Responses of cats to petting by humans

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Abstract

There is evidence that different gland areas in animals of the cat family have different functions. This study showed that nine cats gave more positive and fewer negative responses to petting by their owners in the temporal region (between the eyes and ears), the reverse to petting in the caudal region (around the tail), with the perioral (chin and lips) and non-gland areas intermediate. This suggests that cats prefer being petted in certain body areas.

Keywords: *allomones, Felis catus, interspecific rubbing, pheromones, scent marking glands*

The domestic cat (*Felis catus*) retains many of the characteristics of its ancestors and of its wild counterparts (Leyhausen 1979; Turner and Bateson 1988; Feldman 1994). The domestic cat's dual role as both pet and wild animal is commonly noted as an important part of this animal's psychology (Fox 1975; Turner and Bateson 1988, 2000). The present study is concerned with this duality, suggesting that an ancestral behavior, scent marking, has been adapted for interspecific interactions.

In common with other felids, and many mammals, scent marking plays an important part in the intraspecies communication of the domestic cat (Peters and Mech 1975; Thiessen and Rice 1976; Feldman 1994; Hurst, Fang and Barnard 1994; Blumstein and Henderson 1996). However, Feldman (1994) has emphasized that the "function of scent marking is not fully established." The first to distinguish between different forms of scent marking in the domestic cat, he has noted the dearth of work done on rubbing behavior, in particular.

In the domestic cat, pheromones secreted by rubbing are produced by glands located in several places (Figure 1): (a) on the chin and at the corners of the lips (the *perioral* gland), (b) in the cheek area, between the eye

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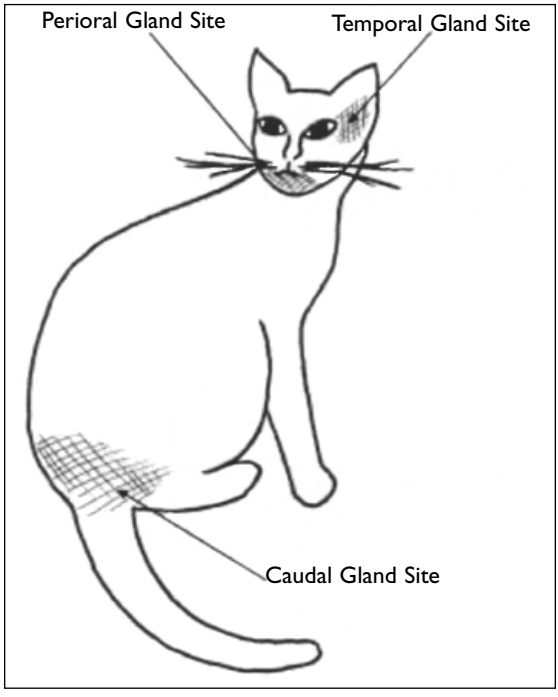
Figure 1. Scent-marking gland areas of the domestic cat



and the ear (the *temporal* gland), and (c) at the base of the tail (the *caudal* gland) (Fox 1975; Feldman 1994). Domestic cats characteristically rub against objects within their territory in a motion which functions to release pheromones from all these glandular areas, beginning with the perioral, moving on to the temporal, then finishing at the caudal area (Fox 1975; Feldman 1994). The material secreted is fatty and strongly scented. In female cats, the chemical balance alters according to current reproductive status (Hart 1977; Feldman 1994).

Another role of scent marking has been assumed to be that of a territorial marker to warn other members of the same species of their presence (Peters and Mech 1975; Bel, Porteret and Coulon 1995; Blumstein and Henderson 1996). However, there is little scientific evidence for this role (Feldman 1994). Leyhausen (1979) was unable to observe any indications that cats' scent marking deterred other cats from a marked territory. Some researchers have suggested another type of territorial function, positing that the pheromones released may serve as an identification of the cat's boundaries, which aid the cat in finding its way around and contribute to the animal's sense of security within its environment (Johnson 1973; Fox 1975). Van den Bos and de Cock Buning found in their 1994 study of a group of female cats that scent-depositing rubbing, which might in their natural lone state have facilitated the avoidance of conspecifics, worked within their laboratory group to help establish bonding and dominance relationships.

So, mutual face rubbing amongst groups of cats, particularly using the temporal gland area, appears to serve a social bonding function (Verberne and de Boer 1976; Bradshaw 1992). Reiger (1979) points out that carnivores who live in groups tend to rub the most, suggesting a social signifi-

cance for rubbing. It has been suggested that cats rub against their human companions for social reasons, as they do with other cats in a group environment, and that the resultant scent exchange increases the cat's feeling of comfort and security within its home environment. Cats most often use the temporal gland area to rub against humans (Hart 1977).

The present study is based on the suggestion that the close relationship between cats and humans has fostered the development of cheek rubbing as an interspecific behavior. It may be that pheromones[1] secreted by the domestic cat through cheek rubbing also function as allomones.[2] This study attempts to explore one facet of the specific mechanics of interspecific rubbing. Bradshaw (1992) believes that stroking of a cat by a human is the closest parallel behavior to the mutual rubbing between cats. The specific question this study asks is whether, because of the posited function of cheek rubbing as a form of interspecies social communication, a cat derives "pleasure" through reciprocal stimulation (stroking/massaging) by its human "owner" at this temporal gland site.

Methods

Research design

Nine cats received tactile stimulation by a household member during three-five-minute sessions at each of four body locations – a total of 15 minutes at each of the four body sites and a total of 60 minutes of petting per cat. Scent gland sites included the area (a) of the temporal gland (Tm), located on the upper cheek-temple, between the eye and the ear, (b) of the perioral gland (Pr), located on the chin and lips, and (c) of the caudal gland (Cu), located on the lower back at the base of the tail. The fourth location was (d), *one* of three non-gland areas: the head (Hd) (but not within 50 mm of the temporal area), the back (Bk) (but not within 50 mm of the head or caudal areas), and the chest (Ch). Body-site order was randomly allocated between cats across all sessions. The tactile stimulation was manual stroking/massaging. Four of the cats were also stroked twice each by a researcher at the same locations stimulated by the owner of each of these four cats, and for the same 5-minute periods. The researcher was obliged to limit stroking to only four cats due to simple time constraints. An analysis was performed to determine if this researcher-stroked group differed from the owner-stroked group of cats, with alpha set at 0.10 to detect the slightest suggestion of difference. When the resulting MANOVA (see below) produced an F value below unity, it was considered acceptable to combine the results of both sub-groups.

Measures consisted of pleasurable, aversive, and neutral behaviors that were not, however, identified as such to handlers, and appeared on a checklist in alphabetical order. Behaviors defined as pleasurable included closing or half-closing the eyes, "kneading" with paws, purring, reciprocally rubbing against the human, and salivary dribbling (Ewer 1968; Leyhausen 1979; Karsh and Turner 1988). Behaviors defined as aversive included biting the human, flattening the ears, flicking and/or swishing the tail, hissing, and smacking or scratching the human (Leyhausen 1979). Neutral behaviors, cited in the literature as neither expressing pleasure or displeasure, included licking itself, scratching itself, and yawning. These neutral behaviors were recorded as a control and were expected to occur in similar numbers across all petting sites.

Cats and procedure

The nine cats were all companion pets living in town or city households. All were neutered, domestic, and shorthaired cats. Handlers were selected at random from among the adult members of each household, with the restriction that roughly equal numbers of male and female handlers were used. Most of the stimulation and recording of behavioral responses was carried out by owners as these are the humans toward whom cats would presumably most readily demonstrate human-directed behavior. To avoid any interaction between cats and owners compromising the validity of experimenter-petting sessions, owners were absent from these sessions.

The cat owners were told that this study concerned the attachment between pet cats and their owners, specifically at where cats prefer being stroked. They were not told which area was expected to be preferred by the researchers, so any possible bias towards any particular area would vary over the different handlers. Each handler was given an instruction sheet and an observation form with a list of behaviours to mark during each session and space for additional comments. It was explained that stroking/massaging should be done in a one-second rhythm and that marking should be done at 15-second intervals. Owners recorded whether any of the five positive, five negative, or three neutral behaviour patterns had occurred during the previous 15-second period. These scores were totalled so that each cat could get a maximum score of 100, 100, or 60 for positive, negative or neutral behaviours, respectively, for a specific area during one 5-minute session.

Handlers were asked to conduct each of the twelve sessions on a different day, in the random order specified, and at times when their cats

seemed in companionable moods. It was emphasised that sessions should not take place immediately before or after feeding, as this has been shown to have a pronounced effect on the amount of physical interaction by cats with humans (Bradshaw and Cook 1996).

Hypotheses

It was expected that the most pleasurable responses and the fewest aversive responses would result from temporal stimulation, for reasons detailed above. It was hypothesized that caudal stimulation would elicit the most aversive responses and the fewest pleasurable responses because this sensitive area seems most highly specialized for cat–cat sexual interactions (Leyhausen 1979). In addition, Bateson and Turner (1988) have observed an increase in tail rubbing in female cats when they are in estrus. Responses to stimulation of the perioral area, used more often for object rubbing (Bateson and Turner 1988), and the three non-gland areas were expected to show intermediate levels of pleasure and displeasure.

Analysis

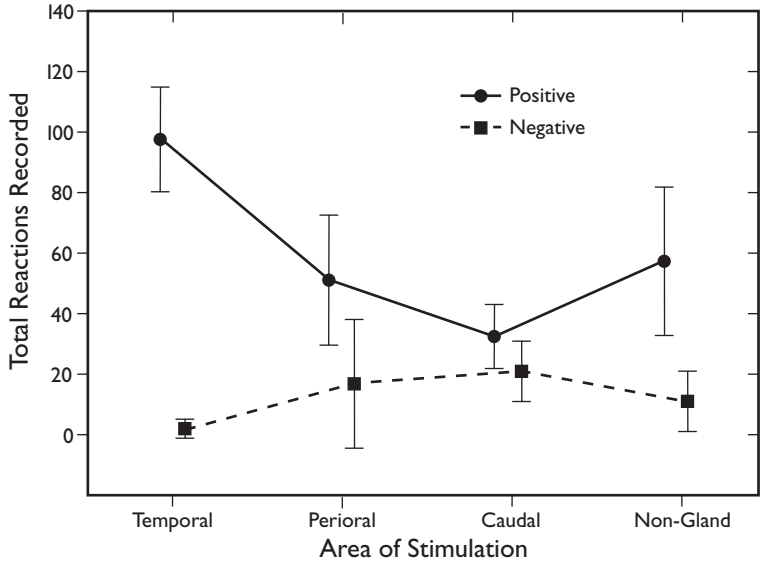
A multivariate analysis of variance (MANOVA) was used to determine significant effects between the six petting sites across the 13 behaviors in this within-subjects experiment. Alpha was set at five percent.

Results

A MANOVA on total positive versus total negative behaviors for the four locations showed a significant main effect of location ($F_{(3,33)}$=5.86, p=0.002). Stimulation of the temporal area resulted in more total pleasurable behaviors (M=50.1) seen in twelve 5-minute sessions than any of the other three areas (27.4 to 35.2), which did not differ among themselves. A significant interaction ($F_{(3, 33)}$=11.24, p=0.00003), shown in Figure 2, shows that temporal positive is the highest positive and lowest negative area. Perioral positive and non-gland positive are greater than caudal positive, but the three do not differ in the frequency of aversive behavior. There is, however, a non-significant tendency for caudal to elicit more aversive behavior than perioral or non-gland areas. The non-gland sites of head, back, and chest were combined for the analysis. Though, as predicted, neutral behaviors did not vary with gland site, the paucity of responses meant it was not possible to statistically analyze this variable.

During some sessions, cats' persistent biting, scratching, or smacking obliged the person to discontinue stimulation at this site. In other instances, cats

Figure 2. Total positive and negative responses to stimulation of temporal, perioral, caudal, and non-gland areas (bars indicate 95% confidence intervals)



themselves ended sessions by running away. In both cases, only data actually gathered during the shortened sessions were used in the statistical analysis.

Discussion

Cats clearly prefer to be stroked by humans most in the temporal region and least in the caudal region, with the perioral and non-gland sites intermediate. Cat handlers should be aware of such preferences and aversions. Area preferences are likely to be present in other animals as well (Crawley and Chamove 1998).

Purring, though recognized as primarily a behavior denoting pleasure, may have a broader meaning. For example, it is suggested that this behavior can also communicate a desire for human company or a request for help, or serve as a self-soothing mechanism (Fogle 1992). Not only was purring the most frequently occurring pleasurable behaviour recorded in this study; it was also present in some sessions in which all other responses overwhelmingly pointed to an aversive response to stimulation at that site. This ambiguity seems to support the idea that the motives for purring may be complex ones deserving of further investigation.

The need for further investigation of the perioral rubbing gland also seems to be indicated. A few people participating in the experiment commented that their cats enjoyed stroking on the chin, but not on the lips. Treating these areas as two discrete perioral sub-sites might reveal interesting differences.

Notes

1. *Pheromones* are defined as scent marking chemicals used to communicate with members of the same species.

2. *Allomones* are defined as scent marking chemicals used for communication with members of other species.

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