Humans and baboons share cumulative culture ability

November 6 2014

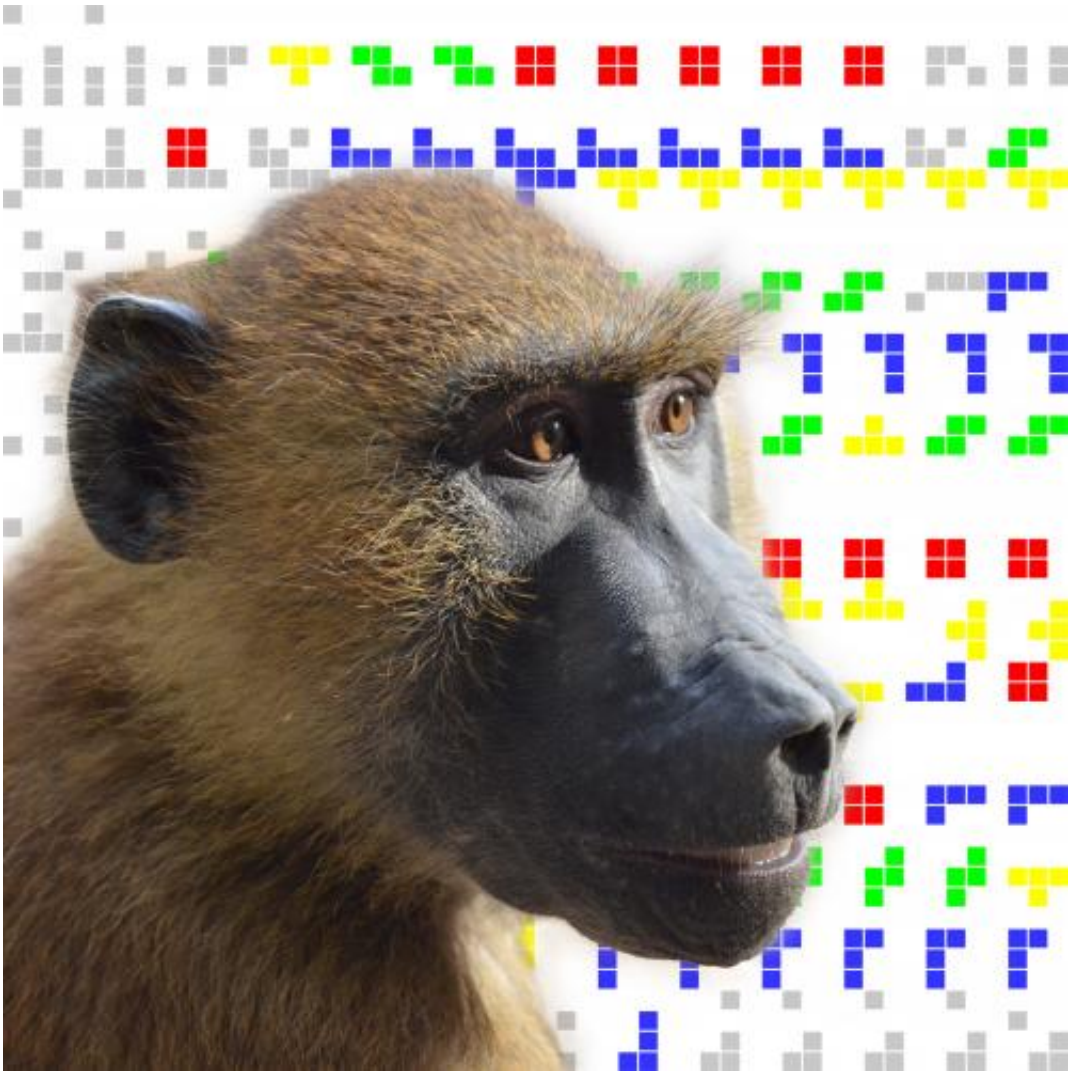
Baboon using a touch screen. Credit: Nicolas Claidière

The ability to build up knowledge over generations, called cumulative culture, has given mankind language and technology. While it was thought to be limited to humans until now, researchers from the Laboratoire de psychologie cognitive (CNRS/AMU), working in collaboration with colleagues at the University of Edinburgh (UK), have recently found that baboons are also capable of cumulative culture. Their findings are published in *Proceedings of the Royal Society B* on 5 November 2014.

Humankind is capable of great accomplishments, such as sending probes into space and eradicating diseases; these achievements have been made possible because humans learn from their elders and enrich this knowledge over generations. It was previously thought that this cumulative aspect of culture—whereby small changes build up, are transmitted, used and enriched by others—was limited to humans, but it has now been observed in another primate, the baboon.

While it is clear that monkeys like chimpanzees learn many things from their peers, each individual seems to start learning from scratch. In contrast, humans use techniques that evolve and improve from one generation to the next, and also differ from one population to another. The origin of cumulative culture in humans has therefore remained a mystery to scientists, who are trying to identify the necessary conditions for this cultural accumulation.

Nicolas Claidière and Joël Fagot, of the Laboratoire de psychologie cognitive, conducted the present study at the CNRS Primatology Center in Rousset, southeastern France. Baboons live in groups there and have free access to an area with touch screens where they can play a "memory game" specifically designed for the study. The screen briefly displays a grid of 16 squares, four of which are red and the others white. This image is then replaced by a similar grid, but composed of only white squares, and the baboons must touch the four squares that were previously red. Phase one of the experiment started with a task-learning period in which the position of the four red squares was randomized. Phase two comprised a kind of visual form of "Chinese whispers" wherein information was transmitted from one individual to another. In this second phase, a baboon's response (the squares touched on the screen) was used to generate the next grid pattern that the following baboon had to memorize and reproduce, and so on for 12 "generations."



Baboon against a background of tetrominos. Credit: Nicolas Claidière and Simon Kirby

The researchers, in collaboration with Simon Kirby and Kenny Smith from the University of Edinburgh, noted that baboons performed better in the phase involving a transmission chain (compared with random testing, which continued throughout the period of the experiment): success rate increased from 80% to over 95%. Due to errors by the baboons, the patterns evolved between the beginning and the end of each chain. Yet to the surprise of researchers, the random computer-generated

patterns were gradually replaced by "tetrominos" (Tetris®-like shapes composed of four adjacent squares), even though these forms represent only 6.2% of possible configurations! An even more surprising result was that the baboons' performance on these rare shapes was poor during random testing, but increased throughout the transmission chain, during which the tetrominos accumulated. Moreover, when the experiment was replicated several times, the starting patterns did not lead to the same set of tetrominos. This study shows that, like humans, baboons have the ability to transmit and accumulate changes over "cultural generations" and that these incremental changes, which may differ depending on the chain, become structured and more efficient.

Researchers have ensured that all the necessary conditions were present to observe a type of cumulative cultural evolution in non-human primates, with its three characteristic properties (progressive increase in performance, emergence of systematic structures, and lineage specificity). These results show that cumulative culture does not require specifically human capacities, such as language. So why have no examples of this type of cultural evolution been clearly identified in the wild? Perhaps because the utilitarian dimension of non-human primate culture (e.g., the development of tools) hinders such evolution.

More information: "Cultural evolution of systematically structured behaviour in a non-human primate," N. Claidière, K. Smith, S. Kirby, J. Fagot. *Proceedings of the Royal Society B*, 5 November 2014. DOI: 10.1098/rspb.2014.1541

Provided by CNRS