frontiers | Frontiers for Young Minds

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DO PRIMATES MAKE FRIENDS LIKE HUMANS?

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YOUNG REVIEWERS:


DIVYA A.
AGE: 15


MIRAL
AGE: 15


MOHAMAD
AGE: 15


TALIN
AGE: 15

Have you ever wondered what skills you need to make friends? How your brain processes the information that you need to make friends? What features of your daily life make having friends difficult? Primates are the mammals that are most similar to us in the animal kingdom. Primates face similar challenges to humans when it comes to making friends. Primates must understand the goals and intentions of others to make friends. However, the stress they experience in their environments can make understanding others' goals and intentions difficult. Stress causes primates to switch from understanding goals to understanding behavior alone, meaning they respond only to input from their senses. To overcome this challenge, primates use sounds and gestures when making friends. These are called intentional communication, and they motivate animals to figure out the goals of other animals by using their knowledge of past interactions. Knowing how primates communicate to make friends can help us to understand how humans make friends, too.

WHAT IS FRIENDSHIP IN PRIMATES?

PRIMATES

A group of mammals that include monkeys, apes, and humans, known for their large brains, forward-facing eyes, and ability to grasp objects with their hands.

VIDEO 1

Bonobo grooming, recorded in the Wamba site.

Primates are the mammals that are most similar to us on the tree of life. Like humans, primates are intelligent and live in large, complex social groups. Primates have friendships within and outside their families—but do primates create friendships the way humans do? It is difficult to identify friendships in animals that do not speak, but we can see friendship in the ways animals interact with one another. Scientists can tell that primates are friends when they remove parasites from each other's fur during grooming, for example [1]. I filmed examples of grooming behavior in a primate species called bonobo (see this video of bonobo grooming in Wamba). The bonobos I studied live in the Democratic Republic of the Congo in Africa. In the Wamba site, Japanese scientists have been studying bonobos for over 50 years!

WHY ARE PRIMATE FRIENDSHIPS COMPLEX?

AWARENESS

The ability to perceive and understand what is happening around you, including recognizing changes in your environment and reacting to them.

The survival and health of primates depend on their success in complex social interactions. **Awareness** is a key skill necessary for social interactions in primates [1]. Awareness means using the knowledge of a certain situation that is stored in memory. Animals can use awareness to understand the goals of other members of their species. However, not all social interactions involve use of awareness. For example, understanding behavior does not take awareness—it can occur when animals respond to input from their senses that comes from their external environment, such as tactile (received through touch), auditory (received through hearing) and visual (received through seeing it).

WHAT IS THE DIFFERENCE BETWEEN UNDERSTANDING BEHAVIOR AND UNDERSTANDING GOALS AND INTENTIONS?

Many behaviors guide social interactions without the need to understand each other's goals and intentions. For instance, if your classmate Rosie stamped her foot and then hit you, this experience would shape your reactions the next time you see someone stamp their foot. You would be scared when you saw foot stamping because you would anticipate being hit, even if hitting did not actually happen. This direct experience of the event would guide your future behavior, even if you did not know anything about Rosie's goal in terms of why she stomped her foot and hit you. Sensory inputs such as tactile and auditory displays evoke strong emotions because they are highly predictive of rewarding (positive) or unrewarding (negative) outcomes. In contrast, visual displays are less predictive of outcomes and evoke weak emotions which are neither positive nor negative. If Rosie's

behavior did not actually predict anything, to respond to Rosie you would need to figure out, in *your* mind, the goal that Rosie has in *her* mind.

AMBIGUOUS

Sensory input or situation can be interpreted in two or more distinct ways.

Understanding goals or intentions is not easy: the goals of others are often **ambiguous**! Ambiguous means there are many solutions possible in a given situation. For instance, when you see Rosie walking toward you across the street, you might wonder: Does she want to talk to me? Or is she waiting for someone? Or does she have a completely different goal?

Predictions about other's goals are often ambiguous because we figure them out from our prior social interactions [1]. Animals behave differently toward different group members depending on how they previously interacted together. They can also change their behavior depending on changes in social interactions between themselves and other group members. For instance, Rosie usually always talks to you, but if you quarreled with Rosie's friend, Rosie might not talk to you for a while.

Predicting others' goals in large social groups is especially complicated. When there are many group members, this requires storage of much information about prior social interactions. Imagine you are at school with 80 children—this means there are more than 3,000 possible pairs of children who can interact with each other every day. The number of combinations of three children is even larger—more than 82,000 different combinations of three children exist in a school of 80 children!

There is a limit to how much information about social partners can be stored. Animals store information about their close social partners better than they store information about others. Usually, animals can only store information for up to five group members. Thus, animals have only a few friendships because they lack information about group members with whom they do not interact often.

When animals do not know goals of others, these social interactions are ambiguous. When animals only understand behavior, in response to ambiguous situations they experience fear and want to avoid one another. When animals can understand the goals of others, this helps them to make friends. To understand the goals of others, they use knowledge of past social interactions. Recall the example of Rosie. We discussed that when you see Rosie crossing the street, you might wonder: Does she want to talk to me? Is she waiting for someone? If you were trying to figure out Rosie's goals, many goal options might be possible. However, you would probably come up with one main goal, by focusing on the most important aspects of the situation such as who Rosie is and your history of interaction. This "zooming in" would help you to respond to Rosie in an appropriate way. Primates may also be able to "zoom in" their attention to figure out the goals of others.

Sometimes, they may come to recognize that the goals of another member of their group are similar to their own goals. This produces a feeling of "liking" the other and wanting to be friends [2].

INTENTIONAL COMMUNICATION HELPS PRIMATES UNDERSTAND GOALS AND INTENTIONS

Like humans, primates use movements of their bodies and hands (gestures) to communicate with each other [3]. They also communicate by making sounds with their vocal tracts [4]. These signals are considered **intentional communication** when the signaler looks at the recipient prior to or after signaling. Intentional communication motivates primates to use their knowledge to understand the goals of others [2, 4, 5]. Watch this video to see an example of this communication in the bonobo.

INTENTIONAL COMMUNICATION

When an animal deliberately sends a signal to influence another animal.

In this video, 18-year-old adult female Puffy is being groomed by a young female named Zeta. At first, Puffy is not looking at Zeta. At this point, Puffy does not find grooming Zeta to be important to her own goals. As she grooms Puffy, Zeta looks at Puffy and touches her gently on the sides of her back with both of her hands. Soon, Puffy turns around and starts grooming Zeta intently. This tells us that Puffy now realizes that she and Zeta have the same goal: Zeta being groomed by Puffy. However, Puffy lacks any evidence in the surrounding environment that this is actually the case! Touching with both hands does not convey the message that Zeta wants to be groomed by Puffy. Touching with both hands occurs in many situations. It only motivates Puffy to try to understand Zeta's goal. Puffy only knows Zeta's goal because she zoomed in on Zeta's goal using knowledge of other situations in the past. Without this knowledge, Zeta's touching with both hands would not help Puffy work out Zeta's goal.

VIDEO 2

Intentional communication in the bonobo—a focal follow of bonobo Puffy, recorded in the Wamba Research Camp.

Communication signals like Zeta touching Puffy with both hands are called **attention getters** [3]. Attention getters are distinctive signals such as making sounds with objects, touching gently, or attracting attention by making hand gestures.

ATTENTION GETTERS

Actions or signals used to capture the attention of others, often to communicate or influence group dynamics, like gentle touches or manual gestures.

Now watch this video for an example of intentional communication in the chimpanzee.

VIDEO 3

Intentional communication in the chimpanzee—a focal follow of chimpanzee Bwoba, recorded in the Budongo Conservation Field Station.

The old male chimpanzee Maani is scratching. He is next to a young male chimpanzee, Bwoba, who is lying on the ground. Bwoba shows the inner part of his arm to Maani while looking at him. Maani starts grooming Bwoba. This raising of the arm motivated Maani to figure out Bwoba's goal. As this situation repeated itself over time, Maani worked out Bwoba's goals—in response to the arm-raising gesture, Maani might sometimes recall one social interaction more often than others. This happened simultaneously with Maani becoming friends

with Bwoba. When signals such as raising of the arm cause the watcher to choose one goal of the signaler over other goals, they are called **intention movements**. Bodily postures and visual hand signals, which are shared signals between the signaler and the watcher, are common types of intention movements.

INTENTION MOVEMENTS

Signals which help recipient infer goal of signaller.

WHY DOES STRESS MAKE FRIENDSHIPS DIFFICULT FOR PRIMATES?

Acute stress often involves the drive to defend oneself against sources of danger (predators, aggression) and to prevent being alone or hungry. Stress helps animals to get the resources they need (social partners, shelter, food). Initially animals zoom in on dangerous situations—but also on neutral, ambiguous situations. However, stressful situations compete with neutral, ambiguous situations for limited memory resources. This happens until success is impossible forcing animals to "zoom in" their attention on unambiguous, stressful situations and "zoom out" of ambiguous, neutral situations when zooming in would benefit them. When animals "zoom out", they are not focused enough to work out the goals of their social partners, so the social interactions are more ambiguous. As animals zoom out, ambiguous interactions including ambiguous sensory input (e.g. visual) evoke negative emotion and fear. When animals zoom out long term this is **chronic stress**.

ACUTE STRESS

A short-term reaction to an immediate threat or challenge, causing a quick burst of energy and alertness.

CHRONIC STRESS

A long-term state of constant tension and worry, often resulting from ongoing pressures or problems.

HOW DOES COMMUNICATION HELP PRIMATES OVERCOME STRESS AND MAKE FRIENDS?

Some primates, such as chimpanzees, have evolved to understand intentions in order to make friends because stress makes having friends difficult [6]. During stress behavioral information coming through the senses does not match up with signaler's goal or intention. Researchers studied whether intentional communication helps chimpanzees to make friends during stress by helping them to understand intentions (Figure 1). Intention movements helped chimpanzees to make friends when they were acutely stressed. These stressed chimpanzees remembered one main goal of social interaction with their friends. This happened when sensory input alone did not make them approach to be friends. When chimpanzees were chronically stressed and they used attention getters, they were able to make friends. Chimpanzees used attention getters with the partners that they did not know well. Chimpanzees figured out the goal of the other to make friends, when neither direct experience with that partner nor sensory input were enough to allow them to approach the partner to be friends [6].

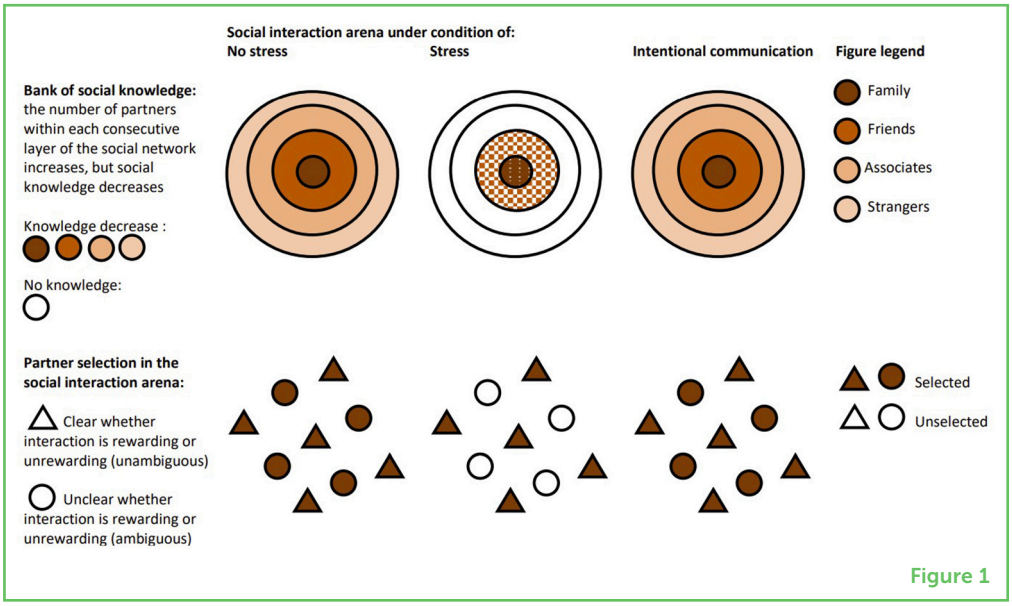

Figure 1

Hypothesis for Communicative Roots of Complex Sociality and Cognition [2] explains the link between social and communicative complexity. Sources of stress deplete "bank of social knowledge". Social partners from outer layers of the social network, who are competing for selection in the "social interaction arena" are not selected. During acute stress animals bias attention toward unambiguous interactions, either positive or negative. Zooming out of ambiguous interactions long term causes chronic stress. Intentional communication motivates animals to use their knowledge. Animals deploy bank of knowledge to understand ambiguous interactions with social partners from the outer layers, therefore these partners are also selected. This expands the number of partners with whom animals interact and makes "social interaction arena" more diverse and complex.

CONCLUSION

When humans first met primates in the jungle, we were amazed. We asked: are primates like us? At first, people thought that primates were not like humans because people believed that primates only understood behavior. People claimed that humans were unique in understanding the goals and intentions of others. But the similarity in communication and social dynamics between primates and humans suggests otherwise. Communication strategies that primates use suggest that primates are very much like us. Stress causes problems with processing of social information, just like in humans. This reduces the number of social partners with whom primates come into contact. Communication strategies, such as attention getters and intention movements, allow primates to broaden the range of social partners with whom they interact [2]. Primates can thrive in the complex social groups in which they live, similar to the way humans do. The complex communications and social interactions of our ancestors help to explain why we have language today: we evolved large brains and language to make friends in large, complex societies [1].

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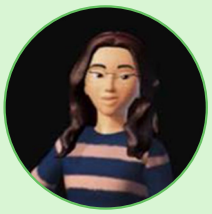
YOUNG REVIEWERS

DIVYA A., AGE: 15
I am a sophomore in High School and I am passionate about neuroscience and healthcare. I have completed a research project examining variations in autism spectrum disorders presentation and severity through the lens of genetics/biology as well as healthcare systems (e.g. diagnosis, treatments, etc.).



MIRAL, AGE: 15

I am 15 years old. I am looking forward to be a doctor in the future since I have a great interest in biology. My favorite thing to do in my free time is playing sports or making pastries.

MOHAMAD, AGE: 15

I am 15 years old. I am interested in both biology and physics, I speak three languages, and one of my favorite things to do is riding horses, reading, and traveling, I am also interested in medicine.

TALIN, AGE: 15

I am 15 years old. I am absolutely captivated by the fascinating worlds of biology and psychology. I love exploring articles about the intricate workings of life, from the tiniest cells to the complexities of the human brain, science always has me hooked. As a young reviewer, I am thrilled to help make science in these areas exciting and easy to understand for young people who share the same interests as me.

AUTHORS

ANNA ILONA ROBERTS

In my work I have ample opportunities to understand why friendships make primates similar to humans. I met Indigenous people in the jungle of Brazil who would pick lice from each other's hair and eat it to make friends. I also saw grooming behavior between bonobos at Wamba, Democratic Republic of the Congo, and chimpanzees in Budongo, Uganda. I studied chimpanzees and bonobos and observed how their hand gestures are so similar to those that humans use. I also observed that, like humans, these primates use hand gestures to engage in social interactions. These experiences made me conclude that primates are not that different from humans! *ar2295@cam.ac.uk