

Normal Behavior of Cats

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OUTLINE

The Biology of Cats, 191

Sense Organs, 191

Communication, 193

Learning, 195

Hunting and Feeding, 195

Grooming, 195

Social Organization and Density, 195

Time Budgets: What Do Cats Do All Day? 196

The behavior displayed at any time by an individual cat is the result of the interplay of genetic predisposition, what the cat has learned from previous experiences, and the current environment in which the cat finds itself. Although some behavioral patterns are common to all members of a species, others are unique to each individual. It is essential to understand the normal or common behavioral patterns of cats to assess the behaviors that owners are concerned about. Sometimes owners are concerned about behaviors that are normal for cats to express, such as spraying or predatory behavior. At other times, knowledge of the normal range of expression of a behavior pattern (e.g., grooming behavior) will help the veterinarian determine whether the behavior is normal and adaptive or abnormal and maladaptive.

THE BIOLOGY OF CATS

To understand the behavior of cats, the veterinarian must first look at the physical characteristics of the cat, such as its size and sensory capabilities, because these are intertwined with behavior. Only by appreciating the behavioral biology of the domestic cat is it possible to understand their behavioral needs.

The domestic cat is a small, crepuscular, solitary hunter of the felid family. Whether the domestic cat is a unique species or a subtype of the wild cat (*Felis silvestris*) of northern Africa remains controversial.¹⁶ The cat evolved in arid areas and hunts small animals such as rodents, frogs, birds, and reptiles. They are small, tending to weigh between 2 kg (4.4 lb) and 8 kg (17.6 lb) and

have large, forward-facing eyes; large, mobile ears; and sensitive vibrissae on the face that aid in detecting prey in dim light. They have large, ventrally flattened canine teeth and sharp retractable claws on all toes to catch, hold, and kill prey. The cat is an ambush hunter. It locates prey using its sensitive hearing, vision, and sense of smell. It then stalks the prey silently until it is close enough for a sudden rush and grab. Cats do not possess the stamina to chase prey for long periods. However, they are able to climb and jump up to five times their own height.¹⁶ Being small, they are potential prey for larger animals, so their agility is an advantage not only for hunting but also for escaping when being hunted.

SENSE ORGANS

Vision

One of the reasons that cats are so appealing to people is their large, prominent eyes. Large eyes are necessary for seeing (and hunting) in dim light. Cats' eyes have many characteristics to maximize the visual field and the collection of light entering the eye and stimulating the retinal cells.³ The cornea is large and bulges outward, which allows about five times more light to enter the eye than does the human cornea.¹⁶ The retina has approximately 25 light-sensitive rod cells for every color-sensitive cone cell. When rod cells in a cluster are stimulated by light, they all stimulate one nerve fiber. This results in cats being able to see in very dim light, albeit a fuzzy image.¹⁶ The tapetum lucidum under the retina reflects light back to maximize the chance of rods

being stimulated. This layer is what makes cat eyes glow yellowish green when light is shone into them. Cats have little need for color vision because they hunt mainly at night, and most prey species do not have a wide range of coat colors. It appears that cats can see yellow and blue wavelengths of light and can be taught to distinguish among red and other colors. However, this is difficult for them to learn, which suggests that cats are just not interested in colors.¹⁶

The lens of the eye has a limited capacity for accommodation. This means that a cat's vision is best at approximately 2 to 6 meters (6.5 to 19.7 feet) from the viewed object.¹⁶ This is why cats have trouble taking treats from an owner's hand. To maximize visual acuity, they have multifocal lenses that focus light at particular wavelengths. The slit pupil prevents the loss of visual fields that can focus at set wavelengths and maximizes the cat's vision.²⁷

Binocular vision aids the cat in judging distances for catching prey, climbing, and jumping. The binocular overlap is about 98 degrees, which allows cats to judge distances very accurately.^{3,16} Their accuracy is even more amazing in light of how short sighted they are. Cats are very attuned to even small movements in their visual field.

The eyes of cats are not functional at birth. The eyelids open between days 14 and 21. Vision develops with experience. If kittens are deprived of vision through blindfolding before their eyes open³⁰ or are housed in environments that are altered to show no horizontal lines, the kittens do not develop normal vision, even though the eyes are structurally and functionally normal.^{21,29}

Hearing

The large, mobile pinnae of cats act to collect and funnel sounds into the ear canal. Each ear can move independently of the other, and the ears can swivel almost 180 degrees, effectively giving them surround sound (Figure 10-1).

When tracking a sound, such as that of a prey animal, cats use a combination of the interaural time differences for sounds to reach both pinnae, level differences between the pinnae, and directional amplification effects of the pinnae to localize the sound and orientate their head.⁴ They are able to do this as both the prey animal and the cat are moving.

Olfaction

Cats have a well-developed sense of smell at birth. These nerves are myelinated at birth, in contrast to most other neurons in the nervous system. This allows signals to pass rapidly to the brain. The kittens use their sense of smell and touch to find the queen's nipples. If they are unable to smell, because of an upper respiratory tract



FIGURE 10-1 Cats' ears are large and mobile and can move independently, as well as swivel almost 180 degrees. (Photo courtesy Mats Hamnas.)

infection, for instance, kittens cannot find the queen's nipples and feed.²⁴

Cats use their sense of smell for locating prey and evaluating communication signals left by other cats. Odors play an important role in the social organization of cats and in reproduction. The feline nasal mucosa is between 20 and 40 square centimeters, small when compared with dogs, although it still eclipses the human nasal epithelium. To further aid in scent detection, the cat has two structures: the subethmoid shelf¹⁶ and the vomeronasal organ (VMO).²²

The subethmoid shelf traps air and scent particles taken into the nasal cavity allowing more time for them to stimulate receptors in the olfactory mucosa.^{11,28} The VMO sits between the oral cavity and the nasal cavity. It has connections with the nasal cavity and the oral cavity. The receptors of the VMO are different from those of the nasal epithelium. The gape or flehmen response may be performed after the cat has sniffed or even licked at a scent source. By wrinkling the upper lip and opening the mouth, the cat opens the ducts of the VMO and pumps saliva and the scent into the VMO.²² Cats cannot fully evert their upper lip as horses and cattle can because of the frenulum between the upper lip and upper jaw. The gape reaction is seen when tomcats encounter urine from another cat. However, queens and neutered cats also exhibit this behavior when investigating odors.

Touch

Anyone who has petted a cat knows how important physical contact is to cats. Touch is used as a means to build social bonds within feline social groups. The response of cats to touch and temperature varies across their bodies. Cats do not react to temperature on their

bodies until the temperatures reach 51° to 54° C (124 to 129° F). However, the skin around the nasal area is exquisitely sensitive to temperature changes, reacting to temperature increases of 0.2° C and decreases of 0.5° C. This ability is an advantage for locating prey. Cats have individual differences in their preferences regarding petting and handling. Some like very strong pressure, whereas others prefer a light touch.

Cats have specialized tactile vibrissae on their faces and forelegs. The vibrissae are long, thick hairs that are obvious against the coat of the cat. They sit in a large follicle with a sebaceous gland attached. Striated muscle attached to the follicle allows the vibrissae to be voluntarily moved. The follicle has several nerve receptors associated with it. These are sensitive to pressures on the vibrissae as light as 2 mg or 5 Angstrom,¹⁵ and they are sensitive to movement of the vibrissae from the normal position.

The facial vibrissae, better known as the whiskers, are synonymous with cats. These are arranged in rows on the upper lips. The upper rows move independently of the lower rows. Cats fold the whiskers back when relaxed and spread them when walking or showing interest in something. Because cats cannot see things that are close, their whiskers are important for the location of prey, food, water, and other objects close to the face. Whiskers also aid in spatial awareness. Cats have a superciliary tuft above each eye and two tufts between the ear and point of mandible known as genal tuft 1 and 2. Genal tuft 1 is dorsal to genal tuft 2. These vibrissae also help in spatial awareness. There are also vibrissae on the back of both carpi just dorsal to the accessory pad. It is thought that these tufts aid the cat in using its forelimbs for activities such as hunting.

Taste

The sense of taste is important to cats. They have two types of taste buds on their tongues: mushroom-shaped papillae at the front and sides of the tongue and cup-shaped papillae at the back of the tongue. Cats can taste salty, bitter, and acid. They have little reaction to sucrose and tend to drink sweet water only if the sugar is masked by salt. In fact, cats lack the ability to taste sweetness, unlike other mammals. The taste receptor for sweetness is made up of two proteins generated by two genes, *Tas1r2* and *Tas1r3*. In cats the *Tas1r2* gene does not code for the normal mammalian protein, thereby impairing the function of taste receptors for sweetness.²⁶

COMMUNICATION

Cats send signals using body language—that is, by changing their posture, the position of their limbs and ears, and the size of their pupils and by puffing up their



FIGURE 10-2 When a cat feels threatened, it will arch its back and puff up the hair coat in an attempt to appear larger. (Photo courtesy Mats Hamnas.)

fur to appear larger. Cats are very expressive, and it can help when learning cat communication signals to look at each area of the body separately.

Body Language

Body

Cats send messages to other cats and animals and humans by using their bodies. The size of the body, the shape of the body, the position of ears, size of pupils, size and position of the tail, and visibility of weapons such as teeth all convey important messages to others. In general terms a confident cat stands tall and evenly on all four feet, with its tail up or level with its back and its ears facing forward. An attacking cat usually makes itself appear larger by standing at its full height and bristling its hair coat. The tail will also be raised, with its fur puffed out. When a cat really wants to convey a message to an opponent that it is ready to fight if the other does not back down, the cat will arch its back (Figure 10-2). The more fearful a cat is feeling, the lower its body gets to the ground. An uncertain cat may take the middle road, often lowering its rump while keeping its forelegs available for striking.

Ears

An interested cat will have its ears rotated forward. A frightened cat will have its ears flat and facing backward. Cats that are attempting to bluff another cat or that are uncertain will hold their ears halfway between forward facing and flat and backwards.

Eyes

Interested cats will look at the person or object of their interest. Cats will stare at other cats or people as an aggressive signal. This should not be confused with

making friendly eye contact. Aggressive stares are intense. Friendly eye contact can be soft and often the cat may blink in an exaggerated manner. Less confident cats and cats that wish to avoid a physical altercation will avoid looking at another cat or a person who is staring at them. In avoiding the eye contact, the cat may simply look away or, if it is feeling very uncomfortable, may engage in intensive grooming—hence the important feline rule of thumb: “When in doubt, wash.” Often, other cats will avoid looking at a cat that is engaged in a bout of composure grooming. In scientific language the grooming strategy is a displacement behavior that occurs when a cat feels threatened but is unsure if it should run away or stay put.

Tail

Cat tails are extremely expressive and rarely still. Vertical tails are seen at greetings, during play, and in the female during sexual approaches. It is thought that cats raise their tails in acknowledgment of the higher social status of another cat.⁵ For example, kittens show the behavior toward their queens. Horizontal tails are seen during amicable approaches. A lowered tail is seen in aggressive incidents, and a tail held between the legs is seen when a cat wants to avoid any altercation. The concave tail position, in which the tail is held vertically from the base and then curves over so that the tip points at the ground, is often used in aggressive incidents but may also be seen during play.

Vocalizations

The noises cats make have been studied for many years because their sense of hearing is more sensitive than that of humans and because cats were used as the animal model for the development of the cochlear implant, or bionic ear.⁸ The sounds cats make can be divided into three main categories: sounds made with the mouth shut, sounds made with the mouth initially open but then closing, and sounds made with the mouth held open. Some sounds are specific to particular circumstances, such as the sounds a queen makes for her kittens.

Closed Mouth

There are two sounds included in the closed-mouth category. They are the purr and the trill/chirrup/greeting meow. Purring has fascinated people for a long time. It is a monotone sound made by cats in a wide range of situations. However, the common feature of all situations appears to be cat-to-cat or cat-to-human contact. Interestingly, cats also purr when in extreme pain. There is little information to explain why this occurs, but some think it may be the cat’s attempt to calm itself. The trill/chirrup/greeting meow is, as its name suggests, uttered on contact with a known and liked cat or person.

Open-Closing Mouth

There are four sounds included in the open-closing mouth group: the meow, the long meow, the female call, and the mowl (a male call, also known as *caterwaul*). Only the meow and long meow will be considered here, insofar as they are social communications that are often directed at humans.

The meow is a general communication sound for cats, with the long meow being a high-intensity version of the ordinary meow. Many cats have expressive meows that can be identified as having different meanings by humans. The variety in the meows of cats appears to be due to individual differences among cats and, for meows directed at people, the result of interactions with humans. The role of the long meow in cat-to-cat communication is unclear at present, but many cat owners know what their cat means when it directs a long meow at them (e.g., “Open the door, please!”; “Hurry up with the food already!”).

Open Mouth

Open-mouth sounds are the sounds of aggression—that is, the growl, the yowl, the snarl, the hiss, and the spit. Growling, yowling, and snarling are used when the cat signals that it is threatening or actively attacking, whereas hissing and spitting tend to be used in defensive aggression when the cat is threatened or attacked.

Odor Signals

Cats recognize members of their social group or a cat with which they have fought by appearance and smell. Each cat has its own particular smell, the result of secretions from glands in the skin of the corners of the mouth, sides of the forehead, and along the tail. Feline greeting behavior involves sniffing these areas and around the anus. Cats will rub or bump their faces against objects, people, familiar dogs, and other cats to spread their scent. It has been suggested that this behavior forms a group scent, which identifies members of a particular social group. Members who go missing from the group may initially be rejected until they smell “right” again. This is why it can be useful in multicat households to rub a newcomer or a recently absent feline family member with a towel that has been rubbed over the other cat members of the family. The fact the cat smells “right” can speed its acceptance into the group.

Urine

Long-term odor signals are posted prominently using urine sprayed on vertical surfaces. The urine can be very pungent and serves to inform other cats as to the gender and sexual status of the cat claiming the territory. Before spraying, the cat may sniff the area and may show a flehmen response. It will then back up to the vertical surface and eject a small, strong jet of urine onto the

surface. The tail is held upright and typically quivers as the urine is voided.

Cat urine owes its characteristic odor to volatile chemicals, some of which have the precursor feline, a unique sulfur-containing amino acid. Feline is unique to certain *Felidae* species, such as the bobcat and domestic cat. Feline concentrations are highest in intact male cats, lower in castrated male cats, and lowest in female cats.¹⁸ It takes about 5 days after castration for feline levels to decrease in urine.¹⁸ The biological function of feline is unknown, but it is believed to be a pheromone precursor.

Spraying behavior differs between the sexes, with intact male cats spraying more than castrated male cats and intact queens. Spayed queens are the group least likely to spray. Spraying increases when queens are in season (estrus). Some cats also spray if they feel worried or anxious. However, cats do not spray because they are angry, spiteful, or mean.

LEARNING

Cats are born with behavior patterns for feeding, hunting, grooming, marking, and reproduction already hard-wired in the brain. Another way of describing these behaviors is being instinctive. Instinctive behavior in cats is refined through learning and experience. Kittens instinctively orient themselves toward high-pitched sounds, and experience helps them learn how to localize the sound; identify it; and then potentially stalk, pounce, and catch the small rodent.

Experience is gained largely through trial-and-error learning. This type of learning describes the way cats learn about their environment by interacting with objects of interest. When cats are repeatedly exploring and manipulating objects, one of the following occurs: they receive a payoff (positive reinforcement); something aversive occurs (positive punishment); or nothing happens, in which case they learn there is no value in interacting with the object.

Cats use trial-and-error learning when learning how to apply instinctive behavior patterns. Thus naïve cats know how to catch new prey species, but their technique improves with experience.^{6,7} However, kittens are capable of some observational learning. Cats also appear able to learn by watching other cats acquire a new skill.²⁰ Kittens can learn by watching the queen demonstrate hunting and killing behaviors.⁶

HUNTING AND FEEDING

The cat is an obligate carnivore that evolved to hunt small animal species—mostly mice and rats but also lizards, frogs, birds, and insects. Cats will also scavenge food from human rubbish.

Cats show distinct behavioral patterns when offered palatable and unpalatable foods.³² When the cat is investigating food, it sniffs at palatable foods and generally licks its lips and sniffs around the food before consuming it. When presented with an unpalatable food, the cat behaves differently, possibly sniffing at the food and then licking its nose. It may then groom its chest and body. After eating, the cat usually grooms its face and body.

GROOMING

The grooming behavior of cats is familiar to most people. Grooming plays a very important role in the self-care and maintenance of cats but can also be performed when the cat is anxious; when performed on another cat, an activity called *allogrooming*, it helps create or reinforce a social bond.

Cats spend approximately 8% of their time awake engaged in grooming behavior.¹³ Most of this time is spent licking multiple areas of the body. A very small percentage of grooming time is spent scratching at a single area with the hind leg.¹³ Grooming removes dead hair and skin parasites. When cats are prevented from grooming, they have higher numbers of fleas than cats that are not prevented from grooming.¹² Cats with fleas groom themselves at a much higher rate than cats that do not have fleas. Cats ingest about two thirds of the hair that they lose annually.¹⁹

As previously mentioned, grooming can be used as a displacement behavior when cats are anxious or after acute stress.³¹ It is not surprising that a common presentation of anxiety in cats is overgrooming, which can lead to hair loss and skin damage.²⁵ Grooming may also be used as a cutoff signal to avoid an aggressive encounter with another cat. Allogrooming is seen among bonded members of a social group.⁹

SOCIAL ORGANIZATION AND DENSITY

The normal social organization of cats is variable, which may be one reason that cats have been so successful as a species. Rather than being easily described by one social system, they are highly variable as to how they can live and organize themselves socially.²³ Cats can be found living as solitary animals, intolerant of other cats, and as members of large, crowded colonies, as well as every variation between those extremes.

Although cats are solitary hunters, insofar as their prey are small animals best caught by a single hunter, it is generally accepted that cats are a social species that form complex social groups.⁹ Cats can live in a variety of social group structures. These include being solitary



FIGURE 10-3 Long-term associates will often be found together and will share sleeping and resting places. (Photo courtesy Susan Little.)

unless mating or raising young to forming stable social groups. The composition of the groups varies in part with the distribution and abundance of food and the sex of the cats. Where food is abundant, cats will gather together and form structured groups.

A population of cats within an area can be considered a colony.⁹ Within a colony the cats will form affiliative and antagonistic relationships. Affiliated cats greet one another, rub heads and bodies, and sometimes twine their tails; as previously discussed, they may groom one another.⁹ It is thought that this behavior helps create a group odor that identifies all members. Long-term associates will generally be found together and may share sleeping spaces and food (Figure 10-3).¹ There are differences between the sexes with regard to social contact, with one study of 60 two-cat households finding that male cats spent more time in close proximity than did female cats² and another study finding a lack of affiliative behavior among feral male cats.¹⁰ Antagonistic encounters are rare in a stable colony. Cats that do not get along tend to avoid each other and use time-sharing arrangement to access shared areas.

Queens generally form groups with their kittens. Queens may raise their kittens with other queens. These kittens have been found to leave the nest sooner than kittens raised by the dam alone: 20 days for group-reared kittens compared with 30 days for single-reared kittens.¹⁴

Intact male cats may join groups briefly. For intact male cats, spending time with queens is important to increase the chance of being able to mate when the queens are next in heat. However, spending too much time with one group of queens reduces the time available to spend with other queens. There is a trade-off depending on how closely the groups of cats live.



FIGURE 10-4 Territorial boundaries are maintained by visual and olfactory signals left by scratching on vertical surfaces. (Photo courtesy Mats Hamnas.)

Neutered male cats often form close bonds with other cats.

Cats are territorial. Territory boundaries are maintained with visual and olfactory signals in the form of scratching on vertical surfaces and depositing urine, feces, or both (Figure 10-4). Surrounding the territory is the home range, which may be shared in part with other cats. The size of the home range is directly related to the density of food sources. Where food is abundant, home ranges may be as small as 0.2 acre for female cats and 2.1 acres for male cats. In areas with less abundant food, ranges have been measured at 667 acres for females and 1038 acres for males.³

TIME BUDGETS: WHAT DO CATS DO ALL DAY?

Although cats are thought of as nocturnal, they are better classified as crepuscular animals, insofar as they are most active at dawn and dusk. They tend to spend most of their time resting.¹⁰ Laboratory cats have been found to sleep approximately 10 hours a day, with short intervals of activity adding up to approximately 1 and ½ hours.

During hot weather cats spend more time lying stretched out, whereas in colder weather they spend more time curled up. One study of urban cats found a positive relationship between nighttime activity of cats and nighttime weather, with cats being less active on colder nights.¹⁷ Rain decreased cat activity, and cat activity increased in spring, before waning in autumn.¹⁷

Grooming and self-care behaviors such as hunting, foraging, and feeding take 50% of cats' time.¹³ The time spent in social interactions has not been measured.

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