is scant. The cases that exist all deal with the immediate future only. There is no compelling evidence that animals flexibly generate mental scenarios of remote future events the way humans do, or communicate mental scenarios to one another to obtain feedback or to coordinate actions. In the next chapter, we will consider whether animals can even appreciate that others have minds in the first place.

#### Human metarepresntation allows us to see ourselves in novel events – allowing planning for things we have never seen before – animals do not have access to this

Redshaw 14 <Jonathan, Professor at the School of Psychology, University of Queensland, “Does metarepresentation make human mental time travel unique?,” Cognitive Science, Volume 5, Issue 5, September/October 2014, Pages 519–531>#SPS

My intent here is not to provide a comprehensive account of all the potential similarities and differences between human and nonhuman mental time travel (instead see elsewhere[[4, 6, 18-21](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0004)]). Rather, I wish to re-establish the crucial involvement of one qualitatively distinct and recently overlooked component of mental time travel—metarepresentation—that has not yet been demonstrated in animals. This capacity allows humans to represent the nature of the relationship between current reality and alternative representations of reality.[[22](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0022)] **Without metarepresentational insight, the future cannot be represented as the future,**[[23](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0023)] which is a form of the temporal awareness central to conventional definitions of mental time travel.[[24, 25](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0024)] Suddendorf and Corballis[[1, 4](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0001)] have previously argued for the decisive importance of metarepresentation to mental time travel, and there is no reason to reject the hypothesis of human uniqueness on the basis of current evidence. In the hope of refocusing the debate at this critical point, I first specify the role of metarepresentation in mental time travel before distilling and defending four key claims: In humans, mental representations of past and novel events are often dissociated from metarepresentational insight into the relationship between these events and current reality. Thus, even if animals are able to represent novel events, they may not have any ability to embed these representations within a specific future context. There are numerous future-oriented adaptive benefits associated with uncontextualized mental representations of past and novel events, but there are further, immense benefits associated with metarepresentational insight into future events. Many previous behavioral paradigms used to assess mental time travel in animals do not (and cannot) provide conclusive evidence for metarepresentational insight, and are more parsimoniously understood in terms of uncontextualized representations. With careful controls, it is possible to provide evidence for metarepresentational insight in nonhuman mental time travel, if indeed the capacity exists.

#### Thinking about states of mind and imagination of how we WOULD FEEL is something non-human animals have been unable to demonstrate

Redshaw 14 <Jonathan, Professor at the School of Psychology, University of Queensland, “Does metarepresentation make human mental time travel unique?,” Cognitive Science, Volume 5, Issue 5, September/October 2014, Pages 519–531>#SPS

UNCONTEXTUALIZED REPRESENTATIONS IN HUMANS AND NONHUMANS The presence of a fully developed capacity for metarepresentation does not imply that adult humans always have metarepresentational insight into mental representations. Dreaming, for instance, clearly demonstrates the human brain's ability to generate uncontextualized representations of novel scenarios, without any online understanding of the (discordant) relationship between these representations and current reality. Except in the special case of lucid dreaming,[[49](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0049)] we only gain insight into this relationship when we wake and our capacity for metarepresentation is applied. Curiously, a similar dissociation is seen in instances of involuntary mind-wandering to past and potential future episodes during wakefulness.[[50-52](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0050)] People often become aware of the nature and temporal context of these representations only when their mind-wandering is interrupted and they reflect upon it after the fact.[[53-55](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0053)] And yet, even when people mind-wander without any awareness of doing so, their behavior is still driven by perceived reality, as demonstrated by the fact that they continue to perform appropriately (albeit less efficiently) on basic perceptual judgement tasks.[[53](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0053)] Human mind-wandering has been characterized as a process in which the mind intermittently wanders and then catches itself wandering, inadvertently halting the spontaneity of the process.[[56](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0056)] Thus, humans appear to possess mechanisms able to generate representations of past and potential future scenarios without any necessary metarepresentational insight into their relationship with current reality. Such insight is an additional, rather than encapsulated ingredient of mental representation (see Figure [1](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-fig-0001)). Both mammals and birds (but potentially not reptiles[[57](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0057)]) engage in rapid eye movement (REM) sleep,[[58](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0058)] which is closely associated with dreaming in humans.[[59, 60](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0059)] In rats, REM sleep is often coupled with the reactivation of hippocampal place cells corresponding to previously explored locations,[[61](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0061)] and behavioral evidence shows that pontine-lesioned cats appear to physically ‘act out’ their dreams.[[62](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0062)] Furthermore, neuroimaging studies suggest that at least some mammalian brains have a human-like ‘default network’,[[63-66](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0063)] which has been implicated in mind-wandering during wakefulness.[[67](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0067)] Thus, it appears that certain nonhuman animals may be able to generate mental representations of alternative versions of reality. And interestingly, as mentioned in Section ['INTRODUCTION'](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-sec-0001), recent evidence suggests that rodents can represent novel movements through a spatial field.[[14, 15](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0014)] Indeed, during sleep and rest, novel representations may comprise up to 85% of the total running episodes generated by the rat brain.[[68](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0068)] As in human mind-wandering, rats' alternative representations during wakefulness are apparently not confused with current reality, as they are able to continue running on a wheel in an appropriate fashion all the while imagining alternative movements through space.[[16](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0016)] Even conceding the phenomenological validity of these neurological findings, however, there remains no conclusive evidence for the capacity to form metarepresentations (as measured by false-belief understanding) in even our closest extant relatives, the great apes.[[69-72](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0069)] This leaves open the possibility that, while some animals may have mechanisms able to generate uncontextualized representations based on elements from memory**, they lack any insight into the specific relationship between these representations and current reality.** And considering the numerous errors associated with memory,[[73](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0073)] it is not surprising that many of these representations would be novel, rather than accurate depictions of past events (evolution may even favor a somewhat imperfect memory that promotes the flexible recombination of memory elements[[74](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0074)]). Yet, as long as they are not embedded within a specific temporal context, such representations are best characterized as mental space travel rather than true mental time travel (see Box [1](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-fea-0001)). As I reaffirm below, the capacity for metarepresentation is not only qualitatively distinct, but also exceptionally adaptive.[[23](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0023)] EVOLUTIONARY PERSPECTIVE: UNCONTEXTUALIZED REPRESENTATIONS VERSUS METAREPRESENTATION One influential theory suggests that dreaming may have evolved to help us prepare for future threats.[[88](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0088)] By experiencing a novel situation in a dream, we are able to mentally ‘practice’ certain adaptive behaviors.[[89](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0089)] In this way dreaming would provide us with future-oriented benefits, although at the time of the dream and the applicable future situation we would usually remain unaware of these benefits. This hypothesis has support from various domains,[[90](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0090)] including from self-report studies showing that dreams often contain survival threats and attempted evasive or defensive action on the part of the dreamer.[[91](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0091)] Indeed, a similar adaptive argument has been applied to uncontextualized representations of past and novel events during wakefulness. Mind-wandering or environmental cueing to such episodes may bias humans and certain nonhuman animals to engage in adaptive behaviors when relevant future situations arise.[[56, 92, 93](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0056)] Supporting this idea, rats that mentally represent spatial paths are more likely to take these paths in the future[[16](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0016)]—including when the represented path is novel[[15](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0015)]—potentially allowing them to discover new rewards. Conceivably, the future-oriented benefits of uncontextualized representations could also be grounded in present behavior. Consider the finding that human episodic memories often trigger limbic activity associated with the reactivation of emotional states from the actual past episode.[[48, 94](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0048)] Without any evidence to suggest otherwise, we can parsimoniously assume these emotional states to be coupled with the phenomenological re-experience of the episode itself, rather than any metarepresentational awareness of the episode's relationship to current reality. If so, then it could be that certain animals, too, can re-experience (and pre-experience) emotional states when engaged in mind-wandering. Indeed, the chimpanzee default network seems to center more on the ventromedial prefrontal cortex, which is associated with emotional processing, than the human network.[[63](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0063)] Perhaps, emotional states associated with mind-wandering or environmental cuing could prompt animals into engaging in behaviors that would incidentally benefit their future selves. A hungry chimpanzee that comes across some stones, for example, might be cued into a representation of using these stones to crack nuts (a ‘desired world state’), and thus experience a specific desire for carrying stones to a place where nuts are available (see Boesch and Boesch[[95](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0095)]). Even though the chimpanzee may be representing a removed spatial context, the adaptive behavior could be triggered without any metarepresentational understanding of the specific temporal context of the represented episode (which may explain why they never refine stones for more efficient long-term future use). Without metarepresentational insight, however, the adaptive benefits of past and novel representations are limited. Specifically, an agent without this capacity might be restricted to uncontextualized representations of events that are consistent with evolutionarily recurring themes (e.g., potential survival threats[[96, 97](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0096)]) or recombinations of personal past experiences (e.g., previously taken and novel paths in a cognitively mapped environment). Any long-term future benefits would be merely incidental rather than insightfully planned (but still common enough for the cognitive process to be naturally selected). An agent with a capacity for metarepresentation, on the other hand, is endowed with a general ability to embed their episodic representations into larger narratives.[[35](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0035)] Such an agent can exert purposeful and powerful constructive control over a given future representation (within the constraints of the particular environmental context in which it was triggered), and prepare with specific knowledge of how their behavior may affect the future.[[23](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0023)] They can account for all (known) variables specific to a future context, such as the amount of time between a present behavior and the future payoff, or the likelihoods of alternative versions of a future event occurring.[[4, 47](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0004)] Agents with metarepresentational insight are not clairvoyants, but their future-oriented behaviors are likely to be far more targeted and adaptive than those of mere mind-wanderers. EMPIRICAL CONCERNS The empirical problem with the proposed qualitative cognitive difference between humans and nonhumans, however, is that many of the future-oriented behavioral advantages it confers may be quantitative. Agents with a capacity for metarepresentation might be able to act to achieve desirable future outcomes, but so might agents without this component—albeit with less flexibility and without the same understanding. Indeed, there is no doubt that various instinctual, procedural, and semantic mechanisms can produce sophisticated future-oriented behavior in many nonhuman species.[[4](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0004)] And, more pertinently for the issue at hand, there remain non-metarepresentational explanations for evidence suggesting that certain animals can solve future problems using mental representations alone. Consider the most commonly cited behavioral evidence for great ape foresight. Studies show that individuals from these species can preferentially select a tool that will be useful in solving a future problem and gaining a reward,[[98](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0098)] even when they have not seen the tool before (but have seen and used similar tools).[[99](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0099)] These studies were designed only to answer the question of whether great apes can represent and act for specific episodes. Nevertheless, **even if we grant them this capacity, the evidence does not (and cannot) imply a capacity for metarepresentation.** In humans at least, episodic memories are easily cued by relevant information,[[100](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0100)] and recent evidence suggests that great apes too can be cued to representations of past events from up to 3 years earlier.[[101](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0101)] Furthermore, we know that great apes are capable of solving means-ends problems mentally, rather than through trial-and-error learning.[[102](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0102)] Thus, when great apes are shown an array of novel objects, one of which can solve a previously experienced problem, they may be cued to their memory of the problem and become biased toward choosing the appropriate object. As we have seen earlier, however, representations of past and novel events do not necessarily occur with metarepresentational insight.[[53, 56](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0053)] And so the apes could be cued toward selecting the right tool without any appreciation of the specific future context in which they can use it. Later on, when the problem becomes available again, they may be similarly cued to their past choice of the tool and thus bring it with them to gain the reward in the present. Both of these behaviors are possible without any insight into the relationship between past, present, and future (see Figure [2](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-fig-0002)). Similar concerns arise when considering the case of Santino the chimpanzee, who has been observed to gather collections of stones, sometimes hiding them under piles of hay, before later hurling them at visitors to his zoo enclosure.[[103, 104](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0103)] Rather than necessarily requiring metarepresentational insight, such behavior could have parallels with the pretend play seen in human children less than four years of age. As described earlier, these young children are able to simultaneously represent current and pretend versions of reality without confusing one for the other, albeit with no understanding of how the representations specifically relate. Similarly, Santino's stone-collecting behavior could have been driven by an uncontextualized representation of zoo visitors appearing (which he had experienced many times before), without any understanding of the temporal context in which that representation would become actualized. And when the visitors did eventually appear, he simply took advantage of the stones he had left in a convenient location (children, too, leave their toys lying around). Although the behavior clearly seems oriented to a specific future representational perspective, a careful analysis shows there is no need to ascribe any metarepresentational insight. Indeed, the authors themselves raise this possibility when they suggest that Santino's behavior could have been produced without any ‘theory-like reasoning’ about his own or others' mental states.[[103](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0103)] A FORESIGHT EQUIVALENT OF THE FALSE-BELIEF TASK? The explicit false-belief task is the acid test of metarepresentation in the theory of mind domain because passing it requires the central understanding that mental representations are just representations and they can misrepresent current reality.[[30](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0030)] Human children younger than four may be able to implicitly track and switch between their own and others' mental representations, but, as in early pretend play, they may not represent the function of these representations as to represent the world from a certain perspective[[105](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0105)]—and so they cannot pass the explicit false-belief task. Along these lines, any acid test of future-oriented metarepresentation must be able to differentiate between (1) an agent that can represent the function of future representations, and (2) an agent that can more simply represent and act on lower-level desired world states, with no explicit understanding of the future representational perspective to which these desired world states belong. And, as for the theory of mind domain, perhaps the most empirically tractable functional element of future representations is that they often misrepresent the future. Indeed, any agent that explicitly represented the future representational perspective might be expected to learn about the uncertain nature of future representations rather quickly. Thus, any nonhuman animal that demonstrated compelling behavioral evidence of understanding future misrepresentation could be said to possess a future-oriented metarepresentational capacity. Well established in the literature, the Bischof-Köhler hypothesis proposes that nonhuman animals cannot act with future desires in mind when they conflict with current desires.[[1](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0001)] Such action may rely on a capacity for metarepresentation because it requires an agent to understand that the current self tends to misrepresent certain aspects of the future self and so behavior should be adjusted accordingly. As we have seen earlier, however, episodic memories can reactivate emotions associated with the memory,[[48, 94](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0048)] and so this may also occur when animals mind-wander or are cued to uncontextualized representations of past or novel scenarios. In this way, an animal might be able to act with a future emotion in mind, simply because they are currently experiencing that emotion to a certain extent (e.g., in the case of Santino). This low-level explanation could also apply to studies of specific satiety in corvids (see Box [2](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-fea-0002)). Thus, emotion-based tests of the Bischof-Köhler hypothesis may be inadequate if one is hoping to measure metarepresentational insight. On the other hand, it remains unclear to what extent motivational drives such as generalized hunger (in contrast to appetite for specific foods), thirst, and temperature sensitivity can be reactivated by episodic memory or mind-wandering. In primates at least, such ‘interoceptive’ states arise directly from the peripheral nervous system,[[110, 111](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0110)] and so they may be less susceptible to reactivation and cognitive appraisal than emotions are. If so, then these drives would make ideal candidates for testing the Bischof–Köhler hypothesis in this particular animal order. Studies that have claimed to provide evidence of great apes acting for future hunger levels[[99](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0099)] have failed to include a conflict with present hunger levels, and so it remains unclear which one the animal is acting upon.[[5](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0005)] A more sound experiment would require the animal to act to reduce a strong future drive even when they are completely sated.[[112](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0112)] Illustrating the trouble that nonhuman primates may have with this behavior, D'Amato observed that, day after day, cebus monkeys would throw food out of a cage when sated, only to later find themselves hungry and with nothing to eat.[[18](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0018)] Nevertheless, although interoceptive state-based tests of the Bischof–Köhler hypothesis can potentially provide existence proof of future-oriented metarepresentation, in some ways they may be setting the bar too high. Among humans, even 7-year-old children (and at times, adults[[113](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0113)]) have great difficulty passing such tests,[[114, 115](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0114)] despite the fact they pass metarepresentational tasks in the theory of mind domain around age four.[[116](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0116)] And so it may be fruitful to search for other means of testing the capacity based on an understanding that future events can be misrepresented, rather than the future self. One possibility could be to test whether animals can prepare for multiple, mutually exclusive versions of a single undetermined future event. Such a test may provide a first-person, future-oriented version of the false-belief task, because it would require the animal to recognize that a represented version of the future could be incorrect and also prepare for alternative versions. In other words, it would require the animal to represent the uncertain nature of the relationship between current reality and the future. Importantly, the criteria for passing should involve preparing for multiple potential outcomes of the single event simultaneously, thus ensuring that the behavior is not simply based on sequential uncontextualized representations of the outcomes. Current evidence suggests that children become capable of such behavior around the fifth year.[[117, 118](http://onlinelibrary.wiley.com/doi/10.1002/wcs.1308/full#wcs1308-bib-0117)] CONCLUSION Nonhuman animals are capable of many impressive future-oriented behaviors, and they may even be able to mentally represent basic novel events. As of yet, however, they have shown no evidence of metarepresentational insight into the relationship between future events and current reality. Without this capacity, they would be extremely limited in their ability to intelligently prepare for specific future episodes. Future research may reveal otherwise, but for the moment the hypothesis that there are qualitatively distinct aspects of human mental time travel remains tenable.

### Morality

#### Human beings have morality separate from the biological necessity of reducing conflict – this makes us completely unique as all other forms of morality can be explained by evolution

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Dale Peterson's aim in his new book The Moral Lives of Animals is to downplay what is unique about human morality. He argues that animals' moral systems are not merely ‘analogous to our own' - that is, superficially similar due to coincidental factors - but ‘homologous to our own' - that is, similar due to a ‘common origin'. He asks us to view morality as a ‘moral organ', ‘equivalent to the elephant's nose: enormous, powerful, multifaceted'. Our ‘moral organ' may have features that differ from that of other animals, Peterson tells us, but ultimately human morality is, like animal morality, an organ residing in the limbic system of the brain. Peterson proposes a functional definition of morality: ‘The function of morality, or the moral organ, is to negotiate the inherent serious conflict between self and others', he claims. But humans and animals negotiate ‘conflict' by fundamentally different means. Peterson is presenting us with examples not of animal morality, but of Darwinian evolution selecting for behaviours that minimise conflict and strengthen social ties among group-dwelling animals. Take his examples of ‘you scratch my back and I'll scratch yours' in the animal kingdom. Chimpanzees for instance spend an inordinate amount of time grooming each other. As Jeremy Taylor, author of Not a Chimp told me: ‘'Strong alliances between individuals in a group will almost certainly lead to a better prognosis for each individual who has successfully cultivated them. There is plenty of evidence, for instance, which shows that an individual that has a strong reciprocal grooming relationship with another will be more inclined to intervene on her behalf in an encounter'. Human beings, however, negotiate conflict through socially created values and codes of conduct. If one reduces everything to its simplest form then one can find parallels between humans and the rest of the animal kingdom. But this kind of philistinism does not deepen our understanding of human beings and human society or indeed of animal behaviour. For instance, Peterson's approach strips a concept like empathy of any deeper meaning. ‘I would prefer to consider empathy as appearing in two different but related forms, contagious and cognitive', he writes. Contagious empathy is ‘the process in which a single bird, startled by some sudden movement, takes off in alarm and is instantly joined by the entire flock'. Cognitive empathy ‘is contagious empathy pressed through a cognitive filter: a brain or mind'. In other words, these two types of empathy are just different forms of the same thing. But there is a world of difference between an instinctual connection between organisms - including some of our instinctual responses, such as yawning when others yawn - and human empathy involving a Theory of Mind, that is, the ability to recognise that one's own perspectives and beliefs can be different from someone else's. Once children are able to think about thoughts in this way, their thinking is lifted to a different level. Human beings, unlike other animals, are able to reflect on and make judgements about our own and others' actions, and as a result we are able to make considered moral choices. **We are not born with this ability.** As the developmental psychologist Jean Piaget showed, children progress from a very limited understanding of morality to a more sophisticated understanding - involving, for instance, the consideration of the motives and intentions behind particular acts. So, for pre-school children, a child who accidentally breaks several cups, when doing what he'd been asked to do by an adult, is ‘naughtier' than one who breaks one cup while trying to steal some sweets. Young children judge actions by their outcomes or consequences rather than by their intentions. Claiming that our morality is merely based on ‘gut instincts' ignores the transformations children go through in their moral understanding from infancy to adolescence. No doubt Peterson would accuse me of what he terms ‘false anthropo-exemptionalism' - that is, ‘an exaggerated insistence on discontinuity' between human beings and other species. His biological determinism prevents him from recognising that something new - something quite exceptional - emerged in the course of the evolution of humans. Human beings have something that no other animal has: an ability to participate in a collective cognition. Because we, as individuals, are able to draw on the collective knowledge of humanity, in a way no animal can, our individual abilities go way beyond what evolution has endowed us with. Our species is no longer constrained by our biology. Many scientists reject any notion that human beings have abilities that are profoundly different from other animals. To do so, they fear, will give ammunition to creationists and spiritualists. But we do not need spiritual or ‘magical' explanations to grasp that the difference between human beings and other animals is **fundamental** rather than one of degrees. There are some fascinating theories put forward in the last decade that go quite far in explaining the emergence, through evolution, of uniquely powerful human abilities. We don't know how or when, but there must have been some gene mutation or set of mutations tens of thousands of years ago that endowed us with the unique ability to participate in a collective cognition. A small difference in our innate abilities led to a unique connection between human minds - allowing us to learn through imitation and collaboration - leading to cumulative cultural evolution and the transformation of the human mind. As I argue in Just Another Ape?: ‘It is this unique ability to copy complex actions and strategies (even those that the individual doing the copying would never have been able to come up with on their own), along with unique forms of cooperation and an ability to teach, that creates the uniquely powerful "ratchet effect" in human culture, whereby gains are consolidated and built on rather than having to be rediscovered.' There are very many unanswered questions regarding how and why our human genetic make-up evolved. But even if we did have all the answers, we would not - as a result of these insights - be able to explain why we behave the way we do today, or the ethical codes by which we currently live. The evolution of the human genetic make-up is merely the precondition for the emergence of distinctly human cultural abilities. We need to look to cultural evolution, rather than genetic evolution, to explain the vast gulf that exists between the capabilities and achievements of humans and those of other animals. Human beings are not perfect and never will be, but we are special and unique among the animal kingdom. We are capable of making judgements about our own and other people's behaviour, and have the capacity consciously to change the way we behave and society as whole.

### Theory of the Mind

#### Err affirmative when considering the theory of the mind – much of what we believe about animal minds comes from conjecture and observation - not systemic study

Spence, Osman, and McElligott 17 <Caroline E., Magda, and Alan G, Queen Mary University of London, Biological and Experimental Psychology, School of Biological and Chemical Sciences, “Theory of Animal Mind: Human Nature or Experimental Artefact?,” Trends in Cognitive Sciences, May 2017, Vol. 21, No. 5 http://dx.doi.org/10.1016/j.tics.2017.02.003>#SPS

Scientific debate regarding the existence and nature of mental states in animals has a longstanding history [2,3] and covers an extensive range of topics, from mirror recognition to numerosity (Box 1). Yet, the majority of people form beliefs about animal minds based on everyday occurrences, such as when caring for pets [4] or consuming animal products. **Understanding how we construct this ‘Theory of Animal Mind’** (TAM) is therefore likely to reveal important insight, based on people’s considerable experience and influence in relation to animals. Additionally, as a form of internal construal of other minds, examination of the psychological mechanisms generating TAM will have broad implications because behaviour interpretation is not confined solely to human–animal relationships [5]. However, little research has been dedicated to exploring the basis on which mental abilities are attributed to nonhuman animals, despite few individuals doubting the existence of animal minds [6,7]. Furthermore, when directly questioned, people often substantiate their beliefs with explanations from personal experience or media sources [7]. As a result, it is unlikely that the psychological mechanisms that contribute to TAM are analogous to the reasoning used by scientific experts to support judgements on animal cognition [8]. This mismatch gives rise to several ethical, scientific, and societal issues. Ethical issues arise because views on the sentience of different species are correlated with attitudes towards their use and treatment by humans [9,10]. Therefore, not only is TAM a potential driver of positive human–animal interactions [11], but also welfare-related decisions for millions of animals are currently based upon psychological mechanisms that we know little about. Scientific issues emanate from empirical approaches to animal cognition, which likely contaminate research design and produce a biased or inaccurate snapshot of the overall picture of TAM. Social issues are associated with decision-making in related policy areas, such as animal welfare, food security, and climate change, which are, understandably, driven by current scientific opinion. The behaviour change envisaged by policy-makers is unlikely to be realised if supporting evidence does not accurately capture actual human thought processes [12,13]. As such, this article is important and timely, and designed to expose some of the core issues regarding the evidence available in relation to TAM as well as the research methods commonly used to investigate the phenomenon. Therefore, we start by identifying, and later proposing, a candidate mechanism underlying the development of TAM that generates judgements on the mindedness of nonhuman animals. Given that TAM involves animal ‘agents’, we also discuss several theories of relevance from social psychology. We then examine ways in which research methods might be affecting the results gained from previous TAM research, and, thus, pose validity (see Glossary) and reliability issues. We propose a model that allows both conceptualisation and empirical investigation of the initial stages of TAM using a measurements cale model (specifically Churchill’s Scale Development Paradigm [14]), which in turn, allows mechanisms contributing to TAM to be determined. We conclude by discussing the importance of reframing TAM in terms of its relevance to ethical and policy issues other than just animal welfare.

#### Only human beings can place themselves in the shoes of another person – animals consistently fail tests of this ability

Suddendorf 13 <Thomas, Professor of Psychology at the University of Queensland, Australia “The Gap : The Science of What Separates Us from Other Animals, Basic Books, 2013. ProQuest Ebook Central”>#SPS

Following these initial findings, Povinelli set up his own chimpanzee research center at the University of Louisiana and examined their understanding of seeing, pointing, intention, and knowledge. To general surprise, he failed to find additional support for chimpanzee theory of mind. Instead, he discovered numerous reasons for lean interpretations of their behavior. In scores of studies, he obtained consistently negative results from his group of young chimpanzees. For example, they would beg from someone who was wearing a bucket over her head just as often as from someone who could see what was going on. When one trainer saw where food was hidden and another could not see this hiding— because they had left the room, looked away, or wore a blindfold or a bucket— the apes were equally likely to follow the advice of the ignorant as of the knowledgeable human. Chimpanzees that had been trained on a cooperative task, such as pulling a box with two ropes, ignore that a naïve chimpanzee lacks the relevant knowledge to get the task done and do not teach them. Povinelli championed the killjoy cause and concluded that chimpanzees only reason about behavior, not about minds. Povinelli’s research suggests that theory of mind is uniquely human. Great ape behavior may be driven by more basic calculations. Indeed, we might be misguided if we think our own behaviors are caused by theory of mind simply because we explain them in such terms. Perhaps we often merely reinterpret behavior in mental terms. For instance, to keep with the theme of soccer that I kicked this section off with, when an offensive player tries to dribble past a defensive player, a common trick is to make the opponent commit to one side and to delay one’s own final move in order to capitalize on that commitment. When we explain these actions afterwards, we may say that we wanted to fake out the defender, misleading him into thinking we were going to go the other way. Yet it is not clear such thoughts drive our actions. We have time before a penalty to plot deception and counterdeception. In the heat of the action, however, we can’t stand there and formulate explicit notions of each other’s intent. We may automatically go through all the motions and only afterwards interpret them in mental terms. Povinelli and colleagues argue that ape behaviors that look as though they might be driven by mind reading, such as apparent deception, empathy, or grudging, may not be. When we see chimpanzees engage in a chase of rapid side-to-side movements, we may be misinterpreting their behavior in terms of faking a turn to fool the pursuer into thinking a certain way; the apes may merely be concerned with actions. 7 **Only humans, they claim, have evolved a capacity to reinterpret behavior in mental terms.** There is an alternative explanation to this proposal, however. Andrew Whiten and I have suggested that in some cases the rapid actions of deception and counterdeceptions are only automatic because we have initially engaged in a lot of practice involving explicit cognitive considerations. Human skill development is replete with examples in which behaviors that had once been governed by slow conscious processes become automatic with training. Just think of the complexities of driving a car. Initially you need to carefully think about what your arms and legs are supposed to be doing to control the vehicle. With experience you can focus on having a conversation or listening to the radio without attending to how your autopilot, as it were, is driving the car. Similarly, strategies that allow one to get around defenders in soccer may become automatized only after extensive training. It requires a lot of practice to become a good player. Perhaps theory of mind also develops like other skill acquisition, from effortful, explicit, and controlled to fast, automatic, noneffortful processing that comes with practice. Initial mental simulations can give way to quicker shortcuts. For example, we may tend to quite automatically follow the gaze of others not, as Povinelli suggests, because we have some low-level mechanism for this but because we had sufficient experience and practice with these situations. In spite of Povinelli’s considerable output, other laboratories— particularly the Max Planck Institute for Evolutionary Anthropology in Leipzig— gradually flooded the field with findings supporting richer interpretations of animal behavior. The comparative psychologists Michael Tomasello and Josep Call and their colleagues showed, for example, that gaze-following abilities in apes were more sophisticated than previously thought. Even dogs and monkeys appear to be able to follow gaze under some circumstances. Chimpanzees can project somebody else’s line of sight geometrically beyond their own immediate visual field and do so even around barriers. They move in ways that allow them to see what another is looking at— even if the target is behind an obstacle. This suggests that chimpanzees may interpret gaze in terms of what the other person might see. They sometimes even glance back and forth as if to check what in fact the experimenter is finding so interesting. In collaboration with Brian Hare, the Leipzig group produced some ingenious studies supporting the possibility that chimpanzees reason about minds. In one set of experiments chimpanzees had to compete with another, more dominant chimpanzee for food. The chimpanzees were found to preferentially head toward seizure of whichever of two food items was visually screened from the dominant competitor. This suggests that they do understand something about what another can see. When the opaque screens were made transparent, the preference for the “concealed” food vanished, presumably because they recognized that it no longer blocked the view of the competitor. Rhesus monkeys similarly act as if they know what another sees. When given the option between a grape in front of a person who looks at it and a grape in front of a person who looks away, or whose sight is blocked, they consistently prefer the latter— in apparent recognition that “stealing” from someone who is not looking is safer. Chimpanzees in earlier experiments by Povinelli and others might have failed because the tasks involved co operation, such as a human informing the ape about where food is. That is not a particularly natural situation. Unlike human toddlers, who constantly want to point out things to their parents and others, primates do not seem to have much inclination to inform others. They tend to compete for rewards instead, and so it may not be surprising that we can observe their competence better when tested in competitive situations. Unfortunately, these newer results, in spite of their substantial publicity, do not actually prove that the primates reasoned about what the human could see. A much leaner explanation is available. It remains possible that the monkeys simply learned that a human facing the grape is more likely to interfere with their attempt at obtaining the treat than one that is not. The same is true of the chimpanzee example. The lower-ranked individual may have learned purely behavioral rules, such as: if a dominant faces the food, it is not safe to approach. But other results suggest that chimpanzees appreciate not only what another sees but also what another has previously seen. In an extension of Hare and colleagues’ previous experiments, the chimpanzees took into account whether a dominant competitor had observed the hiding of a food item or not. When the placement of food behind a particular screen was witnessed by the dominant, the subordinate was subsequently less likely to approach the food than when it was not witnessed. In another experiment, the dominant saw the hiding but was then replaced with a different dominant animal that did not see the hiding. Again, the subordinate chimpanzee was more likely to approach the treat when the competitor was ignorant than when he was knowledgeable about the food location. So it remains possible that chimpanzees, after all, have some capacity to reason about the minds of others. Indeed, other studies support the possibility of competence in great apes. Like two-year-old children, some great apes appear to recognize what someone else is trying to achieve, even if the attempt failed. Some results suggest that they can distinguish accidental from purposeful actions. Other experiments suggest that they can discriminate between someone who is unwilling to do something and someone who is unable to do it. One study suggests that they may be able to distinguish appearance from reality, and they seem to be able to take advantage of when a competitor cannot see them. There is some indication, though scarce, for such capacities in other species. Grey squirrels, for instance, space their caches farther apart when observed by other squirrels, presumably to avoid pilfering. They even preferentially cache while oriented with their backs to other squirrels. Similarly, scrub jays, when in the presence of a potential competitor, preferentially cache food further away, in darker and more occluded areas, than they do otherwise. Hence other species may also take into account what another can or cannot see. Then again, they may not. Unfortunately, none of these behaviors need imply any reasoning about the mind of the competitor. Squirrels, jays, and apes in all of these cases may behave as they do simply on the basis of observable behaviors. Acting one way gets a reward; acting another way leads to punishment. Recall that to demonstrate an animal is taking the mind of another into account, one has to show attribution of **false beliefs.** In spite of several clever attempts at this holy grail of theory of mind research, so far no nonhuman animal has passed false-belief tasks. Even chimpanzees that have demonstrated some impressive competence at other components of the task fail when false beliefs need to be taken into account. It is therefore possible to maintain a lean interpretation, as many comparative psychologists do, and conclude that no other animal has anything like a theory of mind. M Y OWN HUNCH , ACTUALLY , IS that the truth lies between the extreme romantic and killjoy positions. The wealth of recent positive data from great apes suggest, though they certainly do not prove, that they have limited understanding of basic mental states. It will be interesting to see whether apes demonstrate any sign of the early (implicit) false-belief understanding that has recently been documented in infants. Researchers are trying to use eye-tracking devices to test chimpanzees on such tasks, but it is not easy. Perhaps results on such tests will become available by the time you read this book. Given that great apes perform like two-year-old children on a variety of tasks that involve considering more than meets the eye (as discussed in Chapter 3), it would not be surprising if they did so here. They may have a limited, perhaps implicit, understanding of what another sees, believes, knows, attends, desires, and intends, but this possibility should not detract from the remaining gap between the mind reading in humans and the limited reasoning that on current evidence maximally exists in our closest animal relatives. Although Povinelli’s group and Tomasello’s group, the two most influential research laboratories in this field, have been at logger- heads about lean and rich interpretations of data on ape theory of mind, they both agree that there is no sign yet of any false-belief understanding. Thus we have consensus that there is something unique about human **theory of mind.** Povinelli argues that only humans have a theory of mind, period. Tomasello, Call, and colleagues believe that their findings are more parsimoniously explained by granting great apes some basic mind-reading capacities. Yet they, too, maintain that apes lack the most fundamental human socio-cognitive skills. In fact, Tomasello and colleagues argue that great apes do not even show the basic social awareness that is typical of human infants when they point, show, or offer things because they want to communicate about them. These authors argue that the main difference is that humans have what they call “shared intentionality.” As we have seen, humans have a fundamental motivation to share their own mental states with others. This inclination allows us to construct a sense of “we” that enables us to collaborate on unheralded flexible scales— socially constructing tools, meals, games, and theories (drawing extensively on language and mental time travel). Infants demonstrate an inclination toward this sharing early, well before they pass false-belief tasks. For instance, when one-year-olds are engaged in a collaborative task with an adult and the adult stops, the infants typically try to get the adult to reengage. Infant chimpanzees, on the other hand, simply try to do the task themselves. Chimpanzees may gesture to get someone to do something for them, but humans often gesture (and talk) just to inform. Chimpanzees do not point to each other in the wild. This may be the case because it is pointless to point (pardon the pun) if the other chimpanzees do not give you what you want. In experiments, they are poor at using and providing social cues in cooperative tasks requiring communication. For a while experiments suggested that great apes, unlike dogs, could not even understand pointing by humans. More recent work shows that they only struggle when the human points to things that are close to each other; they can discriminate when the options are far apart. Great apes can also learn to point to humans but do so virtually only to request, rather than to declare. (Recall that only some 5 percent of utterances in “language-trained” apes could be categorized as resembling statements or declarations.) Children, on the other hand, constantly want to point out things to share information. My own children are quite insistent that I drop everything and join in the excitement. Humans may be uniquely motivated to establish links between their minds, through reading and telling, that allow us to create common mental worlds of goals, ideas, and beliefs. Great apes may have some capacity to reason about basic states of mind. Even so, they do not seem to have a particularly strong drive to build connections between their minds, which may significantly limit what cooperation they can mount. A recent large-scale examination of over a hundred great apes found that they performed similarly to twoand-a-half-year-old children on a battery of tasks on physical cognition, but much more poorly on tasks of social cognition. 8 Of course, such comparisons depend on what exact tasks are used: social tasks in which apes have to interact with human adults may not be comparable to social tasks in which human infants interact with human adults. Nonetheless, the results add to the mounting evidence that humans’ urge to link with other minds is unique. **After over three decades of research, there is no strong evidence that apes understand the representational character of beliefs.** It remains possible that they only reason about observables, rather than about minds. Humans evidently are mind readers. Though we may frequently get it wrong, we can read and tell our minds sufficiently well to enable us to cooperate in a multitude of clever ways. We share ideas, advice, and goals. We can develop intricate plans and collaborate in bringing them to fruition. We teach and learn from each other’s experiences. We set out to entertain each other and care about what others might find funny or pleasing. We come together to share attention in celebrations and performances. Our cultural inheritance, as we will discuss later, can be conceived of as an accumulation of cooperative exchanges between minds over many generations. We reflect on the nature of mind reading. We even spend considerable effort trying to overcome the obstacles associated with establishing the nature of animal minds. Much of this scientific mind measuring has focused on animals’ capacity for smart problem solving. And so we turn now to research on intelligence.

#### Even though animals pass some versions of “Theory of Mind” tests, what they display is a poor substitute for true human empathy and understanding

Martin and Santos 16 <Alia Martin, 1 Victoria University of Wellington, Wellington, New Zealand, and Laurie R. Santos, Yale University, New Haven, CT, USA, “What Cognitive Representations Support Primate Theory of Mind?,” Trends in Cognitive Science, https://pdfs.semanticscholar.org/3ded/a5f79b28d5c5a45fdb1080597e8a40d175d8.pdf>#SPS

No Evidence that Nonhuman Primates Use Representational Relations in ToM Tasks Over the past few decades, researchers have also tested whether primates have the capacity to form representational relations [27–32]. Although some aspects of the performance of primates in these tasks are still debated [33–39], most researchers agree on one thing: **there is currently no evidence that any nonhuman primate forms representational relations in the same way as humans.** More specifically, there is no evidence that primates attribute decoupled representational states, such as false beliefs, to other agents [27–32]. In one experiment [29], chimpanzees watched as a competitor either did or did not see a high-quality food being hidden. Subjects then chose between that hidden food and a safe low-quality food. Crucially, subject chimpanzees made their own choice only after the competitor made a choice. Chimpanzees went to the hidden location for the high-quality food when the competitor had not seen that food being baited, but switched to the safe low-quality food in cases where the competitor had seen the baiting. These results suggest that chimpanzees understood that the competitor would choose the high-quality food only when the competitor had perceptual access to the baiting. However, chimpanzees did not distinguish between a condition where the experimenter moved the highquality food to a new container when the competitor was not looking (the competitor had a false belief) and a condition where the experimenter simply lifted and lowered the same container over food when the competitor was not looking; in both cases, chimpanzees chose the high-quality food at high rates. Therefore, chimpanzees treated a competitor with a false belief about the location of the food identically to a competitor that had a true belief about the location of the food but that was unaware that the food had briefly moved (see also [30]). In another experiment[27], rhesus macaques were tested on a looking-time false belieftask (see [7] for a similar test in human infants). In a true belief condition, monkeys watched an experimenter see a lemon slide into a green box, then slide back out and into a white box. Monkeys looked longer when the experimenter subsequently reached into the green box than into the white box, suggesting that they expected the experimenter to search for the lemon where she last saw it. In a false belief condition, monkeys watched a series of events identical to those of the true belief condition except that the experimenter's view was occluded as the lemon slid from the green box into the white box. Unlike human infants, monkeys showed no evidence of attributing a false belief to the experimenter. Instead, monkeys showed similar durations of looking no matter which box the experimenter searched. Similar to chimpanzees [29], rhesus macaques treated an agent with a false belief about the location of the food as though the agent was totally unaware of where the food could be, making no prediction about the behavior of the agent. To date, evidence from primate false belief experiments suggests that primates do not understand that other agents have distinct representations of the world that can be decoupled from reality. It is also worth noting that the failures of primates to represent false beliefs in experimental contexts nicely match what has been observed in field reports [40–42]. Indeed, the tactical deception literature has, at least to date, lacked evidence that primates attempt to mislead competitors by actively giving false information (i.e., implanting a false belief). But Nonhuman Primates Can Use Awareness Relations in ToM Tasks Despite the current lack of evidence that primates can form representational relations between agents and information decoupled from reality, there is consistent evidence that primates are sensitive to whether other individuals are aware of information that primates themselves represent as true about the world ([43–50]; reviewed in [35–37]). When competing for food, primates are sensitive to what potential competitors can see [43–48], hear [46,47], have recently seen or heard [48,49], and can infer based on physical clues to food location [50]. Primates also use information about what a competitor could become aware of when obtaining food; for example, primates prefer to take a silent rather than a loud path when approaching contested food [46,47]. In this way, primates do not merely respond to visible cues of awareness (e.g., the presence of eyes), but avoid producing cues that may lead to awareness across multiple perceptual sources. Together, this pattern suggests that primates have a flexible understanding of the link between perceptual access and awareness. In line with these experimental findings, many field observations demonstrate that primates often prevent competitors from becoming aware of useful information, for instance by keeping relevant information concealed [40–42]. In addition, primates can use information about the awareness of others to learn about what is relevant in their environment. In one experiment [49], researchers placed a novel object on a platform between a chimpanzee and an experimenter so that both could see it. The experimenter then left the room, and either the same experimenter or a new experimenter entered and vocalized excitedly while looking in the general direction of the object When a new experimenter vocalized in the direction of the object, subjects assumed that this new experimenter must be looking at the object and followed the experimenter's attention to the object. By contrast, when the old experimenter entered, subjects behaved as though the experimenter must be reacting to something new, and looked for a novel target of the experimenter's attention rather than the original object. In this way, chimpanzees infer that the gaze of an agent is directed at something, even if chimps themselves can not yet see what that target is. A New Cognitive Proposal of Primate ToM Performance What representations underlie primate performance in these ToM tasks? Put differently, what representations would allow primates to succeed in predicting the behavior of agents in some ToM tasks, yet would cause them to make inaccurate predictions in cases where agents have false beliefs? Nonhuman Primates Do Not Represent Knowledge and Ignorance Some researchers [34] have proposed low-level behavior-based accounts of primate performance in ToM tasks, and others [51] have proposed that primates represent something belieflike but that falls short of full-blown beliefs (reviewed in Box 1). However, a middle-ground view that many researchers have converged on [33,35–38], and that we ourselves have argued for previously [27], is that primates succeed in many ToM tasks by representing the knowledge and ignorance of other agents. Under this knowledge-ignorance account, primates are able to represent what others know and do not know (i.e., ignorance) and can use these representations to make predictions and guide their own actions toward other agents. The core problem with this sort of knowledge-ignorance account of the performance of primates concerns the kind of representation needed to truly understand another agent as ignorant per se. Recognizing that an agent is in state of ignorance requires an organism to form a relation between an agent and a state of the world that is, in an important sense, decoupled from the organism's own reality. To truly understand that an agent is ignorant, an organism must attribute to that agent a state of uncertainty or not knowing, even though the organism itself knows exactly where the food is. In this way, representing agents as truly ignorant likely requires the same cognitive resources as representing agents with false beliefs, namely, forming a representational relation, which so far primates appear not to do [27–32]. Nonhuman Primates Use Awareness Relations to Track the Access of Others Given these issues with the knowledge-ignorance account of the performance of primates, we propose a new account: primates succeed in some ToM tasks because they are able to attribute awareness relations between different agents and information about the world that primates themselves are already representing as true of reality. In this view, primates track particular agents (the competitor) and particular bits of information (there is food in the box) and can represent whether there is a relation between the two based on cues relevant to the mental state of the agent (e.g., the competitor sees the food in the box). Such representations of the relation between an agent and information allow primates to track whether an agent is aware of the same things that the primates themselves are aware of, and can be used to predict or interpret the actions of the agent. Importantly, this account posits that the awareness attributions of primates have an ‘on/off’ quality: the primate subject either represents a relation between an agent and some piece of information, or represents no relation at all (see Box 2 for an explanation of how an on/off system also accounts for the lack of egocentric errors in primate false belief tasks). The Awareness Relations View Is Consistent with the Successful Performance of Primates in ToM Tasks Once primates represent an awareness relation between an agent and some target bit of information, they can use this relation to predict how the agent will act on the information. For example, primates can make predictions about what another agent that is aware will do (the agent will search in the green box, the agent will react if I try to approach the green box), and can use these predictions to guide their behavior (I should not steal food if a competitor is aware, I should not produce auditory cues that might make a competitor aware). Awareness relations can also account for the performance of chimpanzees reported in [49]: chimpanzees in this task formed a relation between the experimenter and the object as soon as the experimenter looked at the object. When the experimenter acted surprised, chimpanzees inferred that the experimenter's reaction could not be toward an object with which the experimenter already had a relation. Thus, chimpanzees assumed that the experimenter's increased attention could not be directed at the original object, and searched for an alternative target. The Awareness Relations View Is Consistent with the Limitations of Primates in ToM Tasks Our awareness relations account also leads to a novel interpretation of primates’ failures in false belief tasks, the same performance that led researchers to argue that primates represent an agent with a false belief as ‘ignorant’. While there is robust evidence that primates make positive predictions about how agents will act on based on their knowledge of some piece of information [27,29,43–50], there is less clear evidence that primates make positive predictions about how agents will act when they do not know some piece of information. Consider again the performance of monkeys reported in [27]. When the lemon moved to a new location when the agent was not looking, monkeys looked equally regardless of whether the agent searched in either the correct or incorrect location. One interpretation of this pattern of performance is that monkeys recognized that the agent was ignorant (that the agent did not know where the food was) and, thus, predicted that the agent would search at random. However, another interpretation of this pattern of performance is that primates had no prediction about what the agent would do. That is, monkeys had no representation of this agent in relation to any relevant information and, thus, had no expectation about the agent's behavior. This same alternative interpretation can be applied to the performance of chimpanzees in the false belief condition reported in [29]. The authors claimed that chimpanzees treated the competitor as ignorant and, thus, understood that they could take the high-quality food because the competitor would not know where it was. However, the performance of chimpanzees is also consistent with the possibility that they made no prediction about what the competitor would do when the competitor did not see the movement of the food and, thus, chose the food that they themselves preferred originally. In both cases, one can just as easily interpret the performance of the primates as consistent with them having no representation of a relation between the agent and the food. The idea that primates make no prediction when they have no representation of a relation between an agent and information fits with recent evidence suggesting that primates do not attempt to actively create states of ignorance in others. For example, chimpanzees keep already hidden food from the view of a competitor, but do not actively hide food that is not currently hidden [52]. Again, these findings raise the possibility that chimpanzees cannot represent another agent in a state of ignorance. The Awareness Relations View Makes Novel Empirical Predictions To date, most evidence from primate ToM studies are consistent with both the awareness relations proposal we have argued for here and the knowledge-ignorance account that others have argued for previously. Nevertheless, these two accounts make different predictions in situations in which primates have not yet been tested, ones that require representations of ignorance as a subjective mental state. Our awareness relations account uniquely explains a finding that should be puzzling from a knowledge-ignorance account: competitive primates understand that they should prevent cues that would lead their competitors to gain awareness (e.g., do not reveal hidden food), but not that they should break existing cues that would cause their competitors to become ignorant (e.g., hide visible food). Consider again the performance of chimpanzees reported in [52]. Chimpanzees understood the consequences of making a competitor aware (they knew to keep food that was already hidden from a competitor out of sight) but not how to break the future state of awareness of the competitor: they did not try to actively hide food in advance so that the competitor would not later see it. Under our awareness relations account, this dissociation makes sense: chimpanzees can not anticipate a state of ignorance in others because they have no way to represent a state of ignorance per se. Thus, our awareness relations account predicts this observed dissociation between the capacity to hide food and the capacity to leave food hidden. The awareness relations and knowledge-ignorance accounts also differ on a second empirical prediction: whether primates will show positive expectations about ignorant agents. If primates represent others as ignorant, then they should predict that ignorant agents will engage in information-seeking behaviors to find food. In addition, if primates represent others as ignorant, they should find it particularly surprising if an ignorant agent finds a target object when a guess is improbable. Finally, primates who represent others as ignorant should expect an ignorant agent to react with surprise rather than indifference upon finding a target object. Note that each of these predictions requires researchers to assess primates’ expectations of the behavior of others rather than only primates’ responses. Fortunately, researchers have developed new methods for assessing such expectations [27,28], including new methods that can even probe what primates expect before agents begin acting [53]. Although it is an (exciting) open question how primates would behave in these novel experimental situations (see Outstanding Questions), we predict they will perform poorly: representing a subjective mental state of ignorance would require primates to use representational relations, which primates’ performance in false belief tasks suggests they are unable to do [27–32]. As we have reviewed here, primates understand something critical about the relation between agents and information: primates can represent relations between agents and information that is true from their own perspective. Such awareness relations allow primates to functionally exploit what others know and do not know, and to make correct predictions about others’ future behavior. Importantly, however, there is also a critical limit to the awareness relations that primates can represent: primates cannot represent relations between agents and untrue or decoupled states of the world. These more computationally sophisticated representational relations allow human ToM to go beyond that of other primates. In doing so, **we may have become the only species that is able to track the contents of others’ minds even when the contents of those other minds differ from our own.**

## Negative

### General

#### Err negative – fundamental biases in research and human upbringing mean you subconsciously favor believing that you are better than animals – you should fight that subconscious urge

De Waal 16 <Frans, Prof of Psychology at Emory University, “Are We Smart Enough to Know How Smart Animals Are?,” W. W. Norton & Company, Apr 25, 2016, Google Books>#SPS

But what about skeptics who believe that animals are by definition trapped in the present, and only humans contemplate the future? Are they making a reasonable assumption, or are they blinkered as to what animals are capable of? And why is humanity so prone to downplay animal intelligence? We routinely deny them capacities that we take for granted in ourselves. What is behind this? In trying to find Out at what mental level Other species operate, the real challenge comes not just from the animals themselves but also from within us. **Human attitudes, creativity, and imagination are very much part of the story.** Before we ask if animals possess a certain kind of intelligence, especially one that we cherish in ourselves, we need to overcome internal resistance to even consider the possibility. Hence this book's central question: "Are we smart enough to know how smart animals are?" The short answer is "Yes, but you'd never have guessed." For most of the last century, science was overly cautious and skeptical about the intelligence of animals. Attributing intentions and emotions to animals was seen as naive "folk" nonsense. We, the scientists, knew better! We never went in for any of this "my dog is jealous" stuff, or "my cat knows what she wants," let alone anything more complicated, such as that animals might reflect on the past or feel one another's pain. Students of animal behavior either didn't care about cognition or actively opposed the whole notion. Most didn't want to touch the topic with a ten-foot pole. Fortunately, there were exceptions—and I will make sure to dwell on those, since I love the history of my field—but the two dominant schools of thought viewed animals as either stimulus-response machines out to obtain rewards and avoid punishment or as robots genetically endowed with useful instincts. While each school fought the other and deemed it too narrow, they shared a fundamentally mechanistic outlook: there was no need to worry about the internal lives of animals, and anyone who did was anthropomorphic, romantic, or unscientific. - Did we have to go through this bleak period? In earlier days, the thinking was noticeably more liberal. Charles Darwin wrote extensively about human and animal emotions, and many a scientist in the nineteenth century was eager to find higher intelligence in animals. It remains a mystery why these efforts were temporarily suspended, and why we voluntarily hung a millstone around the neck of biology—which is how the great evolutionist Ernst Mayr characterized the Cartesian view of animals as dumb automatons.2 But times are changing. Everyone must have noticed the avalanche of knowledge emerging over the last few decades, diffused rapidly over the Internet. Almost every week there is a new finding regarding sophisticated animal cognition, often with compelling videos to back it up. We hear that rats may regret their own decisions, that crows manufacture tools, that octopuses recognize human faces, and that special neurons allow monkeys to learn from each other's mistakes. We speak openly about culture in animals and about their empathy and friendships. Nothing is off limits anymore, not even the rationality that was once considered humanity's trademark. In all this, we love to compare and contrast animal and human intelligence, taking ourselves as the touchstone. It is good to realize, though, that this is an outdated way of putting it. The comparison is not between humans and animals but between one animal species—ours—and a vast array of others. **Even though most of the time I will adopt the "animal" shorthand for the latter, it is undeniable that humans are animals. We're not comparing two separate categories of intelligence, therefore, but rather are considering variation within a single one.** I look at human cognition as a variety of animal cognition. It is not even clear how special ours is relative to a cognition distributed over eight independently moving arms, each with its own neural supply, or one that enables a flying organism to catch mobile prey by picking up the echoes of its own shrieks. We obviously attach immense importance to abstract thought and language (a penchant that I am not about to mock while writing a book!), but in the larger scheme of things this is only one way to face the problem of survival. In sheer numbers and biomass, ants and termites may have done a better job than we have, focusing on tight coordination among colony members rather than individual thought. Each society operates like a self-organized mind, albeit one pitter-pattering around on thousands of little feet. There are many ways to process, organize, and spread information, and it is only recently that science has become open-minded enough to treat all these different methods with wonder and amazement rather than dismissal and denial.

#### Any uniqueness of humans must be viewed through the lens that others may have developed it – we just killed off all of our closest relatives before we could study them

Suddendorf 13 <Thomas, Professor of Psychology at the University of Queensland, “Are we really different from animals?,” Thu November 21, 2013, http://www.cnn.com/2013/11/21/health/animals-humans-gap/index.html>#SPS

Why only us? If these traits are so useful, you may rightly wonder why other creatures did not evolve them, too. As it turns out, other creatures did -- but they have gone extinct. The gap between humans and other creatures on this planet previously was not as vast as it is today. Chimpanzees and other apes have not always been our closest living relatives. Some 40,000 years ago, we still shared this planet with several smart, upright-walking, stone tool-carrying cousins, including Neanderthals, Denisovans and the "Hobbits" of Flores. Go back further to around 2 million years ago and there were three distinct genera of hominins (Australopithecus, Homo, and Paranthropus), each likely comprising several species. Though there are debates about how many species need to be distinguished, it is clear that for much of our past our ancestors were but one of a group of diverse hominins. A gap is defined by both its sides: We appear so different from other animals because all our closest relatives have become extinct. And our ancestors may well have contributed to their fate. Note that all our closest animal relatives today, the apes, are endangered because of human activity. They may eventually join Neanderthals and Paranthropus as half-forgotten creatures of the past. And so, if we do not manage to stop this from happening, our descendants may be even more baffled by their own apparent uniqueness.

### Cooperation

#### Chimpanzees have demonstrated cooperation beyond that needed to maintain peace – clearly not a product of evolution

Boesch 05 <Christopher, Department of Primatology, Max Planck Institute for Evolutionary Anthropology “Joint cooperative hunting among wild chimpanzees: Taking natural observations seriously,” BEHAVIORAL AND BRAIN SCIENCES (2005) 28, 675–735>#SPS

In the past, philosophers and scientists have regularly proposed new definitions of human uniqueness based on their personal convictions and intuitions of what animals are or are not able to do. Nowadays, over 45 years of field studies on wild chimpanzees provide a wealth of observational data against which to confront these preconceptions. In this sense, it is more than surprising to find only a single reference to animal field data in Tomasello et al.’s long citation list. Not surprisingly, their portrayal of cooperative hunting in chimpanzees reminds one of the old philosophers’ claims. This is especially disappointing in that their proposition that the ability to share goals and intentions is a uniquely human capacity rests squarely on the assumption that no other species can do so. I will briefly outline an analysis of the hunting behaviour among wild chimpanzees showing that individual hunters’ behaviour is noticeably compatible with sharing goals and intentions. Hunting has been observed in all chimpanzee populations studied so far, and large differences in hunting strategies have been documented, especially in the propensity to hunt in collaborative groups (Boesch 1994a; 1994b; Mitani & Watts 1999; 2001; Nishida et al. 1992; Stanford 1998; Stanford et al. 1994a; 1994b; Watts & Mitani 2000; 2002). Natural observations can address only the question of performance, but we know from human observations that comprehension often exceeds performance (Birch & Bloom 2004; Keysar et al. 2003). During 77% of the 274 group hunts followed, Taï chimpanzees performed four complementary hunting roles (Fig. 1). Briefly: The driver initiates the hunt by slowly pushing the arboreal prey in a constant direction, blockers climb trees to prevent the prey from dispersing in different directions, the chaser may climb under the prey and by rapidly running after them try a capture, and the ambusher may silently climb in front of the escape movement of the prey to block their flight and close a trap around the prey (Boesch 1994a; 2002; Boesch & BoeschAchermann 2000). Hunting success increases with the number of hunters, so that large groups in which all roles are performed are very successful (63 to 89% of captures achieved). During such collaborative hunts, each hunter synchronizes and spatially coordinates his movements to those performed by others, and sometimes anticipates their future actions. Each individual hunter can perform most complementary roles and individuals may even shift roles during a given hunt, **demonstrating a capacity for role reversal and perspective taking.** Tomasello et al. suggest that a chimpanzee hunter “simply assesses the state of the chase at each moment and decides what is best for it to do.” However, drivers and ambushers achieve only 1% and 11% of the captures respectively, while 81% are achieved by individuals following the hunt from the ground. Consequently, drivers are granted about three times less meat than captors of the prey (Boesch 2002; Boesch & BoeschAchermann 2000). Interestingly, ambushers that anticipates movements of the prey and the other hunters are granted an amount of meat equal to captors, even when they have not made the capture. Thus, under a selfish hypothesis, chimpanzees should only wait on the ground for the prey to fall or perform the ambusher role that guarantees more meat. **Group hunting would become rare. This is not the case as Taï chimpanzees hunt about 250 times per year** (Boesch & Boesch-Achermann 2000). On the other hand, a joint goal hypothesis seems more compatible with the observations, with individual hunters assessing whatever role needs to be performed for the joint hunt and able to flexibly perform the roles needed independently of their short-term benefit. Like in a team of soccer players, individuals react opportunistically to the present situation while taking in account the shared goal of the team. Some players will rarely make a goal, like defenders and goalies, but the success of the team will critically depend upon their contribution. This is very reminiscent to group hunting in chimpanzees where synchronization of different coordinated roles, role reversal, and performance of less successful roles favor the realization of the joint goal. Thus, the group hunting behaviour of the Taï chimpanzees fulfills the criteria set by Tomasello et al. for shared goals and intentions. I am not claiming that chimpanzees perform like humans; I am merely emphasizing that the evidence published on hunting in chimpanzees is compatible with the scenario of shared goals and intentions proposed by Tomasello et al and therefore not a distinct human feature. One possible difference might be that human soccer players sometimes explicitly plan movements or strategies before the play starts and we have not yet seen this kind of shared planning in chimpanzees. In the broader interest of the field of comparative psychology one further aspect is worth addressing: Why did Tomasello et al. ignore the published evidence on wild chimpanzee group hunting? Such an attitude is far from being isolated as illustrated by the conspicuous scarcity of reference to observations on wild animals in some of the cognitive literature claiming human superiority (e.g., Evans 2003; Heyes 1994; 1998; Povinelli 2000; Tomasello 1999). Generally, there is a tendency in comparative psychology to accept only experimental data. Observational data are dismissed as mere anecdotes or are discredited as not conclusive because alternative scenario could always been constructed. However, if we want to understand the specificity of cognitive abilities in humans and chimpanzees we have to take in account what they do in real life. Such data are irreplaceable as they provide the necessary information about how human and non-human primates perform. My point is not that field data answer all the questions about mental processes. What I am suggesting is that we need to formulate our hypothesis about human uniqueness in terms of performance that we should confront to the known performance of animals. The outcome could then be used as a guide for the aspects requiring more evidence, including experimental studies. Had that been done in Tomasello et al.’s article, I would probably have had no critical comment to forward on shortcomings or premature conclusions.

#### Bonobos share altruistically

Tan and Hare 13 <Jingzhi, Department of Evolutionary Anthropology, Duke University, Department of Evolutionary Anthropology, Duke University Center for Cognitive Neuroscience, “Bonobos Share with Strangers,” PLoS ONE 8(1): e51922. https://doi.org/10.1371/journal.pone.0051922>#SPS

Our results demonstrate that prosociality and even other-regarding preferences toward strangers are not unique to humans. Our results also raise the possibility that bonobos have a unique prosocial preference for strangers over groupmates (i.e. while humans share with strangers they do not prefer them over groupmates [[55]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Fehr3), [[56]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Levine1)). Our findings highlight two distinct motivations underlying prosociality toward strangers (see [Table 1](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone-0051922-t001)). First is a xenophilic motivation. In experiment 1 and 2 bonobos are willing to forego food in their possession to facilitate an interaction with a stranger – even preferring a stranger to a groupmate. However, this type of xenophilic sharing has limits. In experiment 4 bonobos will not give up valuable food in their possession unless a desirable social interaction is possible [[48]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Jaeggi3). This supports the hypothesis that the relatively high tolerance observed in bonobos allows them to potentially extend their social networks through interactions with strangers [[57]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Engh1), [[58]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Taylor1). However, bonobo sharing is not completely selfishly motivated either. We also discovered a second, unselfish motivation toward strangers. In experiment 3 bonobos do exhibit other-regarding tendencies when no immediate payoff is available. Bonobos will exert effort to help strangers (and groupmates) obtain out-of-reach food as long as the cost of such helping is relatively low (i.e. does not require giving up food in their possession). Controls demonstrate that the bonobos understood the physical properties of the two tasks (i.e. by demonstrating self-regard in a non-social pre-test) and were not opening doors due to local enhancement or a lack of inhibitory control. The observed sharing also cannot be explained by social factors including: harassment, since only subjects could allow recipients to approach the food; kinship, since no participant is related; repayment, since no reciprocal exchange before or after the experiment could occur between non-groupmates; and solicitation, since subjects' door opening behavior is not related to the requests of the recipients. We predict future research with other captive bonobo populations will show a similar tendency for prosociality toward strangers since wild bonobos have the potential to affiliate with neighboring groups [[39]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Furuichi1) and comparisons between the sanctuary bonobos and other captive bonobo populations have shown similar results in other cognitive domains [[49]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Wobber2). Correspondingly, the xenophobia observed in captive chimpanzees mirrors the lethal aggression they can show toward neighboring groups in the wild (i.e. introducing chimpanzees to a pre-existing group often leads to serious injury and even fatalities; [[50]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Seres1), [[59]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Brent1)). It is also unlikely that bonobo's attraction to strangers is an expression of a more general preference for risk and novelty, since bonobos are more risk averse in foraging contexts [[60]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Heilbronner1) and more neophobic in non-social contexts [[61]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Herrmann1) than chimpanzees. However, we also predict that future research will likely find variation in xenophilic sharing among bonobos depending on the age and sex combination of the actor and recipient. Throughout our experiments the majority of our subjects were juveniles and young adults (<15 years old; see [Table S3](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922.s006) showing age of sexual maturity for sanctuary bonobos is between 7–8 years of age). In addition, the recipients in experiment 1 and 2 were always female. It is likely that older bonobos or even male-male pairings of bonobos will not show the same xenophilic preference observed in experiment 1 and 2. Given the variance observed in social behavior across different populations of wild chimpanzees [[62]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Stumpf1) it is also possible that some chimpanzee pairings might show a xenophilic preference (i.e. male actors might prefer strange, adult female recipients). If an ethical way to test chimpanzees could be designed it would be interesting to know when and if they ever show a xenophilic preference for sharing with conspecifics (see [[61]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Herrmann1) for evidence of xenophilia towards humans in chimpanzees). Another important future extension of the current work would be to test whether bonobos are more or less willing to share with groupmates based on their relationship quality during their natural group interactions. It may be that bonobos do readily volunteer to share with specific groupmates even though they do not prefer to share with all groupmates. The current findings suggest that prosociality and even other-regarding behavior toward strangers is likely constrained across species by intergroup tolerance. Therefore, xenophilic prosociality is present in a species without language, social norms, intergroup violence or cooperative breeding because the benefits of initiating a new “friendship” and therefore expanding individual social network [[45]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-No1), [[57]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Engh1), [[58]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Taylor1), [[63]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Silk2) outweighed the costs of a prosocial interaction with a stranger (e.g. lethal aggression or feeding competition) [[34]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Wrangham1), [[64]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Kappeler1). With little chance of serious conflict arising from intergroup interactions bonobos can more quickly develop positive relationships with non-group mates than groupmates with whom they have a long history of interactions (i.e. more social effort is needed to improve an existing relationship than to establish a completely new relationship). Future research will be necessary to establish if the relatively pacific bonobo is unusual among nonhumans in this regard or whether other species behave similarly toward strangers [[65]](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0051922#pone.0051922-Ganem1). In addition, it is possible that bonobos may provide costly help to strangers in other contexts (although a method to non-verbally test nonhuman preferences toward an anonymous social partner remains elusive precisely because anonymity relies on linguistic capabilities).

### Culture

#### Human culture is merely a more advanced form of what tons of other animals exhibit – it is a difference of degree, not kind

Claidiere et al 14 <Nicolas, Aix Marseille Université, Kenny Smith, Language Evolution and Computation Research Unit, School of Philosophy, Psychology, and Language Sciences, University of Edinburgh, Simon Kirby, Language Evolution and Computation Research Unit, School of Philosophy, Psychology, and Language Sciences, University of Edinburgh, Joel Fagot, Aix Marseille Université, “Cultural evolution of systematically structured behaviour in a non-human primate,” Proceeding of the Royal Society, 22 December 2014, Volume 281, issue 1797>#SPS

Our experimental paradigm allows us to show that, with the right scaffolding, baboons are capable of sustaining a culture in the laboratory that exhibits some of the **fundamental** properties of human culture. The behaviours that emerged in our experiment exhibit systematic, lineage-specific structure: individual grids develop a rare but highly salient tetromino structure; the stability and reproducibility advantage of tetrominos depends on the presence of other tetrominos; independent chains converge on differing distributions of the various sub-types of grid. Our results therefore suggest that the differences between human and non-human capacities for cultural evolution might have previously been overestimated. However, they simultaneously beg the question of the origin of the profound difference that we see in the real world between human culture and the cultural systems of all other species. Our work offers one possible explanation for this difference. The structure of grid patterns in our task is irrelevant to their function: regardless of the details of individual grids (e.g. whether they are a tetromino or not), a correctly reproduced grid yields a reward. By contrast, the cultural elements of most non-human primates (e.g. the large inventories of socially learned behaviours in chimpanzees identified by Whiten et al. [[12](http://rspb.royalsocietypublishing.org/content/281/1797/20141541.short#ref-12)]) are highly constrained by their function: for instance, the functional constraints on tools for termite fishing or nut cracking limit their potential to adapt to pressures for systematicity arising from the cultural transmission of sets of such behaviours. Systematic structure is one of the fundamental design features of human language, a product of culture par excellence [[10](http://rspb.royalsocietypublishing.org/content/281/1797/20141541.short#ref-10)]: language exhibits structure both within individual sentences (words are organized hierarchically into constituents) and across sets of sentences (according to rules that characterize the underlying grammar of a language); this systematic structure differs across languages (different languages have different grammars) and must be acquired by children through exposure to their language and is therefore lineage-specific. Intriguingly, bird song evolution also exhibits systematic, lineage-specific structure: song consists of ordered sequences of acoustic units that conform to an underlying grammar (see [[32](http://rspb.royalsocietypublishing.org/content/281/1797/20141541.short#ref-32)] for review), and differ across lineages in a way that has been equated with dialects in human language [[33](http://rspb.royalsocietypublishing.org/content/281/1797/20141541.short#ref-33)]. The fact that cultural evolution produces systematic structure in human language, bird song and in our experiment suggests that, rather than being dependent on species- or task-specific cognitive biases or architectures, systematicity might be the inevitable consequence of the transmission of sets of behaviours where there is an arbitrary link between form and function. Our results also speak to the role of faithful transmission in cultural evolution. High-fidelity social learning is sometimes seen as essential for human cultural evolution [[6](http://rspb.royalsocietypublishing.org/content/281/1797/20141541.short#ref-6),[8](http://rspb.royalsocietypublishing.org/content/281/1797/20141541.short#ref-8)]. However, despite the fact that fidelity can be quite high in transmission chain studies, high-fidelity transmission often fails to stabilize new behaviours [[34](http://rspb.royalsocietypublishing.org/content/281/1797/20141541.short#ref-34)]. Our experiment shows that the low fidelity of grid reproduction during the first generation of transmission trials (only 37% of grids were reproduced without errors) did not prevent the accumulation of modifications. Interestingly, fidelity increased sharply during the experiment (reaching 72% in the 12th generation), suggesting that high-fidelity cultural transmission may not always be the cause of cumulative culture but sometimes, its consequence. Human culture is unique in the animal kingdom and constitutes a crucial piece of the evolutionary puzzle surrounding the success of our species. Understanding how culture evolved is therefore central to understanding the evolutionary history of our species. Our study provides important evidence regarding this question by showing that cultural transmission among non-human primates can result in the spontaneous emergence of efficient, structured, lineage-specific behaviours, therefore demonstrating that we share with our closest relatives **many of the essential requirements for creating human-like culture.**

#### Recent research – specifically into monkeys and whales – show that they have all of the building blocks of true culture

Balter 13 <Michael, Reporter for Science Magazine, Strongest Evidence of Animal Culture Seen in Monkeys and Whales, Science, April 25, 2013, http://www.sciencemag.org/news/2013/04/strongest-evidence-animal-culture-seen-monkeys-and-whales>#SPS

Until fairly recently, many scientists thought that only humans had culture, but **that idea is now being crushed by an avalanche of recent research with animals.** Two new studies in monkeys and whales take the work further, showing how new cultural traditions can be formed and how conformity might help a species survive and prosper. The findings may also help researchers distinguish the differences between animal and human cultures. Researchers differ on exactly how to define culture, but most agree that it involves a collective adoption and transmission of one or more behaviors among a group. Humans' ability to create and transmit new cultural trends has helped our species dominate Earth, in large part because each new generation can benefit from the experiences of the previous one. Researchers have found that similar, albeit much simpler, cultural transmission takes place in animals, including fish, insects, meerkats, birds, monkeys, and apes. Sometimes these cultural traits seem bizarre, such as the recently developed trend among some[capuchin monkeys to poke each other's eyeballs](http://www.sciencemag.org/content/329/5989/266.summary) with their long, sharp fingernails—a behavior that originated among a small group of individuals and which has spread over time. In humans, once a new fad arises, everyone starts doing it, and in tomorrow's issue of Science, two back-to-back papers find this to be true among animals, too. Two international teams led by researchers at the University of St. Andrews in the United Kingdom report new evidence for the strength of cultural conformity in two very different species suspected to exhibit cultural behavior: vervet monkeys and humpback whales. In the first study, a research group led by psychologist Andrew Whiten of St. Andrews tried to induce conformity in four groups of wild monkeys, 109 animals in total, living in a private game reserve in South Africa's KwaZulu-Natal province. The team gave each group two plastic trays filled with corn; the corn was dyed blue in one tray and pink in the other. (These colors were chosen because they are prominent in the genitals of male vervets and so were likely to draw the monkeys' attention.) One set of corn was soaked in bitter aloe leaves and made distasteful to the monkeys. In two groups, the blue corn was made bitter, while the other two groups got bitter pink corn. Over a period of 3 months, the monkeys easily learned to entirely avoid the bitter-tasting food. Four months later, after 27 baby monkeys had been born and were old enough to eat solid food, the monkeys were again offered pink and blue corn, although this time neither had the bitter taste. During the next 2 months, both adults and infant monkeys strongly preferred the same color as before—even though both trays were now edible. Indeed, 26 of the 27 infants ate only the corn preferred by their mothers, ignoring the other tray. Moreover, during the period of the experiments, 10 male monkeys migrated from a group that had preferred one color of corn to a group that preferred the opposite color. Seven of the 10 immediately took up the color choice of their new, adopted group, suggesting that they were influenced by the norms of that cohort. The study demonstrates that [learning from others and cultural conformity play an important role in the behavior of animals as well as humans](http://www.sciencemag.org/lookup/doi/10.1126/science.1232769), Whiten and his colleagues conclude. Deferring to the experiences of others—rather than relying on only personal experience—can help animals adapt. In the second study, a different research team led by St. Andrews marine biologist Luke Rendell, the researchers studied a tradition—invented by humpback whales themselves—involving a fishing method called bubble-feeding: The whales blow bubbles around schools of fish, confusing the fish and herding them together, and then charge into the bubbles and gobble up their prey. In 1980, one whale was observed to have invented a new twist on this technique, striking the water surface several times with its tail before blowing the bubbles, a strategy now called lobtail feeding. Researchers don't know what advantage this gives the whales, but lobtail feeding arose at the time of a crash in the population of the whales' preferred prey, herring, and the rise of another fish, the sand lance. The team speculates that striking the water helps herd the sand lance together. Observers had the impression that lobtail feeding was spreading, but there was no solid evidence. So the team analyzed a 27-year database on whale behavior collected in the Stellwagen Bank National Marine Sanctuary, in the mouth of Massachusetts Bay between Cape Cod and Cape Ann. It entered 73,790 sighting records into the computer, involving 653 whales that had been spotted at least 20 times. Over the years, [lobtail feeding had spread to 37% of the population](http://www.sciencemag.org/lookup/doi/10.1126/science.1231976), and up to 87% of the whales that adopted the technique appeared to have done so by being in close association with another whale that was already clued in to the method. (Individuals were counted as "associated" if they came within two body lengths of each other and demonstrated coordination in their behavior.) Outside researchers say that the two studies serve as a milestone: "Their back-to-back publication marks the moment where we can finally move on to discuss the implications of culture in animals," rather than simply whether culture is present or absent, says Carel van Schaik, a primatologist at the University of Zurich in Switzerland. The vervet monkey findings are a "big surprise," he says, because the animals "gave up existing preferences when they [entered] a group with a different preference." Previously, researchers had assumed that such choices were dictated primarily by a drive to get at the most nutritious food, rather than by social factors. "In retrospect, that monkeys rely on the wisdom of the local crowd makes perfect sense." The whale study also gets a thumbs up. It's "an amazing compilation of … data," says Susan Perry, an anthropologist at the University of California, Los Angeles. "I find this to be a highly convincing case for a foraging tradition in a cetacean." Nevertheless, van Schaik, Perry, and other researchers say, there is still a lot of work to be done to figure out how much cultural transmission in animals resembles that in humans. "Both these papers show that animals pay attention to and are influenced by what other animals are doing," says Mark Pagel, an evolutionary biologist at the University of Reading in the United Kingdom. But neither study demonstrates the kind of sophisticated copying typical of humans and which demarcates humans from other animals, Pagel says. Without the ability to truly copy others, Pagel adds, animals cannot develop the increasingly sophisticated behaviors that have ratcheted human culture to such a high level.

### Language

#### New research into Japanese songbirds prove that they have syntax and grammar – the last believed difference of human language

Suzuki, Wheatcroft, and Gresser 16 <Toshitaka Suzuki, Department of Evolutionary Studies of Biosystems, SOKENDAI (The Graduate University for Advanced Studies, David Wheatcroft, Department of Ecology and Genetics, Uppsala University, and Michael Griesser, Anthropological Institute and Museum, University of Zurich, (2016) Experimental evidence for compositional syntax in bird calls, Nature Communications, DOI: 10.1038/ncomms10986>#SPS

Our results show that Japanese great tits discriminate between different calls containing different note types: they scan the horizon in response to ABC calls, whereas they approach the sound source in response to D calls. These results indicate that these two calls function as different meaningful units to receivers. ABC calls serve as warning calls that elicit predator-scanning behaviour, whereas D calls serve as recruitment calls that attract conspecifics to the callers. These findings are consistent with previous research showing that A, B and C note combinations are used in response to predators[25](https://www.nature.com/articles/ncomms10986#ref25), whereas D notes on its own are used to recruit conspecifics ([Fig. 2](https://www.nature.com/articles/ncomms10986?WT.ec_id=NCOMMS-20160309&spMailingID=50873777&spUserID=MTg0MDE2NTY4ODUwS0&spJobID=881111942&spReportId=ODgxMTExOTQyS0#f2)). In response to ABC–D calls, Japanese great tits both scan the surroundings and approach the sound source, indicating that they extract the meanings of both ABC and D calls from combined ABC–D calls. In addition, we find no correlation between scanning and approaching behaviours, which enables tits to perform and combine these behaviours flexibly according to the presence and absence of each note unit within calls. Moreover, tits reduce horizontal scanning and rarely approach the loudspeaker when the ordering of the two note units is artificially reversed (D–ABC). These results indicate that the tits perceive ABC–D calls as a single meaningful unit but not as two separated meaningful units (ABC and D calls) simply produced in close proximity. As ABC and D notes convey unique meanings and can be used alone[25](https://www.nature.com/articles/ncomms10986#ref25), the combination of these two notes does not meet the criteria of phonology[5](https://www.nature.com/articles/ncomms10986#ref5),[6](https://www.nature.com/articles/ncomms10986#ref6). In addition, unlike call combinations reported in several non-human primates[14](https://www.nature.com/articles/ncomms10986#ref14),[15](https://www.nature.com/articles/ncomms10986#ref15),[16](https://www.nature.com/articles/ncomms10986#ref16),[17](https://www.nature.com/articles/ncomms10986#ref17),[18](https://www.nature.com/articles/ncomms10986#ref18), the combination of ABC and D calls conveys a compound meaning that originates from both of the note units. Thus, we conclude that the combination of ABC and D calls in the Japanese great tit obeys semantically compositional syntax[6](https://www.nature.com/articles/ncomms10986#ref6). Previous studies have shown that parids (chickadees and titmice) alter the repetition rate of particular note types (for example, D notes), which elicits different degrees of response in receivers (i.e., graded call system)[22](https://www.nature.com/articles/ncomms10986#ref22),[23](https://www.nature.com/articles/ncomms10986#ref23),[24](https://www.nature.com/articles/ncomms10986#ref24). One explanation for why tits produce different responses to combined ABC–D calls is that D notes increase the salience of ABC calls (or vice versa), rather than alter their meaning through a syntactic rule. However, we find no evidence supporting this explanation. In Experiment 1, our data show that tits do not alter the intensity of their responses according to the variation in note repetition rate; they scan with similar intensity to both ABC (3 notes) and ABC–D calls (10–13 notes) and, likewise, approach in response to both D (7–10 notes) and ABC–D calls (10–13 notes). Therefore, neither ABC nor D calls simply modify the intensity of behavioural responses. In addition, using a matched-pairs or balanced design controls for the possibility that any acoustic features other than either note combinations (Experiment 1) or note ordering (Experiment 2) influenced the interpretation of the results (see Methods). Using a compositional syntax is likely to provide adaptive benefits to Japanese great tits. Similar to many small songbirds, tits face a variety of predatory threats requiring complex behavioural responses[30](https://www.nature.com/articles/ncomms10986#ref30),[31](https://www.nature.com/articles/ncomms10986#ref31),[32](https://www.nature.com/articles/ncomms10986#ref32). Previous studies have demonstrated that avian antipredator communication is adapted to such complexity: some birds produce different calls for different types of threats (for example, different predator types or behaviours) and receivers respond to the calls with appropriate behaviours[30](https://www.nature.com/articles/ncomms10986#ref30),[31](https://www.nature.com/articles/ncomms10986#ref31),[32](https://www.nature.com/articles/ncomms10986#ref32),[33](https://www.nature.com/articles/ncomms10986#ref33),[34](https://www.nature.com/articles/ncomms10986#ref34),[35](https://www.nature.com/articles/ncomms10986#ref35), leading to positive fitness consequences[30](https://www.nature.com/articles/ncomms10986#ref30),[32](https://www.nature.com/articles/ncomms10986#ref32),[36](https://www.nature.com/articles/ncomms10986#ref36). Our results show that the first units of great tits’ combinatorial calls (ABC calls) serve as general warning calls, whereas the last units (D calls) serve as recruitment calls. The specific combination of these calls may serve as an adaption to facing predators that require complex behaviours to be effectively detected and monitored. For example, scanning the surroundings is likely to allow a tit to efficiently detect a flying predator, such as a crow that can approach a nest from all directions[31](https://www.nature.com/articles/ncomms10986#ref31). In contrast, predators that only approach the nest from below, such as martens, are likely to be effectively detected and monitored both by approaching the caller and scanning the surroundings. Japanese great tits incorporate a greater number of D notes into other note units, such as ABC, when mobbing martens than when mobbing crows[25](https://www.nature.com/articles/ncomms10986#ref25). This suggests that tits have co-opted the signal normally used to recruit other individuals (for example, to coordinate parental feeding visits), to stimulate receivers to perform an appropriate combination of behaviours. In addition, we suggest that the specific note-ordering rule (ABC calls before D calls) used by Japanese great tits in anti-predator contexts may be an adaptation to the greater importance of effectively and quickly warning conspecifics about the presence of predators before transmitting any additional behavioural cues. As D notes are often produced in non-predator contexts, conspecifics hearing D notes before ABC notes may be slower to produce appropriate anti-predator behaviours, which may be of particular importance when tits are defending their nestlings[25](https://www.nature.com/articles/ncomms10986#ref25),[30](https://www.nature.com/articles/ncomms10986#ref30). Although we provide evidence for compositional syntax in the combination of ABC and D calls, it is not yet clear how the meaning of ABC calls is generated. One possibility is that A, B and C notes have different meanings and their combination has a compound meaning (i.e., compositional syntax). However, these notes may be meaningless as their own, but the combinations make the meaningful units that elicit scanning behaviour in receivers (i.e., phonology). Support for this idea comes from the observation that tits use A, B and C notes in many different combinations (for example, AB, AC and BC) when mobbing predators[25](https://www.nature.com/articles/ncomms10986#ref25). Therefore, it might be possible that all these combinations potentially encode the same threat information; however, the difference in note combinations or sequences of different call types may encode additional information, such as individual identity of callers. Note combinations are widely documented in other members of the Paridae, but their complexity may differ across species[37](https://www.nature.com/articles/ncomms10986#ref37). Further comparative studies may provide insight into the socio-ecological factors[38](https://www.nature.com/articles/ncomms10986#ref38) that drive the evolution of combinatorial signalling such as phonology and compositional syntax. In conclusion, we provide the first experimental evidence for compositional syntax in a non-human vocal system. Over the past decades, many key attributes of human language have been reported from animal species: vocal learning[9](https://www.nature.com/articles/ncomms10986#ref9),[39](https://www.nature.com/articles/ncomms10986#ref39), referential communication[7](https://www.nature.com/articles/ncomms10986#ref7),[8](https://www.nature.com/articles/ncomms10986#ref8)and phonology[12](https://www.nature.com/articles/ncomms10986#ref12),[13](https://www.nature.com/articles/ncomms10986#ref13). Our results extend these studies and challenge the long-standing view that compositional syntax is unique to human language[5](https://www.nature.com/articles/ncomms10986#ref5),[6](https://www.nature.com/articles/ncomms10986#ref6). Although previous studies on syntactic communication mainly focused on primates[12](https://www.nature.com/articles/ncomms10986#ref12),[14](https://www.nature.com/articles/ncomms10986#ref14),[15](https://www.nature.com/articles/ncomms10986#ref15),[16](https://www.nature.com/articles/ncomms10986#ref16),[17](https://www.nature.com/articles/ncomms10986#ref17),[18](https://www.nature.com/articles/ncomms10986#ref18), our findings highlight that the ability to recognize the combinations of different meaningful units as compositional calls has evolved in birds. Signal combinations can increase the number of meanings that individuals can convey from a limited number of vocal elements and provide the basis for the generation of novel signals. Uncovering the cognitive mechanisms and socio-ecological functions of syntactic communication in animal models may provide insights into the evolution of structural complexity of human language.

#### Definition of language is difficult – there is no reason to assume that just because we have more sounds we have more language

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Sceptics consider it simpler to assume that humans are unique, and that the burden of proof should be borne by anyone who thinks otherwise. Any claim of language-like elements for animals is considered a more complicated hypothesis, to be dismissed as unnecessary in the absence of positive proof. Yet the alternative hypotheses by which the sceptics instead attempt to explain animal behaviour sometimes strike me as more complicated than the simple, and often plausible, explanation that humans are not unique. (Jared Diamond 1991:130) Humans still have the old innate call system, existing alongside language. Sounds like laughter and screams are controlled by the older neural (subcortical) structures in the brain, which are also responsible for the call systems of other species. Some non-human species appear to have a system of sounds which involve learning and experience, existing alongside the innate call system. Birdsong appears to have much in common with human language. Birds have an innate system of calls, but their songs mostly involve learning and develop by later experience (Aitchison 1996:7-9). Like babies experimentally babbling, young birds have a period of sub-song before their songs are fully developed, and they also appear to have a sensitive period in which they learn their songs. Some birds, e.g. the bullfinch, can pick up the song of another species, just like children can learn any language they are exposed to (Fromkin and Rodman 1998:344-345). Also, the song of a single species of bird may have different dialects. Normally, the left hemisphere of the brain controls both birdsong and human language. The sound units of birdsong are strung together and fitted into intonational patterns and rhythm. All languages have some type of speech melodies. Pitch plays an important role in both human tone and intonation languages, but in different ways. Tone languages, like Chinese, have contrasting pitches or tones, i.e. the same sound will have different meanings depending on its pitch (Fromkin and Rodman 1998:241). The African grey parrot ALEX, studied by Irene Pepperberg, imitates human utterances and seems to relate these sounds with meanings, but his ability to imitate sounds similar to those produced by humans is quite different from the acquisition of syntax (Fromkin and Rodman 1998:23-24). Birds have syrinxes (Michelsen 1977:35-39), which indicates that some articulated speech is possible without a larynx. Studies of communication among whales are limited in scope, but their sounds seem to be motivated by a need to communicate. As they vocalize under water, it is difficult to investigate their communication systems, and many of their sounds are at frequencies that humans cannot perceive. Researchers have tried to teach dolphins forms of language, e.g. 5 acoustic computer-generated whistles in the water, but so far investigation has not revealed whether they use their calls for any kind of human-like conversation (Lane and Molyneaux 1992:128-130). The use of hydrophones has revealed that the creaking sounds consist of a series of clicks, showing certain patterns which are unique to the individuals producing them (Bonner 1980:121- 122). Bottle-nosed dolphins have an impressive auditory memory system, capacities for rule-governed behaviour, and for imitative learning. Investigations of their whistles have revealed different patterns, which have been identified by the pitch contour, e.g. downward glide = distress, upward glide = search, risefall-rise-fall = excitement or irritation (Bonner 1980:128-129). Also, dolphins use vocalizations for echo-location (navigation, food location, object identification, etc.). Observations of humpbacks have revealed that they may have complex communication systems utilizing all their senses to varying degrees (Bonner 1980:124). Each song is made up of a constant number of themes repeated in the same order. The themes are composed of phrases and the main difference between successive songs of a particular whale is the number of phrases in each theme. No theme is ever left out completely, but sometimes a whale repeats a phrase many times before going on to the next theme. Phrases may change gradually through the course of a theme, so that a phrase at the end of a theme may be quite different from what it was at the beginning. Most likely, these intelligent marine mammals could be a threat to human uniqueness.

#### There are many examples of animals speaking their own languages and chimps teaching language to one another

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Apes are our closest relatives in nature, and it is not surprising that they attract a special attention. Many researchers have tried to teach apes to communicate with humans and even with one another. The earliest experiments with chimpanzees showed that they were not physically capable of producing articulated speech (Wardhaugh 1993:43-45) although they did understand many spoken words. Other methods were adopted in order to avoid the problems in trying to teach apes to speak, and some of these attempts were remarkably successful. Some researchers (R.A. and B.T. Gardner and H.S. Terrace) taught the apes American Sign Language (ASL) as apes do not find it difficult to control their hands. Others have used keyboards of symbols (D. and S. Rumbaugh) and plastic tokens (D. Premack) varying in shape, size, texture, and colour representing words (Fromkin and Rodman 1998:350-355). Many researchers have some general idea of the kind of results they want, and in the ape experiments there are some obvious contrasts in the ways the researchers treat their subjects. Some seem biased in favour of apes acquiring language, others go into the studies to prove that non-human primates cannot possibly learn language, each side of the debate is determined to prove the other side wrong, but both sides agree that these animals are communicating. Because of their opposite expectations they disagree as to the extent of this communication. The chimpanzee WASHOE (R.A. and B.T. Gardner) was taught a version of ASL called Ameslan (Fouts and Mills 1997:87-110). She used combinations of signs similar to the telegraphic speech that very young children use, and a gradual increase in the length of her sign combinations was observed. She spontaneously combined signs creating new words, she used wh-questions and prepositions, she associated between arbitrary elements (manual signs) and concepts, she understood the distinction between proper and common nouns, 6 she organized words in a classification system, and she was able to express her thoughts and needs and to talk about the past, things not present, and places she could not see. Also she developed a preference of word-order, in 90 percent of the utterances the word-order was: SVO. Washoe thought of herself as human. When categorizing pictures of humans and animals, she placed herself with humans and other chimpanzees with animals. She actually taught other chimpanzees ASL-signs, and her infant LOULIS managed to learn over 50 signs without being taught by humans, simply picking up the signs from his mother and the other ASL-signing chimpanzees when they signed to each other and to themselves. Washoe's signs were more immature than those made by the adult human deaf, but this may be due to the fact that she was not human, and that her trainers were not experts in ASL themselves (Wardhaugh 1993:45-49). However, some deaf children have been much impressed as they have been able to talk with her. Washoe was born wild in Africa and had already been exposed to her native tongue. She was approximately one year old when the language experiment started, which means that she was learning a second language. Other apes have been older when similar experiments started, some of them may even have passed the critical age, a fact that must have influenced the results. R.A. and B.T. Gardner and Roger Fouts have been very careful not to over interpret the results of their signing chimpanzees, and they have developed procedures in order to test the knowledge and the reliability of the vocabulary of the apes as well as preventing any possible non-verbal cueing. Also, they have taken great pains making the apes feel comfortable, keeping them in a very free and stimulating environment. Comparison of the language of two-year-old children and chimpanzees: Object-attribute: Childs utterances: Big train. Red book. Washoe's utterances: Dink red. Comb black Agent-object: Childs utterances: Adam checker. Mommy lunch. Washoe's utterances: Clothes Mrs. G. You hat. Action-location: Childs utterances: Walk street. Go store. Washoe's utterances: Go in. Look out. Agentaction: Childs utterances: Adam put. Eve read. Washoe's utterances: Roger tickle. You drink Action-object: Childs utterances: Put book. Hit ball. Washoe's utterances: Tickle Washoe. Open blanket. (Linden 1974:30-48, from R.A. and B.T. Gardner Two-way communication with an infant chimpanzee in Behaviour of Nonhuman Primates, eds. A. Schrier et al., New York: Academic Press, 1971.) There are many parallels between Washoe's utterances and those of two-yearold children, despite the fact that Washoe used ASL and the children spoken language. A comparison between the utterances of ASL-signing chimpanzees and ASL-signing children has not yet been undertaken. Bickerton (1990:110-112) points out that we regard the utterances of the child as a foretaste of adult language, because we know that the child within a few years will construct a grammar based on the language it is exposed to, and as we know that the ape will progress only to a limited extent, we conclude that it has no language. Somehow children have the ability to reconstruct the kind of language they are exposed to. Language develops over a period of years as the child interacts with speaking or signing adults, and children reared in isolation do not acquire language (Fromkin and Rodman 1998:343). All social mammals learn by imitating their elders, and children also observe, imitate, and play. Bickerton argues that children under two are not acquiring language but protolanguage and that the preference of word order is just as much a characteristic of apes as it is of children under two. These rules of word order are probably semantic structures preceding the syntactical constructions. Suppose that the neural infrastructure underlying formal syntax crucially involves aspects of the brain that do not develop until after birth and are not completed until the child is approximately two years of age. It would then follow that, at the time a child gains enough vocal control to imitate the utterances of elders (a time that may vary from age twelve months to eighteen months in normal children) that child is still incapable of syntactic language. Bickerton (1990:112) The most obvious differences between the language of apes and humans are the size of their vocabularies and the absence of grammatical items. Mostly the vocabulary of apes has been limited to lexical items. However, Bickerton (1990:106-110) points out that this may be due to the fact that the apes have not been taught grammatical items. The researchers are not linguists, and as they have been making the experiments for rather different reasons (e.g. the development of training procedures for children who do not develop language normally and people who have language difficulties caused by brain damage), quite naturally their interests have been focused on other aspects of language, e.g. semantics. Washoe's trainers draw the conclusion that the chimpanzees capacity for language is similar to that of a human child but may not be exactly the same (Wardhaugh 1993:48-49). The chimpanzees are born with language capacities that are perfectly suited for gestural communication among groups of individuals in the jungle. Human language share some of these origins, but it has become specialized for a very different way of life in much larger communities. When comparing the ape-reports with the Hockett design features of language, **elements of all of the seven key-properties seem to occur.** Washoe and the other ASL-signing chimpanzees talked to one another (interchangeability), and the infant Loulis learned 50 signs from the other chimpanzees as no sign language was used by humans in his presence (cultural transmission). The apes spontaneously created new utterances and used metaphors and combinations of signs, e.g. water-bird was Washoe's way of referring to a duck (productivity). There was no similarity between the manual signs or plastic tokens and the real objects or concepts (arbitrariness). The apes were able to talk about the past, things not immediately present, and places they could not see (displacement). Some apes used warnings like angry and bite without attacking (specialization), and they definately related sign and meaning (duality of pattern). Also the use of language to mislead others purposely (prevarication), was found. Falsity of meaning requires a creative and dishonest system as an instinctively induced limited set of calls is honest. Apes are very good at social manipulation. They can interpret the behaviour and intentions of their fellows, and they can deliberately control some facial expressions and body language in order to mislead others. The ability to lie, to hide your feelings and intentions, is a very important human-like behaviour and very much like direct communication. Unless we teach apes some language that humans also know, the only other possibility is them teaching us their language. No doubt studies of apes in the wild would be very profitable. Among themselves primates use a wide variety of communication (e.g. olfactory, auditory, tactile, visual, and vocal). The meaning of primate communication depends on the social and environmental context as well as the emotional state of the animals, and their calls appear to be like complete human utterances, e.g. you may mate with me (Bickerton 1990:10-12). The monkeys called vervets have the most sophisticated animal communication that we know of (Diamond 1991:126-128). Frequently, like other wild animals, vervets are in dangerous situations in which an efficient communication system increases their possibility of survival. Also, they have complex social relationships, territorial rivalry and fights, and they have to be able to inform each other about sources of food. The application of new techniques, e.g. modern tape-recordings and the spectographic analysis, has made it possible to detect variations which humans cannot perceive. For instance the vervets produce several distinct alarm calls naming the different kinds of predators, they react differently to dominant and subordinate members of their own troop, to their families, and to members of rival troops. Like humans, vervets have to learn part of their language. The young vervets appear to generalize and cannot produce the distinct calls until they reach a certain age. Also, they have to learn how to react to the various calls. The observations of behaviour by T. Struhsaker and the sound experiments by R. Seyfarth and D. Cheeney (Diamond 1991:128-132) have shown a connection between behaviour and call as a deliberate communication which cannot be explained as stimulus-determined expressions as they are messages given honestly to friends or dishonestly to enemies. Also, this shows how easy it is to underestimate the communicative abilities of other species. So far, no evidence of syntax has been discovered, but this is no proof that it does not exist. Most of the calls seem to be single utterances or repetitions of the same call. Gibbons, too, have calls that differ from each other, similar to those of the vervets. Sometimes they consist of more elements in certain combinations, but the meaning of these have not yet been decoded by humans. Certainly, many other species may have calls, the meaning of which we have not yet recognized. Formerly, it was assumed that the only world was the one bounded by the limits of our senses, but there are sensory worlds outside our own beyond our ability to perceive. The application of new techniques such as the use of spectrograms in order to study animals in the wild may one day reveal other complex systems for receiving, analysing, and exchanging signals, perhaps even using a kind of syntax. Contrasting tones and pitch contour may be important features. A single vowel can have eight different meanings in the Iyau language of New Guinea (Diamond 1991:133-134), and a small variation of pitch can change the meaning of the word mother-in-law into that of snake. A warning call could be modified when given different intonations with distinct meanings, e.g. Watch out! A snake!, Is there a snake?, This is not a snake., etc. (Bickerton 1990:11-13). Travel books from the nineteenth century are full of tales of primitive native tribes who used very few words (Diamond 1991:137), and the European travellers found it just as difficult to understand the unfamiliar sounds of these languages as zoologists find it when trying to decode the sounds of birds, whales, or primates. INTERMEDIATE STAGES If language evolved gradually, the theory of natural selection would require some intermediate language systems varying in efficiency. The languages of our human ancestors of millions of years ago would not resemble the languages we speak today. In a less demanding environment they would have had no need for a complex grammar, and the ability to combine a limited number of sounds in different ways would be sufficient. Pinker (1995:352) suggests that calls similar to those of the vervet monkeys may have come under the voluntary control and put together in a rule-governed way for more complicated information exchange. Presumably, the vocabulary was not very large, and grunts and gurgles may have been used rather than modern speech sounds, e.g. chimpanzee pant-hoots, the expressions of solidarity between male primates, very much like the utterances of human male sporting teams (Aitchison 1996:66-67). From the early stage of grimaces, gestures, and sounds, gradually a sophisticated language may have evolved as it turned out to be a supremely efficient means of communication. Bickerton (1990:122-126) argues that there is a primitive variety of language, a protolanguage, existing alongside fully developed language (e.g. the language of signing apes, children under two, language acquired by wild children after the critical period, and pidgin). He assumes that this primitive variety evolved first and that humans are prewired at birth with a kind of creole that can develop by later experience. Pidgin and creole are based on existing languages, but they are similar all over the world, showing how a simple system may develop (Aitchison 1996:11). Pidgin languages are based on nouns, verbs, and adjectives, they are simplified in sounds, vocabulary, and syntax, and characterized by short rule-governed constructions of words. Pidgin utterances are like big true, me no lie meaning it is absolutely true, I am not lying (Bickerton 1990:118-122). When pidgin takes over as a native tongue it develops into creole.

#### Bias against animals leads us to consider whatever they do “not language” without any true justification for it

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CONCLUSION Human and non-human communication have been investigated from a great variety of perspectives within science, and very few disciplines seem to agree on a definition of language. It is of crucial importance that we know exactly what language is if research in non-human communication is to be accepted as evidence of linguistic ability. Some linguists would rather redefine language in order to defend human uniqueness than accept a linguistic continuity on a biological basis. **This rigid view reflects a long bias and is not getting us anywhere.** Many linguists agree with Chomsky's theory, but the primary function of language is that of communication, and the biological and social context cannot be ignored. In the search for a plausible scientific explanation, we should look closely at the non-human systems of social communication in order to find out whether they share the rules and principles of human languages, by observing how they are used, how their components are put together, and how they interrelate with other things. If we accept a linguistic continuity, language cannot be without some kind of intermediate stages, and it seems obvious that animal communication has been the **precursors of human speech.** The fact that chimpanzees are able to learn a human sign language indicates that our common ancestor must have had a capacity for this kind of communication and that nature has built up signed and spoken language on these ancient foundations. The question whether nonhuman species in a state of nature have developed a kind of communication similar to that of humans remain open. The communication of the wild animals who would be most likely to use grammar have not yet been investigated. When deriving our information from laboratory experiments and observations of animals in captivity, we cannot equate our results with what can be observed of animals living free in the wild. The reports on apes in captivity show that trained apes to some extent are capable of acquiring human language, but human children would probably find it just as difficult to acquire any system of primate-communication if they were removed from their natural environment and exposed to any such experiments controlled by members of other species. The maturation of certain language centres in the brain could explain why syntax seems to be absent in the utterances of two-year-old children and trained apes. Apparently, the brains of chimpanzees do not lack the structures necessary for language development, but they may lack the structures resposible for syntax. It seems that their brains reach a fully developed stage when they are similar to those of very young children. Naturally, chimpanzees are not capable of mastering a language that has taken us centuries to develop. However, no experiments have involved adult chimpanzees as they grow too big to handle, e.g. Washoe received no further training after the age of four and may not have reached the limit of her abilities. Within an evolutionary perspective, it seems a plausible scientific explanation that the language of trained apes represents an early stage of language development, a protolanguage similar to that of very young children and speakers of pidgins. **Conclusively, we may regard human language as a further development of communication systems also found among other species rather than being uniquely human.**

### Mental Time Travel

#### Studies prove that animals have foresight comparable to our own

Zentall 05 <Thomas R., Department of Psychology, University of Kentucky, Lexington, KY 40506-0044, USA, “Animals may not be stuck in time,” Learning and Motivation 36 (2005) 208–225>#SPS

The other half of the subjective time travel continuum is the ability to imagine an event in the future or to plan for a future event. Although many animals prepare for the future by storing food or building nests, there is no evidence that these animals understand the relation between their behavior and their future need. In fact, the Bischof-Kohler hypothesis suggests that animals other than humans are not capable of anticipating their future needs (Bischof, 1978). This hypothesis is consistent with the idea that animals may be unable to dissociate their present mental state from their past or future mental state (Suddendorf & Corballis, 1997). Support for the Bischof-Kohler hypothesis comes from research with primates which shows that monkeys and apes have a form of temporal myopia (Roberts, 2002). For example, cebus monkeys that were fed once a day would eat to satiation and then would often throw the remaining food out of their cage (cited by Roberts, 2002). Given that the monkeys were quite hungry by the time they were next fed, why didn’t they learn to save their remaining food. In a more experimental manipulation, macaque monkeys and a chimpanzee showed that they do prefer alternatives that satisfy their current motivational state over those that do not (e.g., they prefer two bananas over one banana), however, they show indifference when both alternatives satisfy their current motivational state (e.g., they do not prefer 10 bananas over 5 bananas, Silberberg, Widholm, Bresler, Frujita, & Anderson, 1998). The problem with research of this kind is it assumes that saving food for later is generally an appropriate strategy. For example, in natural environments, animals that live in social groups may not be able to maintain supplies of food greater than they could immediately consume. Similarly, given that primates typically live in mobile troops, it is unlikely that they would be able carry with them food that they were not able to consume at one sitting. Similar evidence for the absence of future planning comes from the relative deficiency of self-control behavior in rats and pigeons (Mazur & Logue, 1978; Tobin, Chelonics, & Logue, 1993). Animals often choose small immediate rewards over larger delayed rewards, whereas humans are better able to maximize rewards (King & Logue, 1987). However, humans may have acquired those strategies through **social learning** (a form of rule learning rather than planning). Furthermore, the poor self control often found in animal experiments may result from the conflict between predisposed impulsive behavior and planning for the future. That is, in nature, delayed rewards typically mean uncertain rewards (environments generally do not remain stable over time) and thus, self control may be selected against. Furthermore, humans do not always behavior ‘rationally.’ The argument based on maximizing rewards may have difficulty explaining why humans are willing to incur the sometimes high cost of finance charges for the immediacy of possessions such as houses, cars, or appliances. It may be that the evidence against planning in animals comes largely from the underestimation of the costs associated with delayed rewards. Thus, if one wants to argue that choice of a smaller immediate reward represents the failure to plan ahead, then humans, who clearly are able to plan ahead, often appear to be unable or unwilling to do so. An alternative strategy in assessing the capacity of animals for planning is to use more arbitrary tasks that do not trigger impulsive behaviors that appear to show that animals are stuck in time. For some time, a distinction has been made in the animal learning literature between memory for past events (retrospective memory) and memory for future events (prospective memory). A clear distinction between the two can be made by considering a conditional discrimination in which an initial shape stimulus (e.g., a circle or a triangle) indicates which of two hue comparison stimuli (e.g., red or green) will be reinforced. Thus, for example, if the initial stimulus is a circle, the red comparison is correct but if the initial stimulus is a triangle, the green comparison is correct. If one now inserts a delay between the offset of the initial stimulus and the onset of the comparisons, working memory is needed to bridge the delay. The question is, what is it that is held in working memory during the delay? The most obvious candidate is a representation of the initial stimulus. For example, a human asked to perform such a task might label the initial stimulus and rehearse the label during the delay. If this were the case, the memory would be considered retrospective because the memory would consist of a representation of the past event. However, an alternative strategy would be to translate the initial stimulus into a response intention and rehearse the response intention during the delay. Thus, after seeing an initial circle stimulus, one might decide to choose the red comparison at the end of the delay. In this case, it would be the correct comparison that is labeled and its name rehearsed during the delay. The distinction between retrospective and prospective representations has important theoretical implications. In the case of retrospective representations, the event that is represented was actually presented, and thus, it may be that during the delay the aftereffects of the event are maintained in memory (in the form of neural activity). In the case of prospective representations, however, the event that is represented during the delay has not yet occurred, and, thus, the representation must be created as an anticipation. This means that evidence that an animal is capable of forming a prospective memory code would suggest that it is not stuck in time. Some years ago, Peter Urcuioli and I asked whether pigeons would prospectively code comparison choices when performing a delayed conditional discrimination (Urcuioli & Zentall, 1986). Our study was based on the finding that identity matching with hues was acquired and remembered better than identity matching with line-orientations (Farthing, Wagner, Gilmour, & Waxman, 1977). We were interested in what was remembered during the delay. Was it the initial hue or the initial line-orientation stimulus, or was it the intention to respond to the hue or the line-orientation comparison? To answer this question, we trained four groups of pigeons. One group matched initial hue stimuli to hue comparisons. The second group matched initial hue stimuli to line-orientation comparisons. The third group matched initial line-orientation stimuli to hue comparisons. And the fourth group matched initial line-orientation stimuli to line-orientation comparisons. We reasoned that if pigeons were remembering the initial stimulus during the delay, the dimension of the initial stimuli would affect the slope of the retention functions but not the dimension of the comparison stimuli. However, if the pigeons were remembering the comparison that they were preparing to choose, the dimension of the comparison stimuli would affect the slope of the retention functions but not the dimension of the initial stimuli. The results of this study indicated that when the initial stimuli were hues, the retention functions were flatter than when they were line-orientations. But the dimension of the comparison stimuli had little effect on the slopes of the retention functions. Thus, in this case, it appears that the pigeons were using retrospective memory codes (see also, Urcuioli, Zentall, Jackson-Smith, & Steirn, 1989). The conditions under which animals will prospectively code in conditional discriminations is not well understood. It appears that in a typical discrimination with two initial stimuli and two comparison alternatives there is little evidence for prospective coding. However, one can encourage prospective coding by making it a more efficient strategy. For example, if one increases the number of initial stimuli to four (two hues and two line-orientations) but keeps the number of comparison stimuli at two, one can find evidence for prospective coding (Zentall, Urcuioli, Jagielo, & Jackson-Smith, 1989); but, under these conditions, it appears that the pigeons will use prospective codes only when the initial stimuli are relatively difficult to discriminate line-orientations and not when they are relatively easy to discriminate hues. Perhaps the best evidence for the use of prospective codes by pigeons performing conditional discriminations comes from research that has used differential outcomes for correct choices on trials involving each of the different initial stimuli. In a typical conditional discrimination, correct responses to each of the comparisons are reinforced with a common outcome (e.g., mixed grain). But when correct responses to each of the comparisons are reinforced with a unique outcome, important effects on matching performance have been found. For example, Brodigan and Peterson (1976) found that if pigeons were trained on a conditional discrimination with hues as initial stimuli and line-orientations as comparisons, reinforcing correct responses to one comparison with food and responses to the other comparison with water led to better delayed conditional discrimination performance than was found for a control group for which the outcomes were uncorrelated with the correct comparison chosen. The implication of this finding is that, on a given trial, the anticipation of the outcome associated with choice of the correct comparison is elicited by the initial stimulus and that anticipation augments or perhaps even replaces the memory for the initial stimulus. The anticipation then serves, at least in part, as the basis for comparison choice (see also Urcuioli & DeMarse, 1996). The importance of this finding is that a stimulus (outcome) that has not yet occurred on that trial can serve as a discriminative stimulus for comparison choice. Thus, the differential outcomes effect provides evidence for the ability to form and use prospective memory codes. More direct evidence for prospective memory codes comes from the use of transfer designs. For example, Edwards, Jagielo, Zentall, and Hogan (1982) trained pigeons on two matching tasks using differential outcomes. One task involved hueidentity matching, and the other used line-orientation-identity matching. In each task, the outcome following a correct response to one comparison was one kind of food (e.g., corn) and the outcome following a correct response to the other comparison was a different kind of food (e.g., peas). On transfer trials, the pigeons were given initial stimuli from one task (e.g., hues) and comparisons from the other (i.e., line-orientations), and the presumed outcome expectancy elicited by presenting one initial stimulus either signaled the correct response (for the consistent group) or signaled the incorrect response (for the inconsistent group) (see design of this experiment in Table 2). When the outcome elicited by the initial stimulus correctly signaled which comparison to choose, the pigeons performed significantly better than when the outcome elicited by the initial stimulus incorrectly signaled which comparison to choose. More recently, we have investigated whether it is the outcome expectancies themselves that are used by the pigeons to choose the correct comparison, or whether the outcome expectancies cause the pigeon to treat the initial stimuli differently, and the differential sample behavior mediates choice of the comparisons. For example, if a pigeon pecked at one sample stimulus but not at the other, feedback from these different behaviors could serve as cues for comparison choice. We used a differential outcomes procedure but trained the pigeons to treat the initial stimuli similarly, and we still found a significant differential outcomes effect (Sherburne & Zentall, 1995; Zentall & Sherburne, 1994). Thus, the facilitation of performance produced by differential outcomes does not appear to depend on differential behavior in the presence of the initial stimuli. It might be argued that the two outcomes used in differential outcomes research typically differ in ways that may represent differential hedonic value (e.g., food and water, food and no food, peas and corn). Although this possibility does not imply the absence of prospective cues at the time of comparison choice, it does leave open the possibility that those cues may be motivational in nature. Thus, it is possible that initial stimulus presentation generates an anticipation of the outcome in the form of a differential incentive (e.g., “good” vs. “better”) rather than a more specific event (e.g., food or water). However, there is research that indicates that outcomes without differential hedonic value, such as different colored lights (Kelly & Grant, 2001) and differential feeder location (Williams, Butler, & Overmier, 1990) can facilitate both acquisition and delay performance. The implication of facilitation with differential outcomes that do not have differential hedonic value is that the central representation of the outcome is arbitrary and symbolic rather than differentially emotional. Thus, in a typical conditional discrimination, it appears that although pigeons tend to code the initial stimuli retrospectively, they can be encouraged to use prospective codes either by increasing the number of initial stimuli that would have to be coded (especially when the initial stimuli are hard to remember) or by using differential outcomes. Therefore, there appears to be evidence that pigeons have some flexibility in their use of retrospective and prospective codes. Another approach to the study of the development of prospective codes was first reported by Cook, Brown, and Riley (1985) using a radial maze. A radial maze involves a central platform with arms radiating in all directions, each one containing a small amount of food. It is typically elevated and has no side walls or top. The rat starts on the central platform and visits each arm in succession (see, Olton & Samuelson, 1976). A visit to an empty arm prior to visiting all of the baited arms (i.e., a revisit) is counted as an error. Rats are typically very good at this task. After some experience on a 12-arm maze, they can often collect all of the food without making an error. Although the rats could adopt a rule such as, always make a sharp left turn when exiting an arm, they do not appear to do so. In fact, they do not appear to make any systematic pattern of choices on a trial and do not appear to use olfactory cues. Instead, they appear to remember either all of the locations that they have already visited (retrospectively) or all of the locations that remain to be visited (prospectively). Cook et al. (1985) reasoned that they could induce a rat to make errors by introducing a delay during which they removed it from the maze for several minutes at some point in the trial. Where in the trial the delay was placed (or was interpolated) varied from trial to trial. The purpose of this manipulation was to determine the effect of the point of delay interpolation on the probability of making an error (corrected for opportunity). That is, Cook et al. asked if the probability of making an error (corrected for opportunity) would change with an interpolated delay as the rat progressed through the trial. Assuming that the probability of making an error would increase as the memory load (or number of arms to be remembered) increased, the logic of this manipulation was as follows: If the rats remembered their choices already made (retrospectively), the probability of making an error should increase as the point of delay interpolation increased. However, if the rats remembered their choices yet to be made (prospectively), the probability of making an error should decrease as the point of delay interpolation increased. Cook et al. (1985) found that as the point of delay interpolation increased, the probability of an error first increased, until the point of delay interpolation occurred at the midpoint of the trial (i.e., following six choices), and then it decreased (see Fig. 1). There are two important implications of these results. First, it appears that the rats could remember either choices already made (retrospectively) or choices yet to be made (prospectively). The finding that memory load may consist of places yet to be chosen suggests that rats appear to be able to plan their post-delay choice behavior. But more important, the rats appear to be able to learn which strategy is most efficient at each point of delay interpolation. That is, by retrospectively coding choices made up to the midpoint in the trial and then prospectively encoding choices yet to be made, the rats minimized the number of choices that they would have to remember (as compared to either strategy by itself). This implies that, at the time of the delay interpolation, the rats were able to remember both the choices already made and the choices yet to be made. The implication of the inverted V-shaped error functions that were found is that the rats are able to choose to remember either class of responses based on the relative current memory load of each. This finding suggests that the rats exhibited the capacity for some form of meta-memory (or memory strategy), a capacity that has been proposed to be an important component of episodic memory (Suddendorf & Corballis, 1997). Rats are known for their spatial foraging ability and they have a natural tendency to visit locations not recently visited (Timberlake & White, 1990). That is, rats have a natural win-shift foraging strategy that is well suited for learning not to make revisits to arms in the radial maze. Pigeons, however, have a natural win-stay foraging strategy that is not well suited for this task. They tend to return to places where they have once found food. For this reason, pigeons have a more diYcult time acquiring even a simplified operant version of this task (Zentall, Steirn, & Jackson-Smith, 1990). In this study, on each trial, five response keys were lit and choice of any response key was reinforced the first time it was chosen—until each response key was chosen at least once. Pigeons typically begin performing this task by making errors at a rate greater than chance (chance is defined as random choice, that is, no memory for past choices), but they do eventually acquire the task to a reasonable level. In spite of the unnatural nature of this task for pigeons, when they were tested with interpolated delays, and the point of delay interpolation was varied, the pigeons showed an inverted U-shaped error function that was quite similar to that found for rats (see Fig. 2). The data from these outcome expectancy and radial maze experiments provide the best evidence for the use of response intentions by animals (see also Hampton, 2001). The ability to use the anticipation of future events as the basis for one’s behavior suggests the ability to develop meta-representations of those events and thus show the ability to plan for future behavior. Evidence for prospective coding of alternatives not yet chosen suggests that animals are able to represent **future events.** Such an internal list of future events is analogous to the mental shopping list that humans might prepare when planning a trip to the store. Conclusions Animals show some evidence of being able to retrieve information about past personal experiences (episodic memory). Research with differential outcomes and with the radial maze suggests that under the appropriate conditions, animals also show evidence of being able to plan ahead. Thus**, animals may not be completely stuck in time.** Ultimately, however, the best evidence for subjective time travel comes from the human ability to elaborate on behavior by answering questions such as, “Why did you do that?” and “What are you planning to do?” questions that may not be possible to ask of animals

#### Any difference between human and animal time travel ahs been disproven and is a difference of degree, not kind

Corballis 13 <Michael C., School of Psychology, University of Auckland, “Mental time travel: a case for evolutionary continuity,” Trends in Cognative Sciences, Volume 17, Issue 1, p5–6, January 2013>#SPS

In humans, hippocampal activity responds to the imagining of past or future events. In rats, hippocampal activity is tied to particular locations in a maze, occurs after the animal has been in the maze, and sometimes corresponds to locations the animal did not actually visit. This suggests that mental time travel has neurophysiological underpinnings that go far back in evolution, and may not be, as some (**including myself**) have claimed, unique to humans. A distinction is commonly drawn between episodic memory, which is memory for specific personal events, and semantic memory, which is general knowledge about the world. Endel Tulving, who was the first to draw this distinction, has long argued that only humans are capable of episodic memory. He also recognized that episodic memory is adaptive in the planning of future episodes and provided a subjective sense of time [1]. This has led to the extended notion of ‘mental time travel’, implying that we can mentally travel backward or forward in time, imagining possible future events, as well as re-experiencing past ones. **I am among those who have claimed that this, too, is a uniquely human capacity [****2****], but I now question whether this is so.** A number of behavioral studies have purported to show that some nonhuman animals can act on the basis of specific information from past events or with respect to possible events in the future, suggesting that they are capable of mental time travel. For example, scrub jays can choose to retrieve food items on the basis of both where and when they were cached, suggestive of episodic memory, and, if watched by another bird while caching food, they later privately cache it elsewhere, suggesting anticipation of future theft [3]. Chimpanzees also appear capable of selecting tools appropriate to future activity [4]. These and other behavioral studies proclaiming mental time travel in nonhuman species have been criticized, by myself and others, for failing to meet the criteria for episodic memory or episodic foresight, or for not ruling out simpler explanations [5, 6]. However, perhaps the main ingredient missing from these studies is the subjective one – or what Tulving called ‘autonoesis’. It is this issue that has prompted some to use the term ‘episodic-like’ rather than episodic when referring to examples from nonhuman species. Indeed, one might ask whether we can ever know what, or even whether, an animal is actually thinking. A partial answer, however, may lie in recordings of brain activity. Researchers have identified a widespread network in the brain, known as the ‘default mode network’, which is involved in autonomous mental activity, including mental time travel [7]. This network has been identified in humans, as well as in rats [8]. A critical region in the network is the hippocampus, which is active in humans both when they recall past episodes and imagine future ones [9], raising the possibility that hippocampal activity might indicate subjective experience not only in humans, but also in nonhuman species. Some support for this comes from recent studies of hippocampal activity in the rat. Individual cells in the rat hippocampus discharge when the animal is in particular locations in an environment, such as a maze, suggesting that the hippocampus is involved in the construction and activation of cognitive maps of the environment [10]. This activity occurs while the animal is exploring a maze, but is also observed in sharp-wave ripples (SWRs), sometime after the animal has actually been in the maze, either during slow-wave sleep [11] or when the animal is awake but immobile [12]. Further, the paths indicated by the replay activity need not correspond to the actual paths taken in the maze. Sometimes, the replayed path is the reverse of the one actually taken [13] or it corresponds to paths the animal did not actually take [14], which might suggest anticipation of future excursions in the maze ([Figure 1](http://www.cell.com/cms/attachment/2007953004/2030527268/gr1.jpg)). This activity has been interpreted to reflect consolidation of a cognitive map that includes regions beyond those the animal actually explored. The cognitive map is, therefore, extended beyond actual experience, allowing more flexible navigation in the future. Given the role of hippocampal activity in human mental time travel, however, it may not be unreasonable to suppose that SWR activity in the rat brain is more than a process of consolidation, but that it also represents ongoing mental processes. It has been suggested that such processes might involve the possible linking of past, present, and future in the guidance of behavior [15]; they might also be considered tantamount to mental time travel. Regardless of whether or not a rat can be said to be mentally reliving a past experience or imagining a future one during SWRs, it seems highly likely from an evolutionary perspective that this activity is homologous to that involved in mental time travel in humans. How might mental time travel in humans differ from that in the rat? The most obvious answer lies in complexity. Humans imagine much more than locations – our imagined episodes are populated with people, things, places, actions, giving rise to unlimited possible combinations. One measure of this may be language, which may indeed be uniquely adapted to communicating the nonpresent, including the outcomes of our mental time travels. The uniqueness of language, however, may lie more in the imperative to share the contents of thought than in the thoughts themselves. **With respect to memory and mental time travel, at least, it may be salutary to remember Darwin's comment that ‘The difference in mind between man and the higher animals, great as it is, certainly is one of degree and not of kind.’**

### Morality

#### Animals exhibit all of the traditional hallmarks of morality

Bekoff and Pierce 14 <Marc, Professor Emeritus of Ecology and Evolutionary Biology at the University of Colorado, Boulder, and Jessica, American bioethicist, philosopher, and writer. She currently has a loose affiliation with the Center for Bioethics and Humanities, University of Colorado Denver, “Wild Justice : The Moral Lives of Animals,” PUBLISHER, University of Chicago Press, 2014-05-14>#SPS

The social lives of numerous animals are strongly shaped by affiliat­ ive and cooperative behavior. Consider wolves. For a long time research­ ers thought that pack size was regulated by available food resources. Wolves typically feed on prey such as elk and moose, both of which are bigger than an individual wolf. Successfully hunting such large ungu­ lates usually takes more than one wolf, so it makes sense to postulate that wolf packs evolved because of the size of wolves’ prey. However, long-term research by David Mech shows that pack size in wolves is regulated by social and not food-related factors. Mech discovered that the number of wolves who can live together in a coordinated pack is governed by the number of wolves with whom individuals can closely bond (the “social attraction factor”) balanced against the number of individuals from whom an individual can tolerate competition (the “social competition factor”). Packs and their codes of conduct break down when there are too many wolves. As we begin to look at the “good” side of animal behavior, at what animals do when they’re not fighting each other or committing siblicide, we begin to take in just how rich the social lives of many animals are. In­ deed, the lives of animals are shaped at a most basic level by “good”—or what biologists call prosocial —interactions and relationships. Even more, it seems that at least some prosocial behavior is not a mere byproduct of conflict, but may be an evolutionary force in its own right. Within biology, early theories of kin selection and reciprocal altruism have now blossomed into a much wider inquiry into the many faces and meanings of prosocial behavior. And, it seems, the more we look, the more we see. There’s now an enormous body of research on prosocial behavior, and new research is being published all the time on cooperation, altruism, empathy, reciprocity, succorance, fairness, forgiveness, trust, and kind­ ness in animals ranging from rats to apes. Even more striking, within this huge repertoire of prosocial behav­ iors, particular patterns of behavior seem to constitute a kind of animal morality. Mammals living in tight social groups appear to live according to codes of conduct, including both prohibitions against certain kinds of behavior and expectations for other kinds of behavior. They live by a set of rules that fosters a relatively harmonious and peaceful coexistence. They’re naturally cooperative, will offer aid to their fellows, sometimes in return for like aid, sometimes with no expectation of immediate re­ ward. They build relationships of trust. What’s more, they appear to feel for other members of their communities, especially relatives, but also neighbors and sometimes even strangers— often showing signs of what looks very much like compassion and empathy. It is these “moral” behaviors in particular that are our focus in Wild Justice . Here is just a sampling of some of the surprising things research has revealed about animal behavior and more specifically about animal morality in recent years. Some animals seem to have a sense of fairness in that they under­ stand and behave according to implicit rules about who deserves what and when. Individuals who breach rules of fairness are often punished either through physical retaliation or social ostracism. For example, research on play behavior in social carnivores suggests that when ani­ mals play, they are fair to one another and only rarely breach the agreedupon rules of engagement— if I ask you to play, I mean it, and I don’t intend to dominate you, mate with you, or eat you. Highly aggressive coyote pups, to give just one example, will bend over backwards to main­ tain the play mood with their fellows, and when they don’t do this they’re ignored and ostracized. Fairness also seems to be a part of primate social life. Researchers Sarah Brosnan, Frans de Waal, and Hillary Schiff discovered what they call “inequity aversion” in capuchin monkeys, a highly social and co­ operative species in which food sharing is common. These monkeys, especially females, carefully monitor equity and fair treatment among peers. Individuals who are shortchanged during a bartering transaction by being offered a less preferred treat refuse to cooperate with research­ ers. In a nutshell, the capuchins expect to be treated fairly. Many animals have a capacity for empathy. They perceive and feel the emotional state of fellow animals, especially those of their own kind, and respond accordingly. Hal Markowitz’s research on captive diana monkeys strongly suggests a capacity for empathy, long thought to be unique to humans. In one of his studies, individual diana monkeys were trained to insert a token into a slot to obtain food. The oldest female in the group failed to learn how to do this. Her mate watched her unsuc­ cessful attempts, and on three occasions he approached her, picked up the tokens she had dropped, inserted them into the machine, and then allowed her to have the food. The male apparently evaluated the situa­ tion and seemed to understand that she wanted food but could not get it on her own. He could have eaten the food, but he didn’t. There was no evidence that the male’s behavior was self-serving. Similarly, Felix Warneken and Michael Tomasello at the Max Planck Institute for Evo­ lutionary Anthropology in Leipzig, Germany, discovered that captive chimpanzees would help others get food. When a chimpanzee saw that his neighbor couldn’t reach food, he opened the neighbor’s cage so the animal could get to it. Even elephants rumble onto the scene. Joyce Poole, who has studied African elephants for decades, relates the story of a teenage female who was suffering from a withered leg on which she could put no weight. When a young male from another group began attacking the injured female, a large adult female chased the attacking male, returned to the young female, and touched her crippled leg with her trunk. Poole be­ lieves that the adult female was showing empathy. There is even evidence for empathy in rats and mice. Altruistic and cooperative behaviors are also common in many spe­ cies of animal. One of the classic studies on altruism comes from Gerry Wilkinson’s work on bats. Vampire bats who are successful in forag­ ing for blood that they drink from livestock will share their meal with bats who aren’t successful. And they’re more likely to share blood with those bats who previously shared blood with them. In a recent piece of surprising research, rats appear to exhibit generalized reciprocity; they help an unknown rat obtain food if they themselves have been helped by a stranger. Generalized reciprocity has long been thought to be uniquely human. The presence of these behaviors may seem puzzling to scientists or lay readers who still view animals from the old “nature red in tooth and claw” framework. But puzzling or not, moral behaviors can be seen in a wide variety of species in a spectrum of different social contexts. And the more we look, the more we see.

#### Err on the side of accepting animal morality - social conditioning causes human beings to reject it out of hand

Bekoff and Pierce 14 <Marc, Professor Emeritus of Ecology and Evolutionary Biology at the University of Colorado, Boulder, and Jessica, American bioethicist, philosopher, and writer. She currently has a loose affiliation with the Center for Bioethics and Humanities, University of Colorado Denver, “Wild Justice : The Moral Lives of Animals,” PUBLISHER, University of Chicago Press, 2014-05-14>#SPS

So far, very few scientists and other academics have been willing to use the term moral in relation to animal behavior without protective quota­ tion marks (which signal a kind of “wink, wink: we don’t really mean ‘moral’ as in human morality”) or without some other modifying trick, as in the term proto -morality (read: “they may have some of the seeds of moral behavior, but obviously not morality per se”). Indeed, there is strong resistance to the use of the term “moral” in relation to the behav­ ior of nonhuman animals, both from scientists and philosophers. **The belief that humans have morality and animals don’t is such a longstanding assumption it could well be called a habit of mind, and bad habits, as we all know, are damned hard to break**. A lot of people have caved in to this assumption because it is easier to deny morality to animals than to deal with the complex reverberations and implica­ tions of the possibility that animals have moral behavior. The historical momentum, framed in the timeworn dualism of us versus them, and the Cartesian view of animals as nothing more than mechanistic entities, is reason enough to dismissively cling to the status quo and get on with the day’s work. Denial of who animals are conveniently allows for retaining false stereotypes about the cognitive and emotional capacities of animals. **Clearly a major paradigm shift is needed, because the lazy acceptance of habits of mind has a strong influence on how science and philosophy are done and how animals are understood and treated.** The irony, of course, is that the field of animal behavior is already bursting with terminology that has moral color: altruism, selfishness, trust, forgiveness, reciprocity, and spite. All of these terms and more are used by scientists to describe the behavior of animals. Certain words like altruism , selfishness , and spite have been ascribed specific and carefully circumscribed meanings within the field of animal behavior— meanings that diverge from, and even sometimes contradict common usage. Other moral terms such as forgiveness , fairness , retribution , reciprocity , and empathy have joined the animal behavior lexicon, and retain, for now, their con­ nection to the morality we know and live. Lay readers and even scientists are bound to be confused by this apparent lack of consistency. We plan to clear up some of this mess. We could have coined a new word or phrase to describe our particular suite of prosocial behaviors in animals. The phrase “animal morality” will certainly strike some people as odd, and perhaps even as an oxy­ moron. And in some respects, morality is not the most solicitous term. Morality is notoriously hard to define and there is disagreement about how best to understand what morality is. On the other hand, morality is a very useful term, because “**animal morality” challenges some ste­ reotypes about animals and, as we’ll see, about humans. It also empha­ sizes evolutionary continuity between humans and other animals, not only in anatomical structure, but also in behavior.** And this emphasis, in our view, is important. Finally, morality is also a useful term because the root meaning— more , or custom— captures an essential element of animal morality. We need to be quite explicit that the meaning of morality is itself under consideration, and we’re suggesting a shift in meaning. How we define morality will, of course, determine whether and to what extent animals have it. And yes, we’re defining morality in such a way as to lend credence to our argument for evolutionary continuity between humans and animals. But this is not sleight of hand: our definition of morality is well supported both scientifically and philosophically and also by “unsci­ entific” common sense. We want to detach the word morality from some of its moorings, allowing us to rethink what it is in light of a huge pile of research from various fields that speaks to the phenomenon. We ask that you let us play freely with the term and, in the end, you can decide if you think “animal morality” makes sense.

### Theory of the Mind

#### Apes have proven the ability to “submentalize” – a form of empathy that significantly narrows the gap between human theory of the mind and animals

Heyes 17 <Cecilia, All Souls College and Department of Experimental Psychology, University of Oxford, Oxford, UK. “Apes Submentalize,” Trends in Cognitive Sciences, Volume 21, Issue 1, January 2017, Pages 1-2>#SPS

Humans often predict and explain each other's behaviour by ascribing mental states. At the movies, we expect the spy to head for the desk because he wantsthe documents and believes they are hidden there. For nearly 40 years, biologists and psychologists have been trying to find out whether this capacity for ‘mentalising’, ‘mind reading’ or ‘theory of mind’ is shared by other apes [[1–3]](http://www.sciencedirect.com/science/article/pii/S136466131630198X%22%20%5Cl%20%22bib0055). Krupenye and colleagues recently reported a breakthrough in this quest – evidence that chimpanzees, bonobos and orangutans can attribute false beliefs [[4]](http://www.sciencedirect.com/science/article/pii/S136466131630198X%22%20%5Cl%20%22bib0070). In their study, apes watched movies. Here is a description of what happened in one of the movies ([[4]](http://www.sciencedirect.com/science/article/pii/S136466131630198X#bib0070), Experiment 2, FB2), the kind of description provided by Krupenye and colleagues, and that most people would give if asked by a friend: A human actor, behind bars and dressed in green, had a contest with another actor, in the foreground and dressed in a King Kong (KK) suit. On three successive occasions the green actor tried to get possession of a brick, but each time KK snatched the brick and hid it in one of two boxes on his side of the bars. On the first two occasions, the green actor patiently retrieved the brick from the box where it had been hidden. On the third occasion, the green actor left the room after KK had hidden the brick. While he was away, KK transferred the brick to the other box, then removed it from the second box and left the scene taking the brick with him. When KK had gone, the green actor returned to the room, took up the central position from which he had begun to retrieve the brick on previous occasions, and the movie stopped. Krupenye and colleagues found that, when the action stopped, the apes’ first eye movements tended to be in the direction of the box where the brick had been hidden before the green actor left the room. When the action is described in a familiar, folk psychological way (above) it is natural to interpret this as a sign of mind reading - that the apes expected the green actor to search the box where he falsely believed the brick to be hidden – or, at minimum, as a sign of ‘behaviour reading’ – that the apes expected the green actor to search the location where he had last seen the brick ([[4]](http://www.sciencedirect.com/science/article/pii/S136466131630198X#bib0070), p. 113). This study is important because it pioneers the subtle use of eye-tracking to test for mentalising in animals. An infrared eye-tracker was used, without head restraint, not merely to check that the apes looked at the stimulus display, but to record how much they looked at four critical areas in seven phases of the action ([[4]](http://www.sciencedirect.com/science/article/pii/S136466131630198X#bib0070), Figures S3 and S4). Consequently, we can be more confident than in any previous study that key elements of the action sequence ‘went in’ to the minds of the apes. For example, the eye-tracking data indicate that the apes watched the movements of the brick when the green actor was out of the room, and therefore make it unlikely that, when he returned, the apes merely looked towards the location where they believed the brick to be hidden. So, the study by Krupenye and colleagues set a new methodological standard for research on mentalising in animals, and showed something truly interesting about the apes – that they “accurately anticipated the goal-directed behaviour of an agent who held a false belief” ([[4]](http://www.sciencedirect.com/science/article/pii/S136466131630198X#bib0070), p. 113) – but it did not tell us whether the anticipation was due mentalising or to ‘submentalising’; prediction of behaviour by low-level, domain-general psychological processes [[5]](http://www.sciencedirect.com/science/article/pii/S136466131630198X%22%20%5Cl%20%22bib0075). Rather than viewing the movie as a narrative in which agents acted on objects for reasons, the apes may have selectively encoded relatively low-level properties of salient events, including the appearance and disappearance of the striking green shirt; the configuration of three cues (green centre/bell rings/boxes flash) that signalled an excitingly novel event (the box taking flight; see [Figure 1](http://www.sciencedirect.com/science/article/pii/S136466131630198X%22%20%5Cl%20%22fig0005)B); and a predictor of which box would fly next – the last location of the brick when the scene was green. Once the possibility of low-level encoding is acknowledged – once we have entered this potential ‘self-world’ of the apes [[6]](http://www.sciencedirect.com/science/article/pii/S136466131630198X%22%20%5Cl%20%22bib0080) – it becomes apparent that a range of domain-general mechanisms, which process inanimate as well as animate stimuli, could have driven the apes’ eye movements. For example, reappearance of the green shirt could have acted as a retrieval cue, activating a memory of the brick's location when the green colour was last present [[7]](http://www.sciencedirect.com/science/article/pii/S136466131630198X%22%20%5Cl%20%22bib0085). Eye-tracking can give a fair indication of what goes into a mind, but it can’t tell us what is likely to come out – to be remembered. Alternatively, the orientation of the green object relative to the boxes and the brick prior to the green object's disappearance could have acted as a contextual cue priming the apes’ visual search when the green object reappeared. Experiments using inanimate stimuli with adult human participants have shown that this kind of cueing is driven by incidentally learned associations between spatial configurations and target locations [[8]](http://www.sciencedirect.com/science/article/pii/S136466131630198X%22%20%5Cl%20%22bib0090). The retrieval cue and contextual cue hypotheses suggest that the apes were submentalising, or predicting behaviour using mechanisms of attention, learning and memory that did not evolve for, and are not dedicated to, the analysis of agents’ behaviour. Studies of mind reading should control for submentalising because cognitive science has shown that domain-general mechanisms of attention, learning and memory are activated in adult humans whenever patterns recur in a complex stimulus array ([Box 1](http://www.sciencedirect.com/science/article/pii/S136466131630198X%22%20%5Cl%20%22tb0005)). Therefore, to consider the possibility that apes are submentalising is not to belittle them, but to ask in what ways they are similar to humans. Unless one needs to discuss behaviour [[9]](http://www.sciencedirect.com/science/article/pii/S136466131630198X%22%20%5Cl%20%22bib0095), or to catch a Hollywood spy, submentalising may be the smart option.

#### Skeptics of animal theory of the mind beg the question and rely on semantic rather than substantive differences

Buckner 13 <Cameron, University of Houston, “The Semantic Problem(s) with Research on Animal Mind-Reading,” https://philpapers.org/archive/BUCTSP>#SPS

In summary, the only construal of the animal mindreading debate acceptable to both proponents and sceptics is cast in representational terms: they disagree as to whether current evidence supports the hypothesis that animals can represent at least some perceptual states of conspecifics. Whether current evidence supports the representational claim, however, depends upon one’s underlying psychosemantics. If sceptics require fully domain-general, abstract competence, they appear to beg the question against proponents. Moreover, the sceptics’ behaviour-reading challenge threatens to reduce to a much more thoroughgoing scepticism about representation derived from the problem of distal content. Any naturalized semantics must adopt some device to avoid this extreme scepticism, and the most popular such devices appeal in one way or another to the organism’s needs. It is, however, implausible that chimpanzees (or other animals) need to represent in-direct-line-of-gaze (or other proximal behavioural cues) except 24 as evidence for seeing, and current experimental evidence provides strong evidence that animals can flexibly recruit a number of different cues as proximal evidence to better serve this need. Thus, if we are capable of representing distal contents generally, then we already have significant evidence that animals can represent the perceptual states of others. Rather than accepting the consequent of this conditional, anti-representationalists may instead deny the antecedent, celebrating the discovery that the ‘logical problem’ in mind-reading research is at bottom the problem of distal content. Sceptical debates over other cognitive capacities might similarly be seen to depend upon the vagaries of representation, as other disputed capacities such as episodic memory, metacognition, transitive inference, and cognitive mapping are also characterized in terms of their representational contents. If we lack a consensus solution to the problem of distal content, then we might also lack a way to decide when these other mental states count as ‘genuinely’ representing their purported contents. Alternatively, this insight might inspire philosophers to set aside Swampman and Twin Earth to revisit old debates about content with a series of new practical applications and test cases in mind. Before closing, it is worth noting that none of these observations impugn the relevance of Lurz’ or other sceptics’ experimental designs. On any plausible psychosemantics, a positive result in these designs would provide yet more impressive evidence for animal mind-reading (albeit, perhaps, in the sense that calculus would provide more impressive evidence of mathematical ability than long division). However, a perplexing feature of this debate is that most of these experiments have not yet been performed. Because they focus on increasingly sophisticated inferential abilities, and require elaborate materials, pretraining conditions, and controls, there are considerable practical barriers to their proper execution and reproduction. Simplicity is one of the greatest virtues of an experimental design, for every additional complication introduces an opportunity for unexpected challenges: uncooperative or confused animals, failures of apparatus, complexity of data analysis, and the introduction of confounds. In short, while any lab up to the task should be encouraged to perform the experiments suggested by Povinelli, Penn, Vonk, and Lurz, in the meantime the positive view sketched here justifies a more modest approach. In particular, experimentalists should continue to explore the full range of cues and contexts that animals can use in a flexible and integrated way to track the mental states of others, without letting the dream of the perfect experiment become the enemy of the good.

#### Birds have proven the ability to put themselves in future situations and adapt their current behavior as a result

Emery and Clayton 15 <Nathan J. School of Biological & Chemical Sciences, Queen Mary University of London and Nicola S., Department of Psychology, University of Cambridge, Learning & Behavior, September 2016, Volume 44, Issue 3, pp 203–204>#SPS

The question of whether animals have the capacity to think about other minds remains a contentious topic in comparative cognition. Despite over 40 years of research, there is little consensus on whether any animal other than humans has a theory of mind. This research originated from a question posed by Premack and Woodruff in [1978](https://link.springer.com/article/10.3758/s13420-016-0230-5#CR5): “Does the chimpanzee have a theory of mind?”. Despite many elegant studies using complex experimental designs, the field has generated more confusion than clarity, probably because a number of high-profile researchers have discontinued their research programs or changed their minds about their findings, or because theoretical psychologists and philosophers with little empirical training or experience testing animals in social cognitive paradigms have suggested experimental designs that they believe will fix many of the apparent problems with animal mindreading research, but that are empirically naïve. Neither is the case with Bugnyar, Reber, and Buckner ([2016](https://link.springer.com/article/10.3758/s13420-016-0230-5#CR1)), two ethologists and a philosopher who have pooled their experience to design an elegant experiment that gets as close as any other to providing evidence that (some) animals may recognize (some) mental states in others. We believe that part of the problem concerning this area of comparative cognition, more than any other, is the constraining focus on whether animals possess any aspect of human theory of mind. Although humans seamlessly make predictions about what others may be thinking, it remains unclear whether we make these predictions by scaffolding upon perceptual cues, such as another’s line of sight (theory approach), or by using our own introspection and inferences based on previous experience (simulation approach). Most research on animal mindreading has focused on the theory approach, but this has left a field littered with arguments about whether mindreading actually occurs at all in animals, and what positive evidence would look like anyway. The main argument is that animals would act similarly in response to mindreading or to behavior-reading alone, without recourse to understanding what mental states, if any, may drive another’s behavior. For example, does following another’s gaze mean that a viewer understands that the gazer is seeing something, or does the viewer simply compute that the gazer is oriented toward a specific object and, statistically speaking, is more likely to interact with that goal object than with another. The simulation approach does not suffer from these limitations based on behavior-reading, because it is not dependent on perceiving the links between individuals, cues, and objects. For example, I may open a box in which a toy snake springs up and scares me. If I see someone I care for approach the same box, this triggers a memory of that aversive experience, and I may try to stop my loved one from experiencing the same aversive event. I remember the state I was in while experiencing the aversive event, and would want to stop it from happening to someone I care about. But, isn’t this just my memory of something aversive, even though it didn’t happen to me? The key here is whether I would stop someone I did not like from opening the same box. My memory of the event would be just as aversive, but in this context, I might want to harm another or not care about the consequences of their actions. Introspection, in this case, would stop me from preventing another opening the box, because I would want them to experience the same aversive event that I had experienced. This has been termed experience projection, and we were perhaps the first to find evidence of this in a nonhuman animal, namely the Western scrub-jay (Emery & Clayton, [2001](https://link.springer.com/article/10.3758/s13420-016-0230-5#CR2)). Briefly, jays were allowed to hide food (cache) in two different trays in two different social contexts—either in private or in the presence of another jay. Then, 3 h later, the cachers were allowed to retrieve their caches, always in private. When presented with the tray they had previously cached in in the presence of a potential observer, they consistently recached—that is, moved those caches to new places (a new tray). If presented with the tray they had cached in in private, they did not recache. We interpreted this as the birds maximizing their future returns by moving caches to places that the observing birds did not know about. However, most intriguing, and most relevant to the issue of experience projection, was the fact that we presented these two conditions to jays with experience of being thieves (having stolen caches they did not make in a previous experiment), and separately to jays with no pilfering experience. Only birds with pilfering experience performed the protective recaching behavior. We suggested that those birds alone inferred that an observer might pilfer their caches, and so implemented protective actions to prevent this possibility. As such, they may have simulated the future behavior of a potential thief on the basis of their own specific previous experience. Unfortunately, there isn’t the space to go into arguments for why this should or should not be considered experience projection (e.g., Emery & Clayton, [2008](https://link.springer.com/article/10.3758/s13420-016-0230-5#CR3)), or most intriguing of all, why birds who had not seen a bird caching, but had stolen caches they themselves had not made, should then implement a suite of cache protection strategies when in the opposite situation (i.e., potential victims) themselves. Bugnyar and colleagues took a different approach to the question of whether corvids simulate other minds. They adapted a paradigm first suggested by Heyes ([1998](https://link.springer.com/article/10.3758/s13420-016-0230-5#CR4)) to be used with primates. Heyes suggested that chimps could wear different goggles with different colors to distinguish them—one pair transparent, the other opaque. If those experienced chimps were then confronted with other chimps wearing either the opaque or the transparent glasses (which could only be discriminated by their color), then the original chimps would behave differently toward the newcomers on the basis of their own experience of the goggles. Rather than make ravens wear goggles (and all the potential problems that could cause), Bugnyar and colleagues used peepholes to differentiate between the seeing conditions, so that birds could see into a caching arena through one peephole, but not through another. First, birds cached either when a large window was open, so that another raven could see them caching from an adjacent room, or when the window was closed, and a raven remained in the adjacent room but could not see them caching. Cachers hid the food faster and displayed fewer revisits to cache sites to improve the caches if they had been observed caching, as compared to when no observer had been present. Subjects were then given experience of the peepholes, by entering the side compartment and watching an experimenter cache in the arena through one peephole (but not through a second, blocked peephole). Finally, the subjects were moved back into the larger arena and cached when both windows were closed, but one of the peepholes in the windows was open. The clever bit was that Bugnyar and colleagues played the sounds of a raven moving in the adjacent room, from which it was unable to observe caching. Therefore, the cachers likely perceived another raven in the adjacent room who they could not see, but who had the capacity to see their caching through the peephole. In this peephole condition, the cachers behaved as if another raven was present and could see them. Bugnyar and colleagues suggested that the cachers had applied their experience of the peepholes to the potential for another bird to observe them, and so decided they should implement appropriate cache protection strategies. Although we agree that this interpretation seems valid, there are a number of small problems. The first is that the choice of protective behaviors was completely post-hoc, and the more obvious protective behaviors did not differ between test conditions. Speed of caching or checking previous cache sites are not typical cache protection strategies. Second, and perhaps most importantly, the ravens’ decisions on where to cache did not appear to be driven by perception; that is, they did not tend to cache in locations that a potential pilferer could not see through the peephole. The peepholes themselves were quite low to the ground, with a 2-cm diameter, and it is not clear that the cacher could not see that no bird was present in the adjacent room. Although they behaved the same as in the observed condition, this might have been a generally protective response to a strange situation (e.g., the sounds of an unseen bird). A couple of additional peephole conditions could have been more informative, such as ones in which the peepholes were positioned higher up, and so completely out of the cacher’s sight, or both peepholes were kept open but only one had a perch next to it (so that only a bird that had experience of that perch would recognize that the perch was the only viewpoint from which a bird could spy on the caching). As songbirds, ravens should be capable of accurately pinpointing the location of a sound (such as another moving raven), so noise played from the back of the compartment could have been differentiated from noise at the location of the peephole. Perhaps in additional conditions, sounds could be played either at the back or near the peephole (the only relevant location for observing caches). Despite these minor issues, we reiterate our earlier statement that we believe this study is a significant step forward in our understanding of whether nonhuman animals think about other minds, and that it should spark a new focus on whether animals are capable of simulating other minds.