

Analysis of Cat's Communication Style and Cognitive Ability

Mengyi Xu ✉

Institute of Life Science, Jiyang College of Zhejiang A&F University, Zhuji, 311800, China

✉ Corresponding author email: 2373950793@qq.com

International Journal of Molecular Zoology, 2024, Vol.14, No.1 doi: [10.5376/ijmz.2024.14.0001](https://doi.org/10.5376/ijmz.2024.14.0001)

Received: 29 Oct., 2023

Accepted: 08 Dec., 2023

Published: 01 Jan., 2024

Copyright © 2024 Xu, This is an open access article published under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Preferred citation for this article:

Xu M.Y., 2024, Analysis of cat's communication style and cognitive ability, International Journal of Molecular Zoology, 14(1): 1-8 (doi: [10.5376/ijmz.2024.14.0001](https://doi.org/10.5376/ijmz.2024.14.0001))

Abstract Cats, as social animals, employ various methods to communicate and express themselves. This review aims to explore the diverse communication methods of cats, including vocalizations, postures, olfactory cues, and physical contact, as well as their cognitive abilities. Vocal communication is particularly prominent, with purring, meowing, growling, and hissing conveying different emotions and needs. Additionally, postures and movements also serve as a means of communication for cats, such as body rubbing, shoulder raising, and stretching. Olfactory communication, through licking and cheek rubbing, helps cats identify identities and states. Lastly, the review delves into the cognitive abilities of cats, including olfactory acuity, spatial awareness, problem-solving skills, and emotional recognition. These unique communication methods and cognitive abilities enrich our interaction with cats, providing deeper insights into their colorful inner world.

Keywords Cat communication; Vocalizations and postures; Olfactory and physical contact; Cognitive abilities; Social interaction

Cats, as typical representatives of social animals, communicate and express themselves in various complex and subtle ways. In human life, cats have become indispensable companions, and understanding their communication methods and cognitive abilities can help people better interact with them and establish deep connections. Whether they act as companions in leisure or exhibit fascinating behaviors in their own world, cats interact with humans in their unique ways (Turner and Bateson, 2014). However, delving into the communication methods and cognitive abilities of cats is a topic that few have genuinely contemplated. That's precisely why this review is fortunate to take this perspective, offering a glimpse into the mysteries of cat communication and the remarkable intelligence they display in adapting to their environment and forming emotional bonds.

In the communication of cats, various forms such as sound, posture, olfaction, and physical contact interweave to create a delicate language. Cat vocalizations include purring, meowing, growling, and hissing, each conveying different emotions and information (Vitale, 2022). Additionally, cat postures and actions play significant roles, such as body rubbing, shoulder shrugs, and stretching, expressing their emotional states and intentions. Olfactory communication is a unique method for cats, as grooming and cheek rubbing serve not only for grooming but also for conveying scent information, used for marking territory or expressing closeness. Furthermore, tactile communication is also vital in cat social interactions, with intimate physical contact conveying feelings of friendliness, closeness, and comfort.

At the same time, the cognitive abilities of cats are a fascinating subject of inquiry. Their acute sense of smell gives scent a prominent role in feline cognition, enabling them to identify the identity, emotions, and status of conspecifics through scent. Cats are also highly sensitive to spatial perception, accurately recognizing their territory and adapting to changes in different environments. Problem-solving ability is another standout feature of cats, as they tend to independently address problems, even using their paws, mouths, and other tools to solve them. In terms of emotional cognition, cats' sensitivity to their owners' emotions is astonishing, expressing joy, anger, sadness, and happiness through various cognitive behaviors, thus forming deep bonds with humans.

By delving into the social communication methods and cognitive abilities of cats, humans can gain a better understanding of these adorable creatures. This review will provide a detailed analysis of cat vocal communication, postures and actions, olfactory communication, tactile communication, and emotional cognition,

with the aim of revealing this unique form of communication between cats and humans and their profound cognitive abilities. Through this understanding, humans can harmoniously coexist with cats, creating a closer and warmer home environment.

1 Cats' Communication Methods

Cats, as precious companions in human life, bring joy and closeness to people through their unique communication methods. In this mysterious world, cats express their emotions and intentions through various means, including vocalizations, olfaction, and physical contact. This review will deeply discuss cats' vocal communication, including purring, meowing, growling, and hissing (Yeon et al., 2011), as well as other communication methods such as postures, olfaction, and tactile interactions, revealing their emotional world and means of communication.

1.1 Vocal communication

Sound serves as a vital avenue for cat communication, with different sounds representing various emotions and needs (McComb et al., 2009). Through sound, cats can convey information without the need for words.

Purring is one of the most comforting sounds cats produce, often evoking warmth and closeness. This sound is typically generated when a cat feels relaxed and content. When a cat curls up in its owner's embrace and softly purrs, it's expressing its happiness and comfort. Research indicates that purring occurs within a frequency range of 25 to 150 Hz, which may promote bone healing to some extent, making it a natural response in a cat's body.

Meowing is one of the most common sounds cats make, and it serves as a primary means of communication with humans. Cats meow in specific contexts, such as when they need food, want to go outside, seek companionship, or express dissatisfaction. The pitch and tone of meowing can convey the cat's emotions and needs. When cats are hungry, their meows may be sharper and more frequent, while meowing may sound more lingering and melodious when they feel lonely.

Growling is typically a sound cats make when they perceive a threat or harbor aggression. This sound is accompanied by behaviors such as puffing up their bodies, lowering their heads, and raising their fur, signifying their hostility and warning. Growling plays a significant role in feline social interactions, conveying intimidation during territorial disputes or resource conflicts, preventing conflicts from escalating.

Hissing is a sound often produced when cats feel uncomfortable or frightened. It is usually accompanied by open mouths, revealing sharp canines (Figure 1), and may be accompanied by paw swatting on the ground to exaggerate their intimidating appearance. When cats feel uneasy or threatened, they may use hissing as a tactic to deter potential threats.



Figure 1 A hissed cat

Through vocal communication, cats can precisely convey their emotions and needs, building deep connections with humans and other cats. These sounds are not just a part of a cat's daily life but also provide a window for

people to understand their emotional world (Saito and Shinozuka, 2013). In the world of cats, vocal communication is a subtle and fascinating language that deserves in-depth exploration.

1.2 Postures and movements

In the cat world, language isn't the sole means of communication. In addition to vocal communication, postures and movements play a crucial role in conveying emotions, intentions, and relationships among cats. Let's explore cat postures and movements in detail, including body rubbing, shoulder shrugging, and stretching.

Body rubbing is a common social behavior among cats and between cats and humans, representing friendliness and closeness (Bernstein, 2007). When a cat rubs its head, body, or tail against another cat or a human, it is, in fact, sharing its scent, expressing mutual recognition and friendship. This behavior is both a form of social interaction and a bridge for establishing connections, allowing cats to better understand each other's identity. Body rubbing can occur both within the home and when cats are exploring new environments. Regardless of the context, body rubbing highlights the emotional bonds among cats and between cats and humans.

Cats use postures and movements to convey emotions, with shoulder shrugging being a distinctive behavior when a cat is feeling wary, dissatisfied, or fearful. When a cat is nervous or feels insecure, it may tense its body, causing its fur to stand on end, making itself appear larger. This posture signifies the cat's unease and vigilance, as it tries to protect itself and appear more intimidating in situations involving unfamiliar or potentially threatening elements. The shrugging gesture fully illustrates the cats' self-protection awareness and the behaviors they adopt in the face of unfamiliar or unsafe situations.

Cats often assume a stretched body posture when they feel comfortable and relaxed. When a cat lies down, stretches out its limbs, and sometimes even rolls over, it's expressing satisfaction and relaxation. This behavior not only helps cats stretch their bodies but also showcases their inner calm and joy. This relaxed posture typically appears in environments where cats feel safe and comfortable, reflecting their emotional state and mental well-being.

Cats communicate a rich array of emotions and intentions through various postures and movements. Behaviors like body rubbing, shoulder shrugging, and stretching not only reveal their interactions with other members and humans but also provide a window into understanding a cat's emotional world. A deeper understanding of these postures and movements can help people better comprehend a cat's needs, emotions, and social relationships.

1.3 Olfactory communication

In the realm of cat communication, olfaction also plays a significant role. Through behaviors such as grooming and cheek rubbing, cats can convey scent information, mark territory, and express affection. Let's explore cat olfactory communication methods in detail.

Grooming is a common social behavior among cats, serving not only to maintain personal hygiene but also to convey scent information, strengthening their relationships. When a cat grooms another cat, they are not only taking care of their cleanliness but also transferring their scent (Figure 2). This scent information holds significant meaning within a cat group, helping to confirm identities, status, and mutual relationships. Moreover, when a mother cat grooms her kittens, she also transmits scent information in this way, reinforcing the bond between mother and offspring.

Cheek rubbing is a prominent behavior both in interactions among cats and between cats and humans. When a cat rubs its cheek against an object, another cat, or a human, it is essentially releasing a specific secretion from its cheek glands. This secretion contains individual information, essentially acting as a "scent business card" that can be smelled by other cats, enabling them to identify its source. Cheek rubbing not only helps mark territory but also conveys closeness and friendliness. When a cat rubs its cheek against another cat or a human, it conveys a message of an intimate relationship, aiding in building connections within social interactions.



Figure 2 Licking cat

Cats exhibit a high degree of sensitivity and importance toward scent information through olfactory communication. Behaviors such as grooming and cheek rubbing are not only forms of social interaction but also critical pathways for cats to understand each other, confirm identities, and establish relationships. A profound understanding of these olfactory communication behaviors can help people better understand cat social behavior and their emotional world.

1.4 Tactile communication

In addition to vocalizations, postures, and olfactory communication, cats also employ tactile communication to express emotions and build social relationships. Intimate physical contact is a common way through which cats convey friendliness, closeness, and comfort.

Intimate physical contact among cats is a straightforward and direct social method. When cats get close to another cat or a human, curl up together, or lean against each other (Figure 3), they convey closeness and a sense of security. This behavior strengthens the connection between individuals, building a more intimate social relationship. For instance, a cat might lie down next to its owner, allowing gentle strokes on its head or back. This close contact lets the cat feel the owner's care and warmth, simultaneously expressing trust and affection for the owner.



Figure 3 A cat curled up with its owner

Intimate physical contact is a particularly warm and meaningful behavior in the realm of cat communication. Through this means, cats express their affection and attachment to one another and reinforce their deep emotional bonds with humans. Understanding and respecting this form of tactile communication can strengthen the relationship between humans and cats, creating a more harmonious and warm communication environment.

In conclusion, cats communicate their emotions and intentions through postures, olfaction, and tactile interactions. Whether it's conveying friendliness, vigilance, closeness, or relaxation, these communication methods enrich the social world of cats and provide humans with an opportunity for a deeper understanding. Understanding these communication methods while interacting with cats can help establish more harmonious relationships.

2 Cognitive Abilities of Cats

Cats are a group of animals with remarkable cognitive abilities, and in their daily social and survival activities, they display various cognitive skills. From keen olfactory perception to emotional cognition (Vitale Shreve and Udell, 2015), cats process information in their unique way, adapt to environmental changes, and establish profound emotional connections with humans. This review will delve into the cognitive abilities of cats, including olfactory sensitivity, spatial perception, problem-solving, and emotional cognition.

2.1 Olfactory sensitivity

Cognitive abilities play a crucial role in the lives of cats, with olfactory sensitivity being a noteworthy feature. Olfaction not only plays an essential role in a cat's perceptual world but also holds significance in their interactions and cognition among themselves. The following will explore the olfactory cognitive capabilities of cats.

For cats, olfaction is a highly important sense. They possess highly sensitive olfactory organs capable of detecting subtle changes in odors. Olfaction serves multiple functions in the lives of cats, including locating food, identifying territories, confirming identities, and perceiving changes in their environment (Crowell-Davis et al., 2004) (Figure 4). Olfaction also assists cats in finding potential mates, understanding the emotional states of other cats, and sensing potential dangers. Therefore, olfaction plays an indispensable role in a cat's cognition, affecting their behaviors in social interactions and survival.



Figure 4 Sniffing cat

Cats use olfactory recognition to perceive each other's identities, emotions, and states. Each cat has a unique scent determined by the chemical substances they secrete from their bodies. When a cat licks or engages in behaviors like cheek rubbing with another cat, they are, in fact, exchanging scent information, enabling them to recognize one another. Furthermore, cats can identify the identities and emotional states of other cats by sniffing urine, feces, and other excretions. Olfactory abilities also allow cats to discern the freshness of food and even perceive the emotional states of their human companions, deepening the emotional connection between cats and humans.

The olfactory sensitivity of cats plays a vital role in their cognition. Olfaction not only helps cats acquire information about the world around them but also assists them in establishing connections in social interactions,

recognizing the identities, emotions, and states of other cats. A deeper understanding of a cat's olfactory cognitive abilities can enable owners to better meet their needs, provide suitable environments, and enhance understanding and communication between humans and cats.

2.2 Spatial perception

Spatial perception is an important component of a cat's cognitive abilities, with their sensitivity to territories and the environment playing a crucial role in their lives. Cats adapt to changes in their environment through perceiving and utilizing their surroundings.

A cat's innate territorial and environmental sensitivity is a fundamental instinct. Cats are highly territorial animals, preferring to establish their territories in specific areas and guarding them. This territorial perception allows cats to recognize which areas belong to them and which belong to other cats. They mark their territory with their scent through urine, cheek rubbing, and other means, serving as a warning to other cats not to intrude. Cats are also very sensitive to changes in their territories, allowing them to detect if the scents of other cats have entered their territory and take action when necessary.

Spatial perception enables cats to adapt to changes in their environment, whether it's the expansion of their territory or alterations in the external environment. Cats use their territorial perception to plan their actions, deciding when to enter specific areas and when to remain vigilant. When cats perceive the scents of other cats, they may take action to defend their territory. On the other hand, cats can also use spatial perception to adapt to changes in the environment, such as during household relocations or the introduction of new pets. They gradually adapt to new environments by exploring new areas, marking their scent, and observing the reactions of other cats.

The spatial perception of cats not only helps them maintain their territories but also enables them to adapt to ever-changing environments. By perceiving and analyzing their surroundings, cats can make appropriate decisions to protect their territories and survival. A deeper understanding of a cat's spatial perception abilities can help create a suitable living environment for them, allowing cats to adapt to changes more effectively and maintain their roles in social interactions.

2.3 Problem-solving abilities

Problem-solving abilities are a significant aspect of a cat's cognitive skills, and they often exhibit a tendency to independently solve problems, even using parts of their bodies such as their paws and mouths as tools to resolve challenges. This ability not only demonstrates their intelligence but also reflects their flexibility in adapting to complex environments and dealing with various challenges.

Cats are naturally inclined to independently solve problems. When faced with puzzles, they prefer to rely on their own abilities to find solutions rather than seeking help from other cats or humans. This independence is evident in their behaviors, such as when searching for food, exploring their environment, or reaching elevated places, where cats use their efforts to overcome obstacles and showcase their problem-solving abilities. This independent problem-solving ability is especially crucial in the wild for hunting and survival.

When solving problems, cats often use parts of their bodies like their paws and mouths as tools. For example, when they need to open door handles, move light objects, or access food, cats may use their paws to pull, push (Figure 5), or use their mouths to pick up and move objects. This behavior indicates that cats not only have the ability to analyze problems but also can determine when and how to use different body parts to solve them.

Research has also found that cats may employ various strategies when solving problems based on the specific situation, showcasing their intelligence and flexibility. While cats are less likely to seek human assistance compared to other animals like dogs, their problem-solving abilities remain highly remarkable. Cats exhibit independent problem-solving abilities when confronted with various challenges and issues, utilizing their intelligence and body parts to find suitable solutions. The existence of this ability not only enriches people's understanding of cat cognitive abilities but also demonstrates their powerful potential as social animals in adapting to their environment and overcoming challenges.



Figure 5 A cat scratching with its claws

2.4 Emotional cognition

Emotional cognition is a significant aspect of a cat's cognitive abilities, with their high sensitivity to their owner's emotions and their ability to express joy, anger, sorrow, and other emotions through cognitive behaviors being noteworthy research topics. Studies indicate that cats have the capacity to discern emotions and moods, perceive changes in human emotions, and respond through their behavior (Turner, 2021).

Cats exhibit a considerable sensitivity to changes in their owner's emotions. They can perceive their owner's emotional states, such as joy, anger, or anxiety, and may display different behavioral responses when their owner's emotions fluctuate. For example, when their owner is in a good mood, cats may become more affectionate and active, while during periods of low spirits, they may engage in more comforting behaviors, like staying close to their owner or softly vocalizing.

Cats express their joy, anger, sorrow, and other emotions through cognitive behaviors, which can be observed through their posture, expressions, and vocalizations. When cats are content and relaxed, they may assume stretched-out postures and purr, among other signs. Conversely, when cats are displeased or frightened, they may raise their shoulders, bristle their fur, and may even emit growls or hissing. Additionally, cats may choose different resting or hiding spots based on their emotions.

Research on emotional cognition helps deepen the understanding of the emotional communication between cats and humans, providing insights into their inner world. Cats can sensitively perceive emotional changes and respond through appropriate behaviors, which enables them to better adapt to and interact with humans (Bradshaw et al., 2012).

As social animals, cats communicate and express themselves through various means, including sounds, postures, olfaction, and physical contact. They possess the ability to discern emotions and moods, are sensitive to their owner's emotional changes, and express joy, anger, sorrow, and other emotions through cognitive behaviors. This array of complex cognitive and communicative methods enriches our understanding of cat cognition and behavior patterns, while also deepening the emotional bond between humans and cats.

3 Conclusion

Cats are truly remarkable animals that have developed a rich and diverse social communication system through various means, including sounds, body language, olfaction, and physical contact. Their cognitive abilities allow them to display remarkable intelligence and adaptability in social interactions, survival, and environmental adaptation. This review delves into the ways cats communicate and their cognitive abilities, revealing how they interact with humans and other cats, as well as how they adapt to their environments and form emotional bonds through cognitive behaviors.

In social communication, cats use vocalizations to express a wide range of emotions and needs. Sounds such as purring, meowing, hissing, and growling convey a cat's emotional state, allowing people to better understand their

inner world. Body postures and movements also play a vital role in feline communication, with behaviors like body rubbing, shoulder raising, and stretching conveying messages of friendliness, alertness, and relaxation. Furthermore, olfactory communication helps cats identify identities and emotions, playing a significant role in social interactions, such as cheek rubbing used for marking territory and expressing affection.

Cats' cognitive abilities are crucial in adapting to different environments. Their acute sense of smell allows them to detect subtle changes in odors, providing insights into their surroundings and other animals. Spatial awareness enables cats to quickly identify territorial boundaries and the presence of other cats while helping them adjust to new environments. Cats exhibit problem-solving skills by independently using their bodies to find solutions, which is especially important in their natural hunting and survival. Emotional cognition allows cats to perceive their owner's emotions and express joy, anger, sadness, and relaxation through cognitive behaviors, strengthening emotional bonds.

In summary, as social animals, cats have developed a diverse communication system that enables them to form close connections with other cats and humans through various means. Their cognitive versatility allows them to adapt flexibly to different environments, independently solve problems, and establish deeper emotional connections with humans. By gaining a deeper understanding of cat communication and cognitive abilities, humans can better coexist with cats, providing them with a home filled with understanding and care.

Author's contributions

XMY was responsible for conducting literature research, organizing, and writing the initial draft of this review. I have read and agreed to the final text.

Acknowledgments

I would like to express my gratitude to Ms. LMT for providing valuable and targeted feedback during the revision of my paper.

References

- Bernstein P.L., 2007, The human-cat relationship, In: Rochlitz I. (ed.), *The welfare of cats*, Springer, Berlin, Germany, pp.47-89.
https://doi.org/10.1007/978-1-4020-3227-1_3
- Bradshaw J.W.S., Casey R.A., and Brown S.L., eds., 2012, *The behaviour of the domestic cat*, CABI, London, UK, pp.161-174.
<https://doi.org/10.1079/9781845939922.0161>
- Crowell-Davis S.L., Curtis T.M., and Knowles R.J., 2004, Social organization in the cat: a modern understanding. *J. Feline Med. Surg.*, 6: 19-28.
<https://doi.org/10.1016/j.jfms.2003.09.013>
- McComb K., Taylor A.M., Wilson C., and Charlton B.D., 2009, The cry embedded within the purr. *Curr. Biol.*, 19(13): R507-R508.
<https://doi.org/10.1016/j.cub.2009.05.033>
- Saito A., and Shinozuka K., 2013, Vocal recognition of owners by domestic cats (*Felis catus*). *Anim. Cogn.*, 16(4): 685-690.
<https://doi.org/10.1007/s10071-013-0620-4>
- Turner D.C., and Bateson P., eds., 2014, *The domestic cat: The biology of its behaviour*, 3rd edition, Cambridge University Press, Cambridge, UK, pp.71-80.
- Turner D.C., 2021, The mechanics of social interactions between cats and their owners. *Front. Vet. Sci.*, 8: 650143.
<https://doi.org/10.3389/fvets.2021.650143>
- Vitale K., 2022, Normal feline social behavior, In: Stelow E. (ed.), *Clinical handbook of feline behavior medicine*, John Wiley & Sons, Inc., Hoboken, USA, pp.10-21.
<https://doi.org/10.1002/9781119653271.ch2>
- Vitale Shreve K.R., and Udell M.A.R., 2015, What's inside your cat's head? A review of cat (*Felis silvestris catus*) cognition research past, present and future. *Anim. Cogn.*, 18: 1195-1206.
<https://doi.org/10.1007/s10071-015-0897-6>
- Yeon S.C., Kim Y.K., Park S.J., Lee S.S., Lee S.Y., Suh E.H., Houpt K.A., Chang H.H., Lee H.C., Yang B.G., Lee H.J., 2011, Differences between vocalization evoked by social stimuli in feral cats and house cats. *Behav. Processes*, 87(2): 183-189.
<https://doi.org/10.1016/j.beproc.2011.03.003>