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# Cats and domestication – a road less travelled

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**ABSTRACT:** Cats are the favoured domestic companion in the USA and their numbers are closely approaching that status in the UK. Yet the cat's motivation for their behaviours, particularly those that stretch the limits of the human–cat bond, remain a mystery to many owners. By looking at the cat's journey to domestication, we gain an understanding of the motivation for some of the cat's natural behaviours, providing the veterinary team with answers to frequent owner queries.

## Domestication – a time frame

Approximately 15,000–35,000 years ago, dogs had evolved into a distinct species that was sharing a close, bonded relationship with man (Overall, 2013). This was a relationship that, from archaeological evidence, existed in sites throughout the world. About 12,000 years ago, in Egypt, *Felis silvestris lybica* (the African/Arabian wildcat), a striped, tabby-coated feline and the most tameable of the wildcats, was becoming increasingly attracted to the grain stores and associated rodent population, along the banks of the river Nile. It was here that the transformation to *Felis silvestris catus*, the domestic cat, is likely to have begun (Serpell, 2000).

The exact chronology of this transformation has been difficult for archaeologists to track – the skeletal changes have been negligible, making timing of the process hazy. Some of these cats will have been more genetically competent at coping with the proximity of humans – these cats will have flourished and bred. Other wildcats wouldn't have been able to cope with human activity and will have left the sites (although artwork of the time shows many cats to be tethered). But, for those cats that stayed, there began the journey towards domestication of the species (Bradshaw, Casey & Brown, 2012).

The spread of these tame (but not domesticated) cats was slow. Grain was an essential part of Egyptian prosperity and the cats became an important resource for maintaining a competitive edge on the

market. However, the Egyptian empire had expanded and from 9,500 years ago there is evidence of cats providing rodent control and being transported on boats carrying grain to Cyprus – an island without a resident wildcat population. From 4,400 years ago there is evidence of cats seen in Egyptian tomb paintings and by 3,500 years ago art work shows cats sharing human activities. So important was the cat to the prosperity of the Egyptian empire that by 2,950 years ago cat breeding sites were being protected and cats were being provided with supplementary feeding – in addition



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the cat goddess became a national deity (with twentieth-century tomb excavators finding so many mummified cats in tombs that tons of cat corpses were disposed of as fertilizer) (Bradshaw et al., 2012).

But the spread of the cat was slow. Until 1,600 years ago the Romans were still using polecats and weasels for rodent control, and it is likely to have been the Vikings that brought cats to Northern Europe about 1,200 years ago. From then to only a few hundred years ago, the keeping of cats within the proximity of a home for any other purpose than for rodent control was viewed with considerable suspicion, the species being closely linked in folklore with devil worship and witchcraft in many cultures (Bradshaw et al., 2012). Today the extent to which cats are 'owned' still varies greatly from country to country, with many European cities supporting large populations of feral and stray cats.

## The domestication dilemma

*Felis silvestris catus*, the domestic cat, has a dilemma. Although many cats are living as domestic companions and benefiting from the enhanced access to food, shelter and company that humans provide, many more cats are still living a stray or feral lifestyle. For the large number of cats throughout the world that don't have the benefit of a human carer, the retention of a 'wild type' behavioural repertoire is essential to survival (Fitzgerald & Turner, 2000). In addition, as large numbers of the domestic cat community annually enter the stray population, the retention of this behavioural repertoire is often essential to the survival of members of the domestic community.

## Hunting and predation – a necessary evil

The domestic cat retains a fully functioning predatory sequence of behaviour (Overall, 2013). It wasn't until the latter part of the 1900s that pet-food manufacturers fully understood the cat's nutritional needs. Until a fully balanced proprietary diet was available, the nutrients accessed through hunting rodents were vital to successful reproductive health, so the ability to hunt remained an essential behaviour for all domestic cats and the intervening time period is too short to have altered that situation (Bradshaw et al., 2012).



As a consequence, much of the kitten's behaviour that is considered to be playful and endearing, is actually part of the training that is essential to honing its predatory skills (Overall, 2013). The predatory response may be innately triggered by movements in the kittens' environs, but the predator skills are developed during social and environmental play and through observation of their mother as she brings progressively more lively prey back to the kittens. A single opportunity to observe a mother killing a mouse can turn a kitten into an accomplished mouse killer. However, kittens often mimic their mother's taste in prey, being reticent to dispatch a species that they have not observed their mother killing – possibly driven by fear of injury if skills are lacking (Bateson, 2000).

Cats have retained a complete repertoire of wild-type predatory behaviour, not waiting until their hunting prowess is impaired by fatigue or hunger, but rather responding to any movement that may predict the presence of prey, even if recently fed. Although the initial stages of the hunt are dependent upon the cat's visual acuity, once the stalk has reduced the distance between the cat and its prey to one where a pounce is required, eye sight becomes impaired by the positioning of the eyes to the side of the cat's face. It is at this stage that the vibrissae (whiskers) take over sensory feedback, ensuring that the cat is aware of the exact position of the prey prior to the 'strike'. The killer bite inflicted to the prey's vertebrae so accurately is aided by the proprioceptors of the canine teeth (Bradshaw et al., 2012).

Once dead, the prey may not be eaten immediately. The cat is an opportunistic predator and will not pass up an opportunity to hunt in case a later opportunity fails to arise. A cat that has recently eaten will take its kill to a safe place for later consumption (although it is likely to find that owners have disposed of its hard-earned gains in the interim!). Cats may appear to play with their dead prey, when in fact they are trying to separate skin and bones from flesh through shaking of the carcass.

Alternatively, the cat that has failed to learn how to dispatch its prey (as will often occur if kittens are the offspring of mothers that were unable to access the outdoors) will pounce but then experience difficulties, and potentially fear, regarding dispatching. These cats may then experience conflicting behavioural drives that are manifested as approach/avoidance strategies that can be misinterpreted as play. However, as any domestic cat may be forced, by social or environmental pressures, to return to the stray population, the retention of competence in hunting remains essential to the cats' survival.

The independent cat will require approximately 12 live kills per day (Rochlitz, 2009) to sustain its existence, but even the most skilled predator will experience many failures. This may result in the feral or stray cat attempting up to 120 hunts per day – with dawn and dusk being the favoured times, when rodents are most likely to be active. Consequently, most domestic cats attempt daily hunting forays, timing such events to avoid encountering neighbouring cats.

## Social life

Evolving from a species living in conditions where rodent populations were sparse, the evolution of inter-cat social behaviour was far from being a survival asset. With an innate expectation that hunting is a necessary survival activity, competition for access to space and resources within a home will be particularly tricky for cats to cope with. It is generally considered that the cat's capacity for inter-feline sociability is limited, with the exception of litter siblings, cross-mothered kittens and kittens brought together during their socialisation period.

However, feline groups, often sharing relatively small spaces in abandoned buildings, can be seen in urban areas. As the cat has a limited capacity to 'cope' with the presence of other cats, it is highly likely that such social groups are maintained by an availability of resources – usually due to people providing food, either deliberately or accidentally via refuse (Crowell-Davis, 2002). These groups usually consist of a maximum of 10 adult cats, although several small communities may exist in a relatively confined area, giving the impression of larger groups. Such cat colonies tend to consist of related females and their offspring, co-operatively cross-mothering kittens and defending their territory (Rochlitz, 2009). Males appear to be ejected from these groups on reaching sexual maturity, leading a solitary life on the periphery of the environment.

## Communication

An individual wildcat's survival was greatly impeded by the proximity of competitors for prey. This resulted in a severely limited requirement for social communication between cats, and what communication did occur was intended to maintain distance between individuals. It is now accepted that the social repertoire of the domestic cat is a little more varied, but it can still be assumed that the majority of the cat's social communication is intended to maintain territorial boundaries and to communicate readiness for copulation.

### Visual and aural communication

Visual communication, the recognition of subtle changes in facial features and body shape, is really only useful at close range. As this would only naturally occur on rare occasions its range and flexibility is limited. However, those owners that



spend time observing their domestic cat will recognise a limited range of subtle variations in facial expression and body posture.

Although auditory communication is effective during both day and night, long or close range, feral cats are usually relatively non-vocal. Individual domestic cats seem to learn vocalisation to varying degrees (including the need to vocalise when with people and the human tendency to reward it) dependent on their early environment. So, it is likely that humans effectively train the vocal variation between domestic cats (Overall, 2013).

The 'purr' solicits care in young kittens but is retained by domestic cats in greeting and during tactile stimulation from humans, seeming to be associated with desired social contact – a manipulative care-giving signal that is reinforced by humans. However, the purr may be used in its original care-soliciting role when cats are in pain or severely stressed.

The cat lacks the complex visual signalling repertoire of social predators as it evolved as a solitary hunter – it needed neither visual social signalling nor a concept of hierarchy or social appeasement. Consequently, although some cats have the capacity for inter-cat social relationships (Crowell-Davis, 2002), much of the cats' social behaviour is associated with maintaining a distance between cats – even within the same household. When cats are forced together within the confined space of a multi-cat household, individual cats will attempt to manage access to space and resources by time-sharing. When access to a specific,

highly valued resource (e.g. food or an owner's attention) requires cats to congregate in a single area, cats will either attempt to ignore each other (angling their bodies to avoid direct eye-contact) or, if this fails to alleviate social stress, considerable emotional and behavioural problems may develop within the group.

The cat's minimal use of visual signals is associated with defensive reactions rather than social affiliation. As a result of this, cats have a limited capacity to learn about the visual signalling of others (Bradshaw et al., 2012). Between this and the need for neural capacity and space to process the sensory input from the vibrissae, the cat's brain appears to have sacrificed space that might otherwise have been devoted to visual recognition and memory. This has resulted in cats requiring an alternative method of recognising familiar social contacts and of orientating themselves around environmental stimuli.

### Olfaction and pheromones

The importance to cats of olfactory communication is often overlooked. By leaving pheromone-based 'scent' messages, information can be left for many days, enabling signalling between cats without the necessity to meet. Such odour/pheromone-based communication includes:

- social and environmental rubbing associated with facial pheromones (Mills, BraemDube & Zulch, 2013)
- urine, which is possibly associated with territorial and aggressive behaviour (Heath, 2002)

- scratching, which is associated with territorial and alarm marking (Frank, 2002)

It is also thought that odour plays an essential role in maintaining the social cohesion of cat colonies (Bowen & Heath, 2005), ensuring that members carry a communal scent profile. The use of olfactory communication consequently enables both social recognition and geographical orientation, removing the necessity for reliance upon visual recognition (Bradshaw et al., 2012).

However, the cat's requirement for olfactory feedback to enable it to feel safe and secure in a familiar social and physical environment (Heath, 2002) is severely impeded when the cat is removed from its normal environment (e.g. to visit the surgery or cattery) or when other household cats return to the home from the outdoor environment. This can lead to a lack of recognition and potential for loss of social acceptance, even between previously closely bonded individuals. Disruption of environmental cues within the household, following over-zealous cleaning procedures by owners, for example, will be similarly disorientating. It is for these reasons that so many cats benefit from the use of synthetic analogues of feline facial pheromones within the home (Mills et al., 2013).

## Domestication, stress and health

The health problems associated with the cat's struggle to cope with the frequent and, in many cases, chronic stress of domestic life and, in particular, sharing a home with other cats, is well recognised (Mills et al., 2013). Less well documented is the number of cats being re-homed, abandoned or euthanased due to the behavioural changes associated with their attempts to cope with such stress (Seksal, 2009).

For many domestic cats, social and environmental stressors result in physiological stress that results in multi-system strain leading to the development of disease processes as well as behavioural change (Neilson, 2009; Landsberg, Hunthausen & Ackerman, 2013). In addition, the development of stress-related disease will further predispose the cat to alterations in behaviour in response to the specific disease process (e.g. pain, discomfort, hormonal or toxin fluctuation). Consequently, social and

environmental stress can initiate health problems, and the resulting disease further increases the stress experienced by the animal (Horwitz, 2002).

Consequently, failure to consider whether a cat is coping with its social and physical environment may result in severe health and welfare implications.

## Does my cat need a feline companion?

For many owners, it is extremely difficult to understand that it is very unlikely that a cat would actively seek out another cat with whom to share the resources that are essential to survival – food (including an area around which to hunt), water and shelter (Bowen & Heath, 2005). Even a cat that has the capacity for inter-cat sociability needs to feel it can have immediate access to any resource that it may require, without being impeded by another animal. In addition, unless every cat feels that it has complete control over its environment, then the welfare of that cat is likely to suffer.

Sadly, the stress associated with an inability to access resources is not solely confined to the cat within a multi-cat household. The proximity of neighbourhood cats is sufficient to reduce the coping capacity of many domestic cats, leading to health and behavioural problems (Heath, 2002).

## Conclusion

In evolutionary terms, the cat's domestication journey has been short and the domestic cat isn't many generations away from its wild, solitary predator, ancestor. The need for unimpeded access to hunting opportunities to ensure a balanced diet that sustains life and breeding competence has only been removed over the last 50 years (approximately) and even then, only for those domestic cats that are fed on a truly 'balanced' diet. For the millions of feral and stray cats living in European cities and elsewhere in the world, *Felis silvestris catus* retains an innate requirement for unimpeded access to multiple, daily hunting opportunities. This has an inevitable effect on the cat's capacity for inter-cat relationships.

In addition, an American study (Rowan & Williams 1987) has suggested that up to 25% of the domestic feline population will leave home each year, largely due to social stress, either to find an

alternative home or to enter the stray population. For these cats that fail to cope with the stress of sharing resources and domestic life, the retention of their innate behavioural repertoire will be essential for survival. The veterinary team has a responsibility to ensure that prospective cat owners understand the limited capacity that cats have to accept challenges to their access to essential resources (Rochlitz 2009) and to counsel owners appropriately regarding the relative benefits to their existing cat of increasing the household's feline population.

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