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Communication in the Domestic Cat

In its simplest definition, communication is said to occur when one animal responds to signals that are emitted by another animal. Communication may be direct and immediate, as in the case of two individuals of a social group greeting after a separation, or communication may be achieved indirectly and without a specific target, as in the case of scent marks left along a trail. Species-specific communication patterns evolve to enable individuals within a pair or group to interact with one another for social, territorial or reproductive purposes. The signals that are used may also be directed toward other species, as is seen during human-animal interactions.

Domestic cats recognize and understand one other regardless of breed, size, coat length, or the presence of absence of a tail. When interacting, cats use a variety of olfactory, visual, and auditory signals. While some of the cat's communication cues are very subtle and may be undetected or misinterpreted by human caretakers, others, such as demand meows and friendly body postures, are quite clear and easily understood by cat lovers. Understanding the cat's communication patterns and reacting appropriately allows the development of effective communication between human caretakers and their cats, and facilitates the development of a positive and lasting human-cat bond.

Olfactory Communication: Using scent to communicate has several distinct advantages for the domestic cat's ancestor, the African wild cat. Like many carnivorous species, African wild cats live a solitary existence for most of their lives, encountering other wild cats only during mating or when females are raising young. Using scent to mark territorial boundaries allows widely spaced individuals within a habitat to recognize others' territories and reduces the risk of aggressive encounters between cats. Scent marks remain in the environment for a period of time and so have the advantage of conveying information when the sender is not present. Scent marks appear to convey information about a cat's gender, reproductive stage and identity.

Like its wild progenitor species, the domestic cat is still territorial and uses several types of scent marking. However, the domestic cat also has evolved to live in close proximity to other cats, at densities that are often several orders of magnitude greater than that of wild cats. It is theorized that this modification in living conditions during domestication led to an expansion of the functions of scent communication for the cat. For example, cats who live in pairs or groups may use scent to produce group-specific odors for identification and group cohesiveness.[1] Scent marking also appears to be important during various types of social interactions between group members.

There are three primary ways in which cats deposit scent and use it to communicate with others. These include the scent deposited in urine, in feces,

and by specialized skin glands. Urine marking has probably received the greatest amount of attention, probably because this type of communication causes human caretakers the greatest amount of concern. Cats are capable of adopting two different postures for urination, one of which is primarily for elimination purposes and the second primarily for marking. When eliminating, most cats squat and then immediately cover the urine with dirt or litter. While covering urine may function to hide the odor, other cats do sniff areas of covered urine, and the duration of this sniffing is longer when the cat who deposited the urine is not familiar.[2] These observations indicate that even covered urine conveys information to other cats.

Deliberate scent marking with urine is most commonly achieved through spraying. A spraying posture is characterized by the cat adopting a standing posture and directing his back end toward a vertical surface. Urine is then sprayed backwards and upwards, usually onto the surface. The tail is held erect and often quivers as the cat voids urine. Urine spraying is most commonly observed in adult, intact males, but females may also spray. Intact female cats spray most frequently when they are in estrus, and intact tomcats increase their frequency of spraying when there is an estrus female in close proximity. Neutering often, but not always, prevents the development of spraying in companion cats.

The odor of sprayed urine is distinctly stronger and more pungent than that of normal cat urine. This is largely due to the presence of two unusual amino acids, felinine and isovathene, which are produced by the kidneys and excreted in the urine. These two amino acids begin to degrade shortly after the urine has been deposited, and the sulfur-containing by-products of this degradation are very odiferous. These compounds are responsible for the observation by cat caretakers that sprayed urine smells more offensive with time, rather than fading. Studies of cat marking behavior have shown that intact male cats excrete much more felinine in their urine that do intact females or neutered cats.[3] For example, an adult tomcat excretes about 95 mg felinine/day, compared with only about 20 mg/day excreted by female cats.

Historically, urine spraying has historically been interpreted to be a form of territorial marking, used either to deter others from entering an area or to advertise the presence of an individual. However, studies of feral cats have found that spray marks do not deter other cats, and that most tomcats do not use spraying as a method of marking the edges of their territories (see pp. ***).[4] Conversely, barnyard cats spray frequently when they are out hunting and they direct their spray towards visually conspicuous areas within the hunting area, rather than on its periphery.[5] When they detect spray marks, male cats intently investigate and smell the area and spend more time investigating if the mark was left by a female in estrus. This indicates that urine spraying may be a means of providing information about the depositor's identity, reproductive status, and territory, as opposed to being a "warning signal" to stay out of the area.

Cats who come into contact with sprayed urine first sniff the area very intently. Male cats usually spend a longer period of time investigating sprayed urine than females. Adult cats, especially males, also appear to be able to

discriminate between the urine of unknown cats, cats from a neighboring group, and cats within their own group.[6] In addition to sniffing, many cats also react to the odor of urine by displaying a Flehmen or gape response (see Chapter 3, pp. ***). When gaping, the mouth is partially open and the head is raised, and cat's tongue moves rhythmically along the roof of the mouth. These movements function to direct airborne and fluid-borne molecules of scent into the vomeronasal organs located behind the incisors. While the exact function of the vomeronasal organ is unknown, it is believed that the Flehmen response provides a method for a cat to obtain additional information from odors.

When investigating the urine of another cat, cats do not attempt to cover the urine by over-spraying with their own urine. This is dissimilar to dogs, who regularly over-mark the urine of other dogs. This failure to evoke over-marking suggests that sprayed urine does not convey information that intimidates or provokes aggression or fear in another cat, but rather primarily provides social information.

The feces of many carnivores, such as wolves and dogs, provide another form of scent marking. In many cases, glandular secretions are added to the feces as they are voided to provide additional information about the individual. However, it is not clear if fecal odors in the domestic cat have a function in intra-species communication. As with urine, cats usually bury their feces immediately after defecation. In fact, this natural tendency is one of the feline behaviors that allow humans to live so easily with cats in their homes. Studies of free-living cats have found that cats will consistently bury their feces when defecating near their nesting sites or within their home range. Conversely, they do not usually bury feces when they are out hunting or on the periphery of their territories. In fact, they often defecate in exposed and conspicuous sites while hunting. A possible function of burying feces while in the home area is sanitation and hygiene. Conversely, feces left exposed while out hunting may provide a territorial mark. Studies of the function of feces as territorial markers in cats have had inconsistent findings however, and it is still not clear if cats use fecal marks to communicate in the same way that they use urine marks.[7]

Cats have several types of specialized skin glands that are important for olfactory communication. These include the submandibular gland beneath the chin, perioral glands at the corners of the mouth, temporal glands on the side of the forehead, and sebaceous (caudal) glands along the base of the tail. Another important group of scent glands, the interdigital glands, are located between the pads of the feet. The secretions of the submandibular, perioral, and temporal glands are deposited as scent marks when a cat rubs her face and head on objects that are at eye level. The behavior of head rubbing on objects is referred to as "**bunting**" and can take place in isolation or following a Flehmen response to a urine mark or head mark of another cat (**Figure 8.1**). Many cats will direct bunting towards their owner's legs and on objects within their territories. Cheek rubbing is a very specific form of bunting, in which the cat first sniffs the target object, then rubs along a line from the corner of the mouth to the ear.

Free-living cats who are hunting alone revisit sites that they previously head marked within their home range, and will rub-mark these each time that

they investigate. As with urine spraying, adult intact males tend to rub-mark more frequently than females or young cats.[8] Females in estrus also will increase their frequency of head rubbing. Allorubbing (rubbing between cats) and sniffing are common in cats who are housemates or belong to the same group, and appears to function in social communication. When cats sniff each other, they tend to concentrate on the head region rather than the flanks and tail, suggesting that the glands of the head provide information about individual identification.

The final way in which cats deposit their scent is through scratching (**Figure 8.2**). This common and well known cat behavior plays an important role in conditioning the claws of the front feet, but also functions to deposit scent from the interdigital glands. House cats and free-living cats use the same scratching site repeatedly, resulting in a visual mark as well as an olfactory mark. Cats prefer to scratch surfaces that have a rough or hard texture, such as wood, or surfaces covered with heavy cloth. The surface may be either horizontal or vertical, although most cats seem to prefer to be able to stretch upwards while scratching. In addition, because many cats scratch immediately after waking, scratching may serve as a form of stretching. Free-living cats select scratching sites that are along well-traveled paths and routes, rather than on the periphery of their home range or territory.[9] Similarly, house cats tend to scratch in areas where they spend most of their time, like around resting platforms and eating areas. Since other cats do not investigate or mark over scratched sites, it appears that the olfactory function of scratching is a method of providing reassurance and security about territory to the resident cat, rather than as a means of defining territory for other cats who may come upon these marks (**Table 8.1)**.

Acoustic (Vocal) Communication: Vocal communication is important for the African wild cat because it provides an immediate method of communication that facilitates the spacing of individuals within a habitat range. Vocalizations also have the advantage of being effective over relatively long distances or when vision is obscured. The domestic cat is capable of a large range of sounds and uses vocal communication frequently. Many of the cat's vocal signals are contextual, meaning they can convey different messages depending upon the situation in which they are used. Human caretakers often become very adept at interpreting the nuances of their cat's utterances, and vocalizations can be very distinctive and unique to each cat.

Cat vocalizations can be categorized into three general groups, divided according to how the sound is produced (**Table 8.2**). These include murmur patterns, vowel sounds, and strained intensity calls. Murmur patterns are sounds that cats make with their mouth completely closed. The two most common murmur patterns are the purr and the trill/chirrup. The purr is the most interesting of all cat vocalizations, as it is ubiquitous among domestic cats. Kittens begin to purr when they are only a few days old and adults continue to purr throughout life. The purr is also unusual in that it is one of the few vocalizations that is produced during both inhalations and exhalations, rather than only during

exhalations as in most forms of vocalization. Purring is produced in the cat's throat through alternating activation of the intrinsic laryngeal muscles and the diaphragm. This causes a repetitive build-up and release of air pressure in the **glottis**.[10] The resultant air turbulence produces the purr sound, and both the air and the muscle vibrations are the sensation that humans feel then they hold a purring cat.

Although purring is most commonly associated with pleasure or contentment, cats purr in a wide variety of circumstances. Kittens purr while they are nursing or being groomed by their mother. Adult cats typically purr when they are in contact with a human caretaker or a familiar housemate, when resting quietly, or when they are rolling and rubbing. While all of these situations are decidedly pleasurable for cats, veterinarians report that some cats purr continuously when they are very ill or even in pain.[11] In most cases, purring is only observed when cats are in the presence of a human or a known cat, so purring may be an important method for social communication.

The second type of murmur pattern, the trill or chirrup, is commonly given by cats to their human caretakers or to familiar housemates upon greeting. Many cat caretakers refer to this call as their cat's "greeting murmur". This vocalization is also used in other amicable social encounters, such as to establish contact, when playing, or when asking for food. The volume of this murmur is often very low, and is also heard when a mother cat returns to her litter after a period of absence.

The second category of feline vocalization, vowel sounds, are made with the mouth open and gradually closing as the sound is emitted. The most common vowel sound of domestic cats is the "meow". Interestingly, the meow is a call that domestic cats direct almost exclusively towards humans, and they do not typically use it when interacting with other cats. Though cats' meows are extremely variable, all are uttered during amiable social encounters, to establish contact and friendly interaction, or to request interaction, play, or food. Individual cats are known to develop an entire set of meows for specific situations when interacting with their human caretakers. For example, a cat may use one meow when asking to be fed and another when demanding to be let out of a room. It seems that cats probably learn to produce and modify these sounds through associations with feeding, petting and other types of interactions. A second vowel sound of the cat is the female mating call, which is typically uttered during proestrus and estrus.

Strained intensity sounds are emitted with the mouth held open for the duration of the sound. These include the feline growl, hiss, and pain shriek and are typically used only in times of intense emotional stress. The growl is the lowest pitched sound made by cats, and is used during aggressive encounters (usually prior to the start of an actual fight). A very low-pitched growl is thought to have the effect of deceiving the other cat into believing that the sender is large and powerful. Conversely, the hiss is primarily a defensive sound, given only when a cat is frightened or cornered. The spit is considered to be a more intense form of the hiss, and is used to deter predators or overt threats. The male mating

call is usually categorized as a strained intensity sound. It is uttered during mating or when competing for estrus females.

Visual Communication (Body Postures and Facial Expressions): The cat has a very wide range of body postures and facial expressions that are used to communicate with other cats and with their human caretakers. Many of the body postures that cats use are intended either as **agonistic** displays or to inhibit aggression. This can once again be explained by the cat's evolutionary history. As a solitary animal, the African wild cat uses olfactory and auditory signals to minimize chances of coming into unwanted contact with another adult wild cat. However, should such an encounter occur, visual signals are used to either diffuse a potential fight or to signal defensive or offensive aggression.

Like many mammals, the cat alters its body size to convey either confidence or avoidance (fear) during agonistic encounters. A cat who is confident and on the offensive adopts a body posture that makes the cat appear larger than reality. Cats showing offensive threat have piloerection over the back, and extend the back legs to stand at full height. The ears will be drawn partially back, presumably to avoid damage from bites should a fight ensue. The cat gazes directly at his opponent, and the pupils of the eyes are constricted. The tail is held down and pointing toward the ground (not tucked), and the tip may be flagging slowly (**Figure 8.3**).

In contrast, a cat who is nervous or fearful during an encounter will display a defensive threat posture (**Figure 8.4**). Cats on the defensive show piloerection and present themselves towards their aggressor with an arched lateral display. This sideways display is thought to be an attempt to maximize the cat's visual impact, and as such, is an attempt to bluff. However, the cat's facial expressions belie this and show the cat's true state of mind. A defensive cat's ears are flattened down and back, the whiskers are drawn back, the corners of the mouth are pulled back to bare the teeth, and the pupils of the eyes are dilated. The tail is either erect or is concave with the tip pointed down. If an actual fight ensues, the defensive cat usually will flip over on his back, and keeping his ears pinned back, will use his back legs and claws to attack the more confident aggressor (**Figure 8.5**) Finally, a submissive (fearful) cat crouches on the ground, flattens his ears back, and generally attempts to look as small as possible (**Figure 8.6**).

The use of body postures is also important for the cat during encounters that are not agonistic, such as when greeting house mates or human caretakers, when soliciting petting or play, and during interactions between mother cats and their kittens. These body postures are often grouped together and categorized as "affiliative" postures. For example, cats use a greeting posture called active approach when they are reunited with a feline member of their group or with a human caretaker (**Figure 8.7**). The greeting cat approaches with her tail held vertically and the back legs slightly extended. When greeting humans, the cat will first touch the person very softly with her nose, followed by head rubbing to solicit petting. Many cats then rub along the person's legs from head to tail. When meeting another cat, the nose-touch is followed either by sniffing of the face and mild rubbing, sitting next to each other to groom, or by simply walking away.

Rolling is another affiliative posture. Female cats in estrus often roll when first meeting an interested male cat. Companion housecats also use rolling as an invitation to play and to solicit petting.

It is currently theorized that some of the cat's affiliative body postures are unique to the domestic cat (i.e. are not seen in the wild cat), and are a direct result of the process of domestication.[12] Several of the cat's body postures are exhibited only towards human caretakers and so may be an example of a true interspecies communication pattern that evolved as the cat began to cohabitate with humans. It is also possible that these communication patterns are a form of neoteny, in which some kitten behaviors have persisted into adulthood and are directed towards humans instead of a mother cat. Two behavior patterns seen in domestic cats that are not used in an affiliative context in the wild cat are "tail up" when greeting, and rolling as a friendly gesture to solicit petting or play. These behaviors are directed towards familiar cats within a social group and towards humans. Additionally, domestic cats regularly engage in social grooming with other cats within a social group or between housemate pairs. Cats also show social rubbing with their human caretakers, a behavior that is unique to the cat-human relationship.

Dominance and submission (social hierarchies) in the domestic cat: A final concept that should be discussed when examining feline communicative body postures is the utility of the concepts of social hierarchies and dominance when explaining cat relationships and communication. The behavior of some social species, such as the domestic dog, is explained using the model of social hierarchy. This model is predicated on the idea that maintaining a cohesive social group that functions with minimal strife is essential for the survival of individuals. Social ranking systems have evolved in many species to achieve this goal.

For some social species, especially social predators, dominant and subordinate relationships constitute designated roles of individuals within a ranked social group. This ranking facilitates social cohesiveness. In these groups, the dominant individual is defined as the animal who actively seeks out competition for social rank, either through the use of ritualized communication patterns or through overt aggression. Within a group, the dominant animal initiates aggression and displays of dominance with impunity, offers few submissive postures to other animals, and evokes deference and submissive displays from other animals.[13] The concept of dominance and the model of social hierarchies provides a useful method for explaining many (but not all) of the domestic dog's social interactions. However, although it is common for companion animal caretakers to attempt to apply this highly popularized theory of social behavior to the domestic cat, it is not an effective model for cats.

During domestication, the African wild cat slowly adapted to live in higher densities, and once domesticated, adopted group living in certain situations (see pp. ***). As a previously solitary predatory species that used communicative signals to avoid close interactions with others, this resulted in selective pressure for changes in communication patterns. In addition to increasing interactions

with others of its own species, the cat also was engaging in inter-specific communication with human caretakers, and slowly developed communicative signals to facilitate living in groups. However, the existence of established hierarchies within social groups has not been demonstrated and social rankings are not an important component of cat relationships. Although a single dominant male or female may exist within social groups of cats, there is little ranking beyond this. A dominant cat is typically described as simply the most aggressive cat in a social group. This does not conform to the accepted definition of a dominant animal as one who controls the access of others to resources such as food, resting places and opportunities to mate.[14] This type of resource guarding and control is not seen in cat social groups. Social rankings are not functional in cat groups in the same sense that they are for species who cooperate during hunting and protection of territory, such as the wolf. Dominant postures in cats are therefore simply offensive threat postures, while submissive postures function primarily to inhibit an attack or to convey a non-threatening (possibly fearful) message.

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