

**Title:** Fake snakes uncover chimpanzees' mind-reading ability

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### **Summary**

Crockford et al. (2017, *Science Advances*, 3(11), e1701742) conducted experimental studies in the wild in Africa to investigate the ability of chimpanzees to understand the mental states of other conspecific individuals. Their findings suggest that chimpanzees understand whether or not other individuals are aware of dangers, and they behave differently according to their understanding about the mental states of other individuals.

**Keywords:** Chimpanzee, Theory of mind, Alarm call, Perspective taking

The work reported by Crockford, Wittig, and Zuberbler (2017) represents a valuable integration of three scientific approaches to the mind of nonhuman animals: theory of mind (Premack & Woodruff, 1978), alarm calls (Seyfarth, Cheney, & Marler, 1980), and field experiments on wild chimpanzees (Matsuzawa, 1994). Crockford et al. (2017) revealed that wild chimpanzees are aware of other individuals' perceptions of danger by conducting a nicely designed field experiment with chimpanzees in Budongo Forest, Uganda, involving playback of chimpanzee vocalization recordings. Their results shed light on a longstanding debate between mind reading, or understanding of others' mental states, versus behavior reading in nonhuman animals.

Suppose that you are walking on a narrow street with a small child. You and the child are talking about something while walking. Then you hear the sound of a car approaching you from behind. The child keeps chatting. Here, you will feel that you need to warn the child about the car. This is because you understand that the child is not aware of the approaching car and the potential danger associated with it. You can imagine another scenario. You and the child are walking the narrow street and you hear the sound of the car approaching from behind. The child keeps talking but says, "I can hear the sound of

the car approaching from behind.” In this case, you will not warn the child about the car. This is because you understand that the child is aware of the car.

Crockford et al. (2017) conducted experimental studies in the wild and created a situation similar to the abovementioned anthropomorphic story. They placed a fake model snake on the ground of the forest of Budongo, which is inhabited by a group of chimpanzees. Snakes are potential danger for the chimpanzees, and they emit a call, called an “alarm hoo,” when they spot a snake. Many species of animals, including chimpanzees, emit alarm calls in response to potential dangers, such as predators and snakes. The function of the alarm call is to convey information about the danger to other group members, resulting in increased fitness through kin selection or reciprocity. In their experiment, Crockford et al. (2017) played recordings of one of two types of chimpanzee vocalizations from a speaker hidden in a nearby bush, before the subject chimpanzee saw the model snake. The function of the hidden speaker is to make the subject chimpanzee feel that there is an invisible groupmate in the bush. Then, this imaginary groupmate, actually the speaker, either emits an alarm hoo, which means that this imaginary groupmate is aware of the snake, or a different type of vocalization, which means that the imaginary groupmate is unaware of the snake. After hearing one of the two calls, the subject chimpanzee sees the model snake (perceiving it as a real snake).

The question is then whether or not the subject chimpanzee himself or herself emits the alarm call. If the subject chimpanzee understands that the groupmate in the bush is already aware of the snake, evidenced by the alarm call from the bush, then there is no need to emit an alarm call to alert the groupmate. In contrast, if the subject chimpanzee understands that the groupmate in the bush is unaware of the snake, then there is a need to emit an alarm call to alert the groupmate. The results supported the latter scenario. The subject chimpanzees tended to give alarm calls when they had just heard the sound of a nonalarm call from the bush, whereas they tended to not give an alarm call when they had heard the alarm call. Crockford et al. (2017) also conducted a different test on the same topic. The results were consistent with the idea that the chimpanzees are aware of other individuals’ perception of danger.

Among theory of mind researchers, there has been a longstanding debate on mind reading, or understanding of others’ mental states, versus behavior reading in nonhuman animals. In the case of humans, we can ask questions verbally, and the subjects’ verbal answers can provide good evidence about understanding of others’ mental states. However, we

cannot use such a procedure in the case of nonhuman animals; all researchers can do is observe and measure the behaviors of animals. This fact is associated with the difficulty of separating mind reading from behavior reading. An animal may behave in a certain manner because it understands the mental state of another individual, or the behavior may be just a response to the behavior of another individual, without any attendant understanding the other's state of mind. Crockford et al. (2017) used speakers to rule out the possibility of behavior reading. Because the speaker is hidden in the bush out of sight, and, moreover, because it is not a real conspecific groupmate but rather an illusion of another chimpanzee, the behavior of the subject chimpanzee cannot be merely a response to the behavior of another individual (which actually does not exist). The authors also carefully ruled out other factors, such as the effect of habituation to the model snake and the effect of the identity of the individual whose call was played back.

The study conducted by Crockford et al. (2017) can be categorized as a field experiment: experimental manipulation in wild conditions with wild animals. Regarding chimpanzees, Kortlandt (1967) was the first to conduct an experiment in the wild. In 1966–1967, he placed a stuffed leopard in the habitat of wild chimpanzees in Guinea, West Africa, to observe the antipredator response of the chimpanzees. His attempt was successful; he recorded clear excitement behaviors among the chimpanzees. Some decades later, Matsuzawa (1994) started more systematic field experiments on tool use by chimpanzees in Bossou, Guinea. The chimpanzees in Bossou have been known to use stones as tools to crack open oil-palm nuts. Matsuzawa (1994) provided oil-palm nuts and stones, which were collected from inside the chimpanzee habitat, to a certain place within their habitat, called an outdoor laboratory. This experimental approach succeeded, resulting in the collection of more data from a wider range of individuals than would have been possible through naturalistic and opportunistic observations alone. Matsuzawa and his colleagues also introduced nuts that were unavailable in the chimpanzees' habitat to investigate their reactions to unfamiliar nuts. The playback experiments in Budongo Forest are a nice addition to the history of field experiments in chimpanzees. Of course, caution must be taken not to disturb the natural behaviors of wild individuals, but a carefully designed field experiment can shed light on the minds of wild animals, which would be difficult to access if we relied on naturalistic observations.

Seminal work by Seyfarth et al. (1980) must be mentioned regarding alarm calls in animals. They conducted playback experiments among free-ranging groups of vervet monkeys, which can also be categorized as field experiments. They showed that vervet

monkeys respond differently to three different types of alarm calls played back from a speaker, suggesting that the monkeys understand and communicate semantic information on different predators via their alarm calls. Thus, Crockford et al.'s (2017) study is rooted in historical works on theory of mind, alarm calls, and field experiments. Lastly, admirable longitudinal efforts in Budongo Forest enabled the authors to record enough stimulus vocalizations from multiple individuals, find ideal situations for playback experiments, and collect data on social relationships among target individuals, which were essential to their study. In conclusion, careful application of playback studies in field experiments has great potential to advance research in theory of mind and other difficult problems in comparative cognition.

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