

I understand you, do you understand me? Feline communication and implications for human-cat interaction

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INTRODUCTION

Nowadays, for pet cats, human interaction is a daily occurrence and, for many, interacting with other cats is a very common encounter. It is therefore vitally important to ensure such interactions occur in as welfare friendly a manner as possible; minimising distress, reducing risk of injury (from scratching and/or biting) and improving veterinary care (e.g. allowing a full physical examination). In order to achieve such aims, mastering three key skills are essential;

- 1) identification - correctly identifying a cat's behaviour and body language alongside the context the cat finds itself,
- 2) understanding - comprehensive understanding of the emotional-motivations (Panksepp, 1998) that drive both behaviour and body language and
- 3) deduction – utilising such information to create reasoned deductions as to which emotional-motivation(s) a cat may be experiencing at any one time. Empirical studies in this area are becoming more commonplace and should be utilised alongside professional experience to successfully recognise and interpreting feline communication (and the underlying emotional-motivations) as the first step towards promoting the welfare of cats.

WHAT IS COMMUNICATION?

Communication involves the transfer of information from one individual to another. Information transfer alters the likelihood of a change in the recipient, which can take several forms: cognitive; physical; physiological; emotional; and behavioural. Such changes may be of benefit to the sender, the receiver or to both. The information being communicated can take many forms comprising changes in behaviour, body language and posture, release of specific chemicals, vocalisations and physical contact. Such transfer of information can be either intentional (eg, a cat hisses at another in an attempt to physically displace it) or non-intentional (eg, a cat may lick the area of the base of its tail when feeling in conflict, and while such behaviour may not be intentionally directed towards a specific receiver, we, as humans can identify and use recognition of the communicative information to make an assessment of a cat's welfare.

The meaning of the information that cats communicate to others also takes many forms, for example, a cat may communicate:

- emotional-motivation, eg, fear
- intention to act, eg, to approach,
- internal state, eg, hunger
- fitness, eg reproductive state.

WHAT IS AN EMOTIONAL-MOTIVATION?

We cannot think of feline emotions in the same way as human emotions because, although we are both mammals, we do have very different brains. As people, we are able to:

- report on our feelings to others
- self-reflect on them
- understand how they influence how behaviour
- comprehend how they relate to experiences in the past and also how they may influence future events in our lives.

Life is slightly more simpler for the cat without such high-level cognitive abilities. The emotions cats experience stem from the ancestral part of the mammalian brain (which part we do share) and are often called emotional-motivations and are responsible for instinctual emotional arousal which is one driver of feline behaviour. One widely used theoretical framework within which to view such emotional-motivations and interpret behaviour and body language is that developed by neuroscientist Panksepp (1998). His approach categorises emotional-motivations into positive emotional-motivation systems:

- SEEKING [reward expectancy]
- PLAY social play]
- LUST [sexuality]
- CARE [nurturance]

and negative emotional systems:

- RAGE [frustration]
- FEAR [fear and anxiety]
- PANIC system [separation distress].

In addition, the emotional motivation of pain, although not considered by Panksepp as a distinct emotional system (but instead part of the FEAR system), is of paramount importance when it comes to reading behaviour and body language in the veterinary clinic. See Steagall et al (2019) for interpreting the facial expressions of the cat for pain.

CHALLENGES TO UNDERSTANDING FELINE COMMUNICATION

There are several challenges when trying to understand feline communication. In comparison to other companion animal species, the cat is often considered to be relatively difficult to read in terms of recognising and understanding the intent of its behaviour, body language, postures, vocalisations and other communicative signals. Such difficulty most likely relates to the subtle nature of much of cat body language, particularly aspects commonly used at close range (e.g. facial expressions). This is no surprise when we consider the relatively recent evolution of the domestic cat from a highly solitary species. The cat therefore lacks the complex visual signaling repertoire seen in socially complex mammals such as dogs and primates. Much communication has evolved for a feline recipient and thus our sensory modalities may not be sensitive enough to detect all aspects of feline communication. For example, we may be able to see that a cat has sprayed urine from the wet mark left but we are unable to detect the chemical components (without chemical analysis) of such urine and consequently limited in our ability to interpret their meaning.

To further complicate matters, communication exhibited in different contexts can also appear very similar in presentation but may have very different meanings, for example, purring occurs in situations where a cat is experiencing a positive emotional-motivation (e.g. SEEKING) and in situations where a cat is experiencing a negative emotional-motivation (e.g. pain). Similarly, communication in the same context can often look very different at different time points or between different cats. Thus, as well as a solid scientific understanding of feline communication, experience observing many cats in many situations is paramount to decoding the cat.

VISUAL COMMUNICATION (EYES, EARS AND TAIL)

What information does a cat convey through its eyes?

It is commonly described in various texts on cat communication that a cat who blinks slowly is one who is signalling its relaxed (Bateson & Turner, 2000; Ley, 2016) and contented state yet there is little scientific evidence to date to substantiate this. However, professional observations show that cats will often slowly blink when being greeted in an amicable way by another person. However, this is only true if the cat perceives the person as positive. A recent study found that the blinking frequency of cats increased as the distance between person and cat decreased (Koyasu and Nagasawa, 2019), suggesting that at very least, blink rate increases with increasing arousal. An approaching person is likely to increase arousal in the cat, regardless of whether this arousal is positive or negative. Indeed, a much more rapid blinking has been witnessed to occur when a cat is experiencing a negative emotional-motivation in relation to the approach of a person. Interestingly, both blinking and half-blinking have been shown to be associated with the emotional-motivation of FEAR when a cat is in close proximity to or interacting with a person it is not comfortable with (Bennett et al, 2017). The rate of blinking was not specified but the sampling time for which blinking was coded as occurring or not was only two seconds long suggesting if blinking occurred, it must have been relatively rapid. Such blinking may have the function of protecting the eyes from perceived harm as well as possible communicative function. Eyes completely closed have been reported as a sign of high level pain (Merola and Mills 2016) and in these cases, can generally be differentiated from relaxed shut eyes by the tight pressing of the lids together, often causing creasing in the inner corner of the eye.

Where a cat looks is also important information in terms of understanding its underlying emotional-motivation. There is some evidence to suggest that at lower intensities of fear (eg, when cats in hospital cages are observed from a distance) their head is turned to the left-hand side more than the right (Bennett et al, 2017). Interestingly, across many species, a left-gaze bias is

associated with right hemispherical dominance for the processing of more negative stimuli.

What information does a cat convey through its ears?

It is commonly thought that erect forward-facing ears generally indicate a cat that is in a positive state (whether relaxed, explorative or other). However, they can also occur in situations where a cat is being offensive towards another cat, for example, when blocking access to a resource. Flattening and rotation of the ears appears a little more complex to decipher – while both tend to occur when a cat is experiencing a negative emotional-motivation, there has not always been scientific consensus as to why and when cats flatten their ears and why and when they rotate their ears and why and when they do both.

Preliminary research has indicated that cats tend to flatten their ears downwards when in contexts associated with acute anxiety or fear-inducing stimuli, at least when in close proximity to or interacting with a person (Bennett et al, 2017). In very fearful cats, approach of a person has been observed to lead to a cat's ears becoming so flattened (a combination of moving downwards and also rotating backwards against the head) that they are no longer visible, producing a very rounded head shape. The context of an approaching person and retreat (which is desired due to fear of the person) is not possible, such as the case in caged or physically restrained cats, frustration cannot be ruled out as an additional underlying activated emotional motivation since the cat is denied the opportunity to escape to safety – a resource it desires. Therefore, the flattened ear position observed in domestic cats may reflect a combination of the two emotional-motivational systems being activated.

Like eye gaze, movement of only one ear (known as lateralisation of ear movement) has also been shown to be associated with the emotional-motivation of fear. Siniscalchi and colleagues (2016) found that cats were more likely to rotate their left ear (and turn their head in this direction) than their right when orientating to the potentially threatening sounds of a dog vocalising. They were also more likely to rotate their right ear (and turn their head in this direction) when hearing cats meowing and purring.

What information does a cat convey through its tail?

In undomesticated cats, holding the tail in a vertical position is related to urine spraying. However, in the domestic cat, the tail is also held up when approaching another (cat and human) with friendly intent. The function of the 'tail-up' signal has thus been proposed as inhibiting intraspecific aggression (Cafazzo & Natoli, 2009; Cameron-Beaumont 1997). During the 'tail-up' signal, the tail is raised almost vertically and remains relatively still although the tip of the tail is often slightly bowed (Cafazzo & Natoli, 2009). This differs from the tail position held during spraying where the tail is usually held completely vertical but often quivers from side to side. Allo-rubbing (a cat rubs its body, head and neck along the body of the other cat) and sniffing noses (two cats sniff each other's noses) are commonly associated with the 'tail-up' signal when directed towards another cat, but not when directed towards a person suggesting there may be slightly different functions at play (Cafazzo & Natoli, 2009; Cameron-Beaumont 1997). Studies using two dimensional silhouettes of cats have shown that cats were more likely to raise their own tail in the 'tail-up' posture and approach faster when viewing a silhouette of a cat displaying the 'tail-up' signal in comparison to a similar silhouette but with its tail down. In fact, the tail down silhouette was associated, in some cases, with fearful postures in the responding individual (Cameron-Beaumont, 1997). If a receiver responds to a 'tail-up' signal by lifting its own tail in such a way, there is a higher probability that the interaction proceeds and other affiliative behaviour occurs (Cafazzo & Natoli, 2009).

Other movements of the tail have received little scientific study but vast professional observations have deduced that a quick moving tail is usually indicative of heightened arousal, which can be of positive, or negative valence. Individual cats also tend to show a great deal of variation in the movement of their tail and their tail carriage when relaxed and thus it is particularly useful to note what is normal for a particular cat as one cat's relaxed tail movement and carriage may be indicative of increasing arousal and discomfort in another.

AUDITORY COMMUNICATION

What information does a cat convey through its meows?

The meow is a common occurrence in cat-human interactions, yet is rarely heard during adult domestic cat-cat interactions, suggesting its target audience is primarily human (Bradshaw et al, 2012). Cats have been documented to meow to people in a variety of different contexts including when they want something such as food, when they are frustrated as in situations where they cannot navigate a barrier such as a closed door and during affiliative interactions (Ellis et al, 2015; Nicasatro & Owren, 2003). A recent study showed that meows emitted during confinement continued to occur at the same rates with repeated

occurrences of the confinement (whereas movement decreased) suggesting it is a relatively reliable measure of distress in this particular situation (Urrutia et al 2019). Furthermore, Fermo and colleague (2019) found the only vocalisation to be emitted in the negative context of car transport was meowing. Although meowing was also found in the positive context of being offered food, other vocalisations such as trills and purring were also recorded. Thus a context hypothesised as negative where meows are heard without any other vocalisations may add weight to your hypothesis.

People can find it difficult to identify the exact context a meow occurs in and the meaning of that meow vocalisation when they hear it in isolation, out of the context it was produced in (Nicastro & Owren, 2003). However, a person's ability to correctly identify the context improves slightly with experience of the species (Nicastro & Owren, 2003) and improves even further when the vocalising cat is their own (Ellis et al, 2015) although not to levels that would suggest the domestic cat, as a species, has a context-specific repertoire of human-directed vocalisations.

What information does a cat convey through its purring?

Scientific study has documented that there are two situations in which cats purr – one occurring when they are relaxed and contented and another when they are actively seeking food or attention (e.g. the emotional-motivation of SEEKING is active). The latter is known as the solicitation purr and has been shown to contain high-frequency voiced components that are not commonly contained within purrs produced in the relaxed (non-solicitation) contexts (McComb et al, 2009). These high-frequency voiced peaks occur at approximately the same frequency as human infant cries (220–520 Hz in the cat compared with 300–600 Hz in the human), and have been interpreted to function as a subtle means of exploitation, tapping into inherent mammalian sensitivity to such cries (McComb et al, 2009). Furthermore, such purrs are perceived by human listeners as being significantly more urgent and less pleasant than “non-solicitation” purrs. Consequently, they have been hypothesised to be difficult for people to ignore – owners will often attend to their cat on hearing this purr by giving it attention and feeding it, highlighting the cat's advantageous ability to manipulate recipient emotion, and subsequent behaviour (McComb et al, 2009). Anecdotally, veterinarians have reported a third context where cats can be heard purring and that is the context of pain and/or distress (Robertson, 2016). Female cats will also purr during labour, another situation of possible discomfort. Purrs in such contexts have not yet been scientifically investigated and thus possible functions of such purrs are purely speculative but involve hypotheses comprising cries for help and self-calming behaviour – the latter being more probable.

CHEMICAL COMMUNICATION

Cats use pheromones a great deal in intra-specific communication, utilising their well-developed vomeronasal organ to detect both the pheromones they deposit and those deposited by other cats. Pheromones are produced in several specific gland sites across the cat's body and are thought to be deposited through facial rubbing, flank rubbing, tail wrapping, urine spraying, middening and scratching. In the case of facial rubbing, flank rubbing and tail wrapping, pheromones can be deposited directly onto another individual whereas in the other cases, deposition is generally within the physical environment.

What information does a cat convey through its urine?

It has been proposed that cats spray urine in their environment as part of a “time-plan” spacing mechanism to communicate to other cats where they have been and when they have been there without having to actually meet them face-to-face. For an animal that has evolved from a solitary ancestor, cats unknown to one another tend to try and avoid meeting as such face-to-face encounters can often result in overt aggression, particularly when related to territorial disputes. It is therefore safer for a cat to have a way of communicating their presence in space and time without actually being there. Spraying urine appears to be the main mechanism by which they do this with cats being shown to be able to discriminate between urine of different ages and from different donors (De Boer, 1977; Suzuki et al, 2019). In a study involving free-ranging cats, reactions to sprayed and excretory urine marks from unfamiliar and familiar cats (who were part of the same social group) were investigated (Natoli, 1985). Sprayed urine from an unfamiliar entire male cat elicited the greatest amount of sniffing, significantly differing from responses to all other samples of both genders. The reaction of males was more prolonged than that of females. Both male and female cats spent more time sniffing the sprayed male urine than the excretory male urine. Unfamiliar sprayed male urine was investigated for longer (by both sexes) than familiar sprayed male urine. Results suggest that excretory urine is less likely to contain pheromones and the dichotomy between males and females reactions to urine (males sniffing longer) suggests at least some of these pheromones are sex-related pheromones. In conclusion, the author suggests that two functional aspects of urine marking behaviour by cats must be considered: a) its role within the social group the cat belongs to which may be to allow contact with conspecifics, and b) towards cats unfamiliar to the social group to signal to keep their distance (Natoli, 1985). In a social context, the ability to discriminate between urine marks of strange and familiar donors could be adaptive, especially since an animal recognised as a member of the group (and consequently accepted) could be a relative.

What information does a cat convey through its middening behavior?

When toileting, cats generally bury their faeces but there are also incidences when they will leave their faeces uncovered – this is known as middening and in free-ranging cats tends to occur when cats are out hunting or are deposited on the periphery of their territories. Many mammals use their faeces to communicate information about their sex, relative health conditions and reproductive status as well as providing spatial and temporal records of their movements and behaviours, long after they have deposited the faeces (Brown & Macdonald, 1985). It is highly likely that cats also use the odour of faeces in this way. A recent study explored the ability of pet cats to distinguish familiarity of other cats based on their faecal odour by comparing the sniffing duration of cats' own, familiar and unfamiliar faeces (Nakabayashi et al, 2012). Sniffing durations differed between unfamiliar faeces and the other types of faeces (own and familiar). When cats were exposed to faeces belonging to an unfamiliar cat, sniffing durations decreased over time of exposure. However, when cats were exposed to the faeces of a new unfamiliar cat, sniffing durations increased suggesting cats could differentiate between unfamiliar individuals from faecal samples (Nakabayashi et al, 2012). Furthermore, specific chemicals within the faeces are believed to be used by cats (via sniffing) to determine whether the 'producer' of the faeces was male and how long ago he was in the area (Miyazaki et al, 2018). Results therefore suggest that middening behaviour is most likely linked to communication to unfamiliar individuals and thus may serve as another means of maintaining territorial boundaries as well as having a possible role in reproductive behaviour (ie, identifying potential mates and/or male competitors).

TACTILE COMMUNICATION

What information does a cat convey through physical contact?

Physical contact during agonistic interactions between cats is usually of short duration and involves overt aggression such as scratching, biting and kicking with the back legs (while bodies are interlocked in an altercation). Cats will however use other forms of communication such as agonistic vocalisations (hissing, growling, spitting) and offensive body postures to communicate their discontent at the presence of another cat before escalating to physical contact, which is generally a last resort and avoided in most instances.

More common intraspecific physical contact occurs when cats have formed close amicable relationships with one another and such physical contact takes the form of allo-rubbing, allo-resting and allo-grooming. While it is believed that allo-rubbing involves some form of chemical exchange since much of the body areas that are used in allo-rubbing are those that have been identified to produce pheromones, the exact function of the behavior is not fully understood. Some propose that by rubbing against each other, cats are creating a communal scent which aids identification that the cats belong to the same social group (Crowell-Davis et al, 2004). Cats generally tend to begin an allo-rubbing sequence by rubbing their cheeks against each other and if the cats are particularly well-bonded to one another, rubbing of the shoulders and flanks can occur with each cat moving in the same direction or opposite directions and inter-wrapping of the tails can also be witnessed. The rubbing of the face and body is also seen directed towards preferred people, often on their legs if the person is standing. In such situations, the tail can also be directed to make physical contact with the person. However, it is unknown whether any chemical 'messages' are deposited during such human-directed interaction. One study took into account the places where cats come into physical contact with one another during amicable interactions and sought to determine whether these were preferred places by cats for human touch by investigating the influence of body region touched, order of body region touched and handler familiarity (owner versus a stranger) on the domestic cat's behavioral response to being stroked (Ellis et al, 2015). Handling by a cat's owner, in comparison to being handled by the stranger, led to significantly higher negative behavioural scores displayed by the cats, a result that was quite unexpected. Furthermore, while positive behavioral responses were seen when cats were stroked in the facial regions, stroking the area at the base of tail produced the highest negative scores in comparison to other body areas and this effect occurred during stroking from familiar and unfamiliar people (Ellis et al, 2015). Results suggest that handling of cats should avoid the base of tail (despite cats having physical contact with one another in this area during tail wrapping). Further research is required to investigate whether the duration of time spent stroking this area may influence the behavioural response. When cats come into physical contact in this region during allo-rubbing and tail-wrapping, the contact is usually just fleeting.

Allo-grooming is another area of behaviour that is poorly understood in the domestic cat. It is commonly described as a behaviour that occurs in amicable situations between bonded individuals (Crowell-Davis et al, 2004) and indeed appears to be a behaviour that does not exist in the behavioural repertoire of household cats that are generally described as having hostile relationships with one another. Most common areas to be allo-groomed are the head and neck areas. However, not all allo-grooming appears to be fully amicable. A study of 25 neutered cats where 83 incidences of allo-grooming were observed found that in 35% of grooming interactions, agonistic behavior was witnessed (van den Bos, 1998). Groomers showed offensive behaviour more often than groomees, most often after grooming a partner. Furthermore, groomers often groomed

themselves after grooming a partner. These results are consistent with the hypothesis that allo-grooming in domestic cats may be a way of redirecting (potential) aggression in situations in which overt aggression is too costly. However, in some cases, allo-grooming does result in aggression, although perhaps at intensities lower than what might have occurred if allo-grooming had not occurred. In such situations, a common observation is that the groomee does not appear to fully be comfortable with the grooming interaction and, when tries to end or avoid the interaction, is physically restrained by the groomer, often by its front paws. Biting in the throat area by the groomer may also be witnessed as can defensive kicking with the back legs from the groomee. Furthermore, the behavioural patterning of allo-grooming that ends in agonistic encounters appears to have a higher frequency of tongue licks and these appear to be of greater intensity. In addition, the allo-grooming appears to be more uni-directional, ie, one cat appears to groom the other but the recipient does not then groom the groomer and if it does attempt to, aggression can ensue. The behavioural expression of allo-grooming and contexts in which it occurs therefore requires further scientific investigation to fully understand its (multiple) communicative function(s).

CONCLUSION

While initial observations of the cat may lead to conclusions that its communication is not very complex in comparison to a more social species, close inspection illustrates how similar behaviour patterns can occur in very different contexts and that subtle changes in a behavior, body posture or vocalisation may communicate very different messages. The importance of ongoing scientific research to further our understanding of feline communication cannot be underestimated.

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