

Self to Self, Self to Others:  
A Cognitive Bridge Between Mirror Self-Recognition and Empathy in  
Non-Human Animals

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## Introduction

What does it mean to recognize yourself, and why does it matter if a dolphin or an elephant can do the same? Over the past several decades, there has been a growing interest in animal behavior. In particular, the field has shifted toward exploring how emotion, cognition, and consciousness relate to behavior. In 1970, a psychologist by the name of Gordon Gallup Jr. introduced a novel approach to understanding animals: the mirror self-recognition (MSR) test. After placing a mirror in a chimpanzee habitat, he found that, following a period of exposure, the chimpanzees appeared to perceive the reflection as themselves rather than as a potential conspecific. He also tested monkeys, who did not seem to have the same capacity for recognition (Gallup, 1970). At the time, this was a groundbreaking idea, and it significantly influenced the direction of animal behavior research.

Since then, the validity of the MSR test—particularly in regard to what it tells us about self-awareness—has been widely debated. A major issue that researchers continue to face is the tendency to equate self-recognition with self-awareness (Gallagher, 2011). If the two were identical, any animal capable of recognizing itself in a mirror would also be aware of itself in a higher cognitive sense. However, other evidence suggests this is not the case. Self-recognition is the basic ability to distinguish oneself from others on a physical level. It represents bodily recognition and is necessary for proper autonomy (Gallup, 1970; Lei, 2023). Self-awareness, on the other hand, involves a deeper understanding of one's situation concerning others, especially regarding distress. For example, chimpanzees will console a mother who recently lost her child (Goldsborough et al., 2020). It includes the ability to reflect on past experiences and recognize how those experiences relate to the present, especially in a social context (Morin, 2011; Lei, 2023). Because of its cognitive complexity, self-awareness is significantly more difficult to

measure experimentally. This is also a reason why scientists are cautious when it comes to identifying animals as truly self-aware (Anderson & Gallup, 2015).

Another reason for this caution lies in the ethical implications. If animals are self-aware, then society may need to reconsider how certain species are treated, particularly in livestock industries and laboratory research. Philosophical and practical concerns arise when consciousness is attributed to animals. There is also the concept of *umwelt* to consider—the idea that each species experiences the world in a unique way, shaped by its own sensory and cognitive abilities (von Uexküll, 1957). This subjective experience can be difficult for humans to grasp, especially when applied to non-human animals. Yet difficulty has never been a barrier to scientific progress.

Empathy is an advanced socio-cognitive ability that may emerge from self-awareness. It is generally defined as “any process that emerges from the fact that observers understand others’ states by activating personal, neural, and mental representations of that state, including the capacity to be affected by and share the emotional state of another, assess the reasons for the other’s state, and identify with the other, adopting his or her perspective” (de Waal & Preston, 2017). It is likely that empathy evolved in the context of parental care—the ability to detect and respond to the physical and emotional needs of offspring would have been vital to survival (Dugatkin & Driscoll, 2021). Unsurprisingly, empathy has been most commonly observed in mammals, particularly because many species give birth to altricial young who require extended care and support. The frequent display of comfort behaviors among African elephants, most often directed toward their young, supports this theory of evolution (Bates et al., 2008). Since empathy depends on understanding the emotional states of others, and such understanding likely

relies on personal experience, it follows that empathy depends in part on some degree of self-awareness (Gallup, 1982; Plotnik, de Waal, & Reiss, 2006; Bates et al., 2008).

This paper will explore the connection between self-recognition, self-awareness, and empathy in animals, examining both experimental evidence and evolutionary theories. In doing so, it aims to shed light on how these capacities arise, how they differ across species, and what they ultimately reveal about our own place in the animal kingdom.

### Self-Recognition, the Mirror Test, and Self-Awareness

Self-recognition is often considered a foundational indicator of self-awareness, a complex cognitive trait traditionally thought to be unique to humans and a few other species. In the study of non-human animals, the mirror self-recognition (MSR) test (Gallup 1970) has become a widely used method for assessing whether an individual can identify itself as distinct from others. First tested in chimpanzees (Gallup, 1970), the MSR test has since been applied to a range of species including the other great apes like bonobos (Shorland et al., 2020) and orangutans (Suarez & Gallup, 1981), dolphins (Reiss & Marino, 2001; Morrison & Reiss, 2018), elephants (Plotnik, de Waal, & Reiss, 2006; Plotnik et al., 2010), magpies (Prior et al., 2008), and even some invertebrates like ants (Cammaerts & Cammaerts, 2015), prompting ongoing debate about its validity and interpretation. In some cases, researchers have had to slightly modify the procedure to accommodate the species being tested. For instance, dolphins are unable to touch their faces or manipulate their bodies in the same way that chimpanzees can. Therefore, instead of touching the mark, they would orient their bodies and observe it (Reiss & Marino, 2001; Morrison & Reiss, 2018). However, the core structure of the test has remained relatively consistent over time. Typically, MSR tests follow five experimental phases. The first is the

baseline phase, during which researchers observe the animals in their natural environment without a mirror, documenting typical behaviors. The second is the covered-mirror phase, where a mirror concealed by a sheet or similar covering is introduced into the environment. In the third phase, the open-mirror phase, the cover is removed, allowing the animals to interact with the mirror as a novel object. The fourth phase is the covered-mirror sham test, where the mirror is again covered, and the animals are given an invisible or fake mark. These stages lead up to the final phase: the actual mirror test, in which a visible mark is placed on the animal, and researchers observe its behavior in front of an uncovered mirror (Gallup, 1970; Reiss & Marino, 2001).

It is now widely accepted that mirror responses occur across several levels. The most basic of these is the social response, in which an animal reacts to the mirror as if encountering another individual. The next level is physical mirror inspection, where the animal investigates the mirror itself without showing evidence of self-directed behavior. The final and most advanced level is self-directed behavior, which is typically demonstrated when an animal uses the mirror to examine or touch an otherwise unseen mark on its own body (Plotnik, de Waal, & Reiss, 2006).

As of the writing of this paper, several species have been recognized as demonstrating mirror self-recognition. These include chimpanzees (Gallup, 1970; Hecht et al., 2016), bonobos (Shorland et al., 2020; Clay & de Waal, 2013), Asian elephants (Plotnik, de Waal, & Reiss, 2006), and bottlenose dolphins (Reiss & Marino, 2001; Morrison & Reiss, 2018). However, it is important to acknowledge the limitations present in many of these studies. For example, Plotnik, de Waal, and Reiss (2006) included only two individual Asian elephants. Similarly, research involving bottlenose dolphins was conducted with a very small sample size. This is likely due to

limited access to captive individuals and the logistical challenges of conducting such tests in the wild. Nonetheless, the small sample sizes must be taken into account when considering whether these findings can be generalized to entire species. Can conclusions about species-wide self-recognition be accurately drawn from observations of only two or three individuals?

Research on other species has produced ambiguous results, leading to ongoing debate regarding whether or not they truly pass the MSR test (Anderson & Gallup, 2015). One surprising example is gorillas - considering their status as great apes and thus closely related to humans, most would assume that they exhibit MSR, but some individuals have shown promising results, while others have not (Suarez & Gallup, 1981; Posada & Collel, 2007; Shillito et al., 1999). There have been a few critiques on the ways in which gorillas have been tested; James Anderson and Gordon Gallup (2015) have a great review of the possibility that these experiments have been engineering the methods so that the gorillas would be concluded to show self-recognition. Another example is that of pigs. The biggest issue is that they were not administered the mark test, but a different type of mirror test in which they were to use a mirror to find a novel object. The results showed that they were able to use the mirror to obtain information, thus finding an otherwise hidden object that is only visible in the mirror. This shows their ability to use a mirror, but not necessarily their ability to (Broom et al., 2009). Finally, laboratory specimens like rats have been tested; the critiques are similar to those for pig mirror testing; they have been tested in front of mirrors, but have not necessarily been administered the mark test. They are able to use mirrors to gain information, but do not seem to gain information about themselves (Yakura et al., 2018).

It is also important to note that Gallup's procedure measures recognition, which is fundamentally different from awareness. In the scientific community, there has been considerable

disagreement over the definition of self-awareness, with some researchers using the terms recognition and awareness interchangeably (Gallagher, 2011). In the context of this article, *self-recognition* will be referred to as the ability to identify oneself in a reflective surface (Gallup, 1970; Lei, 2023). In contrast, *self-awareness* will be used to describe the capacity to understand oneself in relation to others. Yanyu Lei (2023) defines self-awareness as “one’s capacity for self-directed attention, including knowledge of one’s private mental states.”

### Empathy

Until recently, empathy was believed to be a behavior exclusive to humans. However, after observing several highly cognitive animal species, it has become clear that empathy is not a trait unique to us (Booker et al., 2024). Before exploring how animals demonstrate this behavior, it is important to establish a clear definition of empathy. In 2017, prominent behaviorist Frans de Waal proposed a "Russian Doll Model" that has since gained wide acceptance within the scientific community. This model suggests that empathy exists on multiple levels that build upon one another. He first provided a general definition of empathy as, “any process that emerges from the fact that observers understand others’ states by activating personal, neural, and mental representations of that state, including the capacity to be affected by and share the emotional state of another, assess the reasons for the other’s state, and identify with the other, adopting his or her perspective.” The most basic level—the innermost doll in de Waal’s model—is known as the perception-action mechanism. This concept explains how an animal may perceive the actions of conspecifics and respond accordingly. Common examples of this mechanism include motor mimicry, such as contagious yawning, and emotional contagion. Although these behaviors may appear largely unconscious, many studies in animal behavior have used contagious yawning as an indicator of empathy. Human research has shown a strong connection between the two:

individuals with higher levels of empathy tend to exhibit more contagious yawning, whereas individuals with developmental or personality disorders that impair empathetic abilities tend to show less (Gallup & Platek, 2002; Platek et al., 2003). Furthermore, both in humans and animals, yawning and empathy are positively correlated with familiarity. This suggests that contagious yawning is more than simple imitation; it is a sign of empathic response (Campbell & de Waal, 2014).

The next level of the model includes empathic concern and consolation. This stage builds directly upon emotional contagion and involves not only matching the emotional state of another but also attempting to alleviate distress or discomfort. Finally, the most complex level is perspective taking and targeted helping, which is defined as "assistance and care based on a cognitive appreciation of the other's specific needs or circumstances" (de Waal & Preston, 2017). It would be remiss to review empathy without mentioning the theory of mind. This theory, originally developed by René Descartes in the 17th century, evolved from its origins to ultimately refer to the ability to attribute mental states to others, such as knowledge, intentions, and beliefs (Platek et al., 2003). It could be argued that the theory of mind is necessary for survival for all species, as it is imperative to understand the intentions of others based on contextual clues alone. Non-human animals do not communicate in the same ways humans do - they often rely on body language and sound to understand the motives of predators and prey, and respond correctly to the situation. Otherwise, the animal could be out of luck with mating, hunting, or even living (Bates et al., 2008). However, the theory of mind suggests a more sophisticated thought process that relates more to conspecific interactions and sociality rather than survival. Premack and Woodruff (2010) indicated that chimpanzees can understand the problems others face and offer the correct solution. For example, if they were shown a video of

someone unable to access a food item due to distance, they would point to a solution that would bring the item closer, like a long stick. Therefore, the chimpanzees recognized both the issue and the intent of the actor (Premack & Woodruff, 2010). Thus, theory of mind is necessary for perspective taking (Bates et al., 2008).

As explored above, theory of mind and empathy are deeply interconnected abilities that support complex social behavior. The process of these, however, would not be possible without self-awareness, which, at its core, includes the capacity to distinguish self from others in both a physical and mental sense (Platek et al., 2003). A sense of self is fundamentally necessary for attributing thoughts, emotions, and perspectives to others (theory of mind) and responding appropriately to their potential distress, which reflects empathy. Empathy relies on both recognizing another's emotional experiences and being able to relate them to one's own (Platek et al., 2003; de Waal & Preston, 2017). Without self-awareness, it would be difficult to map another's experiences onto oneself, which is essential for empathic responses. In essence, self-awareness enables the theory of mind, which in turn enables empathy. Together, they form a cognitive and emotional chain that underlies many forms of prosocial behavior, cooperation, and even moral reasoning (de Waal & Preston, 2017; Bates et al., 2008). The rest of this review will explore the intersection between these concepts by connecting studies of mirror self-recognition and empathy in nonhuman mammals.

It should be noted that higher encephalization and advanced cognitive capacities are indicators of mirror self-recognition, self-awareness, and empathy (Reiss & Marino, 2001; de Waal & Preston, 2017). Although many animals possess these traits, mammals have shown the most compelling evidence of empathic behavior. Research suggests that species such as magpies (Prior et al., 2008), cleaner wrasse (Kohda et al., 2019; de Waal, 2019; Kohda et al., 2022), and

ants (Cammaerts & Cammaerts, 2015) display mirror self-recognition. However, these animals are not believed to demonstrate the theory of mind, and therefore do not exhibit empathy. This could be the result of limited testing, but it is important to remember that species are typically selected for theory of mind studies based on their cognitive abilities and behavioral complexity. Overall, empathy in non-mammals remains understudied. Thus, while it cannot be definitively stated that all animals capable of mirror self-recognition also show empathy, there does appear to be a meaningful connection between the two. Notably, every species that has demonstrated empathic behavior has also passed the mirror test, suggesting that mirror self-recognition may be a reliable indicator of empathy (Gallup, 1982).

#### Evidence of Empathy in Mammals That Show Self-Awareness

Starting at the most fundamental level of empathy, motor mimicry is observed in many mammals through behaviors such as contagious yawning. As our closest primate relatives, chimpanzees and bonobos are ideal candidates for studying this phenomenon in animals. These primates typically live in large communities but separate into smaller subgroups during the day, allowing for selective social interaction (Wilson & Wrangham, 2003). Their social dynamics are further shaped by the fact that females leave their natal groups upon reaching sexual maturity, which contributes to increased sexual competition (Nishida et al., 1985).

Several studies have demonstrated that chimpanzees respond to yawning by both conspecifics (Anderson et al., 2004) and humans, but not to yawns from other primate species. This supports the idea that empathy—and by extension, contagious yawning—is strongly influenced by familiarity (Campbell & de Waal, 2014). A 2020 study on African elephants produced similar findings: while only about half of the subjects exhibited contagious yawning,

the behavior was nonetheless present. The variation in response is likely due to individual differences in familiarity and prior experience, both of which play a critical role in empathic reactions (Rossman et al., 2020).

Progressing to a more advanced level of empathy, consolatory behaviors are well-documented across species. These behaviors require not only the recognition of another's emotional state but also a motivation to provide comfort. Chimpanzees, once again, offer a compelling example. In one notable case, a group of chimpanzees was observed consoling a bereaved mother following the death of her infant. Typical reassurance behaviors included embracing, kissing, and grooming. Over several months, researchers recorded the group's interactions and found that affiliative behaviors significantly increased in frequency following the infant's death. The evidence suggests that this was not simply a response to heightened group tension but rather an expression of empathy that persisted well beyond the initial event (Goldsborough et al., 2020).

While the previous study focused on animals in captivity, similar empathic behaviors have been observed in the wild. In 2006, a long-term observational study on wild African elephants in the Samburu National Reserve in Kenya documented the responses of several elephants to the death of a matriarch named Eleanor. Shortly after Eleanor collapsed, another matriarch named Grace showed visible distress, attempting to lift Eleanor and calling out vocally. After Eleanor briefly stood and fell again, Grace remained by her side for nearly an hour until sunset. Eleanor passed away the following morning. Grace's actions were particularly notable given that the two elephants were not closely related. Interestingly, Eleanor's closest living relative, Maya, displayed the most prolonged reaction to her death. Though Maya was not present when Eleanor fell, she was observed frequenting the site of Eleanor's death more than

any other elephant in the area (Douglas-Hamilton et al., 2006). Just two years later, Bates et al. conducted a similar observational study to assess whether these behaviors were genuinely empathic. The most frequently observed response was comforting, particularly directed toward calves. Numerous instances of mobility assistance were also recorded, reminiscent of Grace and Eleanor's actions. Such helping behaviors suggest both mental and emotional state attribution: the individual recognizes that the other is not just physically impaired but also in need of aid. Despite having the option to conserve energy, the helper elects to intervene, indicating a conscious, empathic choice (Bates et al., 2008).

Interestingly, rodents have also been observed to display learned helping behaviors, which fit into the middle level of empathy. Learned helping is the idea of aiding another to relieve pain or distress. Targeted helping, however, is considered an aspect of the next level, as it relates more to the adaptive values of helping. The idea that laboratory animals contain self-awareness has been controversial. The implications of this would suggest that the parameters around animal testing and studies would have to change drastically to accommodate their emotional needs. Ethical standards would be brought into question, and the scientific community would have to adjust accordingly. However, the evidence of rodents displaying empathy is frankly hard to deny. The most famous experiments are from Russell M. Church; he found that rats would forego receiving food to avoid another conspecific from getting hurt. Therefore, they give up something they want or need to protect another (Church 1959). A few years later, Rice and Grainer confirmed these results and exemplified that the rats did not require prior experience to forego getting food, meaning the reaction was not learned but innate (Rice & Grainer, 1962).

Lastly, the level of perspective-taking and targeted helping comes into play. Few mammals have been documented displaying these behaviors. Targeted helping is the assistance

or care based on a cognitive appreciation of another's situation or needs. Typically, it is accentuated by emotional contagion. It also requires one to take the perspectives of others and to self-regulate (de Waal & Preston, 2017). This has been observed in apes (Yamamoto et al., 2012), dolphins (Jaakkola et al., 2018), and elephants (Rossman et al., 2020), some of the most encephalized mammals. Dolphins help incapacitated companions to the surface of the water to facilitate their breathing and prevent them from drowning. This act requires the knowledge that breathing at the surface is vital for all dolphins, not just oneself. Realistically, the helper would not gain much benefit from providing aid in this situation. So, why offer help? The reason would be selfish, like the distressed individual provides some sort of service, or selfless, in which they just want to help the individual because they can, or somewhere in between, because they care for the individual in need. No matter what, the helper would remember past experiences with them, which requires self-awareness (de Waal & Preston, 2017).

Theory of mind is a great predictor of targeted helping; understanding another's situation is vital for deciding how to help. Another 2012 chimpanzee study further proved that they exhibit both the theory of mind and targeted helping. After viewing another individual in a predicament, the subjects were given seven different objects that could be used to help; almost all individuals chose the correct item every time. The research also showed that chimpanzees will provide aid even if they do not know the situation at hand. However, they will only provide help upon request; they seldom, if ever, aid others on their own volition (Yamamoto et al., 2012). The previous examples demonstrate the necessity of self-awareness for complex empathic behaviors. Self-awareness implies the knowledge of one's situation, whereas the topmost level of empathy is the knowledge of another's situation, with the application of past knowledge. Therefore, the progression from self-awareness to advanced empathy highlights a cognitive continuum in which

understanding oneself becomes the foundation for understanding others (de Waal & Preston, 2017).

### Connections

Empathy exists as an extreme on the spectrum of prosocial behaviors. Current research suggests that only cognitively complex species are capable of the highest levels of empathy. However, even at the most basic level, nearly any prosocial behavior could be interpreted as empathic. This introduces the counterpoint of altruism, and beyond that, eusociality. Prosocial behaviors benefit the recipient of an action, but not necessarily the individual performing it. Altruistic behaviors fall under this category, defined by the actor sacrificing time, energy, or resources without any guaranteed return (Kerr et al., 2004). There are thousands of examples of altruism throughout the animal kingdom, ranging from the smallest invertebrates to the largest vertebrates.

Eusociality represents the most highly organized form of social behavior. It is characterized by cooperative brood care, overlapping generations within a colony, and division of labor (Crespi & Yanega, 1995). Among mammals, only mole-rats are known to be eusocial (Jarvis et al., 1994). This level of sociality is often examined through the lens of relatedness and fitness. Humans have the cognitive capacity to weigh the fitness outcomes of raising their own offspring versus helping raise those of close relatives. However, animals are not consciously calculating such trade-offs, as doing so would require a level of self-awareness and cognition that many may not possess (Nowak et al., 2010).

While some scientists remain cautious about attributing mirror self-recognition or empathy to animals, others lean toward overly complex explanations for behaviors that may stem

from simpler mechanisms (Shilito et al., 1991). Understanding how animals perceive the world remains a challenge for the human mind. How do animals live without conscious thought? Unfortunately for us, it may be a long time before we can truly understand what life looks like through their eyes. Unfortunately for us, it may be a long time before we are truly able to see life through their eyes, so we must do our best to interpret their intentions in the meantime. However, humans tend to anthropomorphize and project human thoughts and emotions onto non-human organisms. While the mammals discussed in this paper do exhibit anthropoid traits and behaviors, it is important to remain aware of the fundamental differences between their experiences and our own.

The implications of non-human animals not only passing the mirror test but also displaying signs of self-awareness and empathy are both vast and unsettling. If laboratory animals such as rats and mice are capable of these behaviors, then the ethical standards of scientific research would need to be reevaluated. Many experiments currently rely on the assumption that these animals are not conscious in the way that humans are—that they do not feel or express emotions comparably. If these animals are, in fact, able to comprehend their circumstances, they may also be emotionally affected by them and could potentially retain memories of traumatic experiences. Even studies like Church's could be viewed as unethical, considering that multiple individuals were either harmed or exposed to distressing situations involving conspecifics.

This concern extends to livestock as well. While many ranchers do their best to provide quality care, large-scale meat production operations often confine animals to overcrowded, concrete enclosures. Research has shown that these living conditions not only impact the animals' well-being but also affect the quality of meat they produce (Faucitano, 2018; Frimpong

et al., 2014). When we acknowledge their cognitive capacities and recognize that they are capable of feeling emotions and demonstrating empathy, it becomes increasingly difficult to justify the current practices of the livestock industry. Significant reforms would be necessary.

Another aspect worth considering is how behavioral research influences conservation efforts. Presently, much of the public's attention is focused on so-called "charismatic" mammals—species that are easily recognizable and often labeled as "cute" or "fascinating." Common examples include elephants, pandas, lions, tigers, and gorillas. These animals are not only typically large mammals, but they are also often regarded as intelligent. While this paper has primarily focused on mammalian empathy, particularly in those charismatic species, the potential for self-recognition, self-awareness, and empathy in other animals could significantly support conservation efforts on their behalf. Gaining a deeper understanding of these animals' cognitive complexities and shaping public perception of less charismatic species may help elevate their conservation status. Ultimately, expanding our understanding of animal cognition extends far beyond enriching the field of animal behavior; it has the power to influence how we protect, care for, and coexist with the many minds that share our world.

## Conclusion

Mirror self-recognition has been a key element in the study of animal behavior and cognition for the past half century. However, Gallup's test does not measure self-awareness, which implies a much more complex cognitive capacity. Self-recognition reflects the ability to distinguish oneself from others, primarily on a physical level, while self-awareness builds on this by enabling an individual to connect personal past experiences to present situations, particularly those involving others (de Waal & Preston, 2017; Lei, 2023). Empathy, in turn, is the capacity to

be affected by and to understand the emotional states of others within a given context. To understand another's circumstances, one must first understand one's own. Therefore, self-awareness is a foundational requirement for the most intricate levels of empathy (Gallup, 1982; de Waal & Preston, 2017). Notably, the most cognitively sophisticated mammals that have passed the mirror test often display empathic behaviors and, in some cases, may be considered empathic species based on the consistency of these behaviors (Reiss & Marino, 2001; Plotnik, de Waal, & Reiss, 2006).

The implications of recognizing self-awareness extend well beyond academic understanding. If certain animals are shown to be both self-aware and empathic, conservation efforts could shift in their favor. Empathic behaviors may lead to greater public affinity and memorability, ultimately benefiting species survival. The same perspective applies to livestock animals. Over the past fifty years, there have been major reforms in the livestock industry; most recently, the U.S. Department of Agriculture updated the Animal Welfare Act, which protects both livestock and laboratory animals. Although the Act was first introduced in 1966, significant reforms have only been made in the past few years (USDA, 2023). A better understanding of these animals' cognitive capacities and perspectives could further improve their welfare. Yet, the potential for large-scale changes in both agricultural and scientific industries has made some researchers hesitant to label non-human animals as self-aware or empathic.

It is also plausible that, as humans, we are reluctant to relinquish our perceived place at the top of the cognitive hierarchy. Our anthropocentric worldview often blinds us to the inner lives of other species. However, acknowledging animal self-awareness and empathy can provide crucial insights into the origins and evolution of consciousness. It may also reflect back on ourselves, deepening our understanding of human empathy and pushing us to grow in our own

emotional capacities. Recognizing empathy in animals allows us to see them more clearly, but it also challenges us to view ourselves more honestly. Ultimately, identifying self-awareness and empathy in other species confronts long-standing assumptions about the human-animal divide. It encourages a more compassionate, scientifically informed perspective of the sentient minds that surround us. As our exploration of animal cognition continues, we do more than advance science—we reframe our role in the interconnected web of conscious life.

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