# DOG BEHAVIOR

# Does attachment to man already exist in 2 months old normally raised dog puppies? A pilot study

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*Abstract*: Based on the current knowledge, adult dogs are able to establish an attachment bond towards their owners and puppies are able to establish an attachment bond towards their mother. The aim of the current study was to assess whether dog attachment to people already exists in puppies.

Fourteen 2 months old puppies were tested in the Ainsworth Strange Situation test in which the role of the human caregiver was played by the person with whom puppies had interacted more in their first weeks of life, i.e. their breeder.

As expected, puppies displayed more protest at separation (whining, behaviors against the door, close to the door etc.) when involuntarily separated from the breeder. They also increased the seeking of proximity after separation, but they did not show a clear preference for the breeder over a human stranger. The duration of exploration, play and resting seem to be related to the order of episodes more than to a secure base effect.

The findings of this preliminary study do not fully support the hypothesis that dogs establish an attachment bond towards their human caregivers since puppies, provided that they are raised by their mother. It is likely that a longer time spent together is needed for this peculiar kind of bond to be formed.

*Key Words*: Ainsworth Strange Situation Test, attachment, breeder, dog, puppy, secure base.

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## Introduction

All modern dog breeds derive from an ancestor who was domesticated over 15,000 years ago (Grimm, 2015), and subsequently dogs were subjected to an intense process of artificial selection. This process has been suggested to promote general socialization (Kretchmer & Fox, 1975) and predispose dogs to form attachment towards humans (Topál et al., 2005).

Attachment can be defined as an affectional tie that an individual forms to another specific one, binding them together in space and enduring over time (Ainsworth & Bell, 1970). The theory of attachment currently known has been developed by Bowlby (1969), one of the first authors who tried to pool the results of research on the bond between young animals and their mothers, regardless of the species they belonged to. The behavioral test commonly used to study child attachment to the mother is called Ainsworth's strange situation test (ASST; Ainsworth & Bell, 1970). Modified versions of the same test have also been used for testing the young of other mammalian species towards their mother (e.g. Bard, 1991) or to individuals other than the mother (e.g. Bard & Nadler, 1983 in young chimpanzees towards their peers), including subjects belonging to a different species (e.g. chimpanzees towards a human caregiver: Miller et al., 1990, 1986). Although the presence of an attachment bond is particularly important in young animals, being protection its main function, attachment persists into adulthood (e.g. McConnell & Moss, 2011).

Topál et al. (1998), hypothesizing a similarity between dog-owner and child-mother relationship, adapted the ASST to make it suitable to test adult dogs with their caregivers, i.e. the owners. Since then, many studies have been carried out to study dog bond towards humans (for a review see Payne et al., 2016). Only recently research has also focused on dog-dog bond and used ASST to analyze canine intraspecific attachment. Previde et al. (2009) found that dog puppies tested in the ASST showed patterns of behaviors indicative of an attachment bond towards their mothers, as expected when testing young mammals with their primary caregivers. Two studies carried out on adult dogs living in the same household (Mariti et al., 2014; Mariti et al., 2017) instead suggest that the relationship between two adult dogs having shared the same environment for a long time does not fulfill all the requirements needed to properly call this relationship an attachment bond. However, the findings of Mariti et al. (2017) suggest that the puppy-mother bond can be somewhat maintained, provided the possibility to keep living together.

Based on the current knowledge, i.e. adult dogs are able to establish an attachment bond towards their owners (Mariti et al., 2013) and puppies are able to establish an attachment bond towards their mothers (Previde et al., 2009), it can be hypothesized that puppies establish an attachment bond towards their owners. Consequently, the aim of the current study was to assess whether dog attachment to people already exists in puppies. As most puppies are raised by their mother, only normally raised (not hand raised) puppies were included in this pilot study.

## Subjects, materials and methods

### Participants

Fourteen puppies were involved in this study. All puppies were 2 months old (58-60 days of age), equally divided per sex, belonging to five litters of different breeds (2 Australian Kelpies, 3 Bearded Collies, 3 Border Collies, 3 Flat Coated Retrievers, and 3 Labrador Retrievers). All puppies were raised in a home environment and still lived in the household where they were born and raised by their mother, i.e. puppies were tested before being adopted by a new family.

The role of the human caregiver in the ASST was played by the person with whom puppies had interacted more in their first weeks of life, i.e. their breeder. For the current study, only female 25-35 years old breeders were included, in order to match their characteristics with those of the stranger as far as possible. Breeders were all volunteers recruited by personal contacts among people who could guarantee that puppies had regular and positive contact with them.

### Experimental setting

The experimental environment was a relatively bare room, 4.50 x 4.30 m, unfamiliar to the puppies. The room was prepared to match as far as possible the requirements described in the ASST (Ainsworth & Bell, 1970), especially in the version modified for dogs. The room was equipped with two chairs, one for the breeder and one for the stranger; a water bowl; three dog toys (a Kong®, a little ball, and a knotted rope); a table to leave the leash on; and two video cameras to record the whole test. One video camera was oriented to the door and the surrounding area, whereas the other one recorded the whole room.

To avoid external noise, tests were conducted during the weekend, when the facility was not in use. At the end of each test, the experimental room's floor was washed using a nontoxic weakly scented disinfectant.

*Procedure*

The procedure was as faithful as possible to the Ainsworth Strange Situation Test (Ainsworth & Bell, 1970). Seven 2-min episodes were carried out in an experimental room, unfamiliar to all puppies. As recommended in the ASST, the procedure included two separations from the presumed attachment figure, i.e. the breeder (episode 3, puppy with stranger; episode 5, puppy in complete isolation; and episode 6, puppy with stranger) and two reunions with her (episode 4 and 7). A more detailed description of the procedure is reported in Table 1.

**Table 1.** Behavioral test used for this study. Each episode lasted 2 minutes.

| Episodes | Subjects involved | Description |
|---|---|---|
| 1 | Puppy + Owner | Owner and puppy entered the experimental room. The puppy was unleashed and set free to explore the room. The leash was placed on the table. Owner sat on the chair and interact with the puppy only if he/she performed attention seeking behaviors. |
| 2 | Puppy + Owner + Stranger | The stranger entered the experimental room and sat in the free chair. Participants couldn't talk to each other and interact with the puppy only if he/she performed attention seeking behaviors. At the end of the second minute, the owner left the room. |
| 3 | Puppy + Stranger | The owner was out of the room (taken in another room 20 m away from the experimental room), the puppy was with the stranger in the room . |
| 4 | Puppy + Owner | The owner came back into the room and sat into the same chair. In the meanwhile, the stranger left the room. If the puppy initiated interaction, the owner greeted and comforted the animal as he/she usually does at reunion. At the end of the second minute, the owner left the room. |
| 5 | Puppy | The puppy was left alone in the room. |
| 6 | Puppy + Stranger | The stranger came back into the room and sat on the same chair. If the puppy initiated interaction, the stranger greeted and comforted the puppy. |
| 7 | Puppy + Owner | The owner came back into the room and sat into the same chair. If the puppy initiated interaction, the owner greeted and comforted the animal as he/she usually does at reunion. In the meanwhile, the stranger left the room. |

The owners and the stranger were asked to not interact with the puppy, and to remain seated during the whole procedure, except when they had to leave or come back into the room.

Puppies were videotaped throughout the test and their behavior was analyzed using a continuous sampling method in order to measure the duration (in seconds) of puppies' social and non-social behaviors; social behaviors were analyzed both towards the stranger and towards the breeder. The list of analyzed behaviors is reported in table 2 and 3; they correspond to behaviors commonly used for the analysis of dog behavior in the ASST (see e.g. Mariti et al., 2013; Topál et al., 1998).

*Statistical analysis*

The statistical analysis consisted in comparing the duration of each behavior for all the episodes using a Wilcoxon paired-sample test (multiple comparison corrections were performed using the Benjamini-Hochberg procedure) run with the software SPSS Statistic 17.0 (Chicago, IL).

## Results

Comparisons resulting in statistically significant differences are summarised in Tables 2 and 3. Behaviors non reported in the tables did not result significantly different in any of the performed analyses.

Exploration was found to be longer in episode 1 compared to all the other episodes; on the contrary, resting was shorter in episode 1 than in any other episode.

Proximity was higher in later episodes, after separation. Visual orientation to people showed a different trend.

Whining and behaviors against the door were displayed statistically more in episode 5 (complete isolation); locomotion, staying close to the door and being visually oriented at the door were longer in episode 5 and 3 (first separation from the breeder).

**Table 2.** Summary of statistically significant results for proximity seeking and secure base effect. For episode 2, being owner and stranger present at the same time, o=owner and s=stranger.

|  | Behaviors | Episodes | Statistical values |
|---|---|---|---|
| Secure base | Exploration | 1 > 2 | W = -2.975, P = 0.003 |
|  |  | 1 > 3 | W = -2.668, P = 0.008 |
|  |  | 1 > 4 | W = -3.061, P = 0.002 |
|  |  | 1 > 5 | W = -2.481, P = 0.013 |
|  |  | 1 > 6 | W = -3.076, P = 0.002 |
|  |  | 1 > 7 | W = -3.041, P = 0.002 |
|  |  | 2 > 6 | W = -2.197, P = 0.028 |
|  | Individual play | 1 > 3 | W = -2.675, P = 0.007 |
|  | Resting | 1 < 2 | W = -1.992, P = 0.046 |
|  |  | 1 < 3 | W = -1.992, P = 0.046 |
|  |  | 1 < 4 | W = -2.028, P = 0.043 |
|  |  | 1 < 5 | W = -2.197, P = 0.028 |
|  |  | 1 < 6 | W = 2.197, P = 0.028 |
|  |  | 1 < 7 | W = -2.666, P = 0.008 |
| Proximity seeking | Attention seeking | 6 > 4 | W = -2.214, P = 0.027 |
|  | Social exploration of owner | 2(o) < 4 | W = -2.040, P = 0.041 |
|  |  | 2(o) < 7 | W = 2.240, P = 0.025 |
|  | Proximity to owner | 7 > 1 | W = -2.062, P = 0.039 |
|  |  | 7 > 2(o) | W = -2.276, P = 0.023 |
|  | Proximity to stranger | 6 > 2(s) | W = -2.552, P = 0.011 |
|  | Proximity owner versus stranger | 7 > 2(s) | W = -2.272, P = 0.023 |
|  |  | 7 > 3 | W = -2.063, P = 0.039 |
|  | Social exploration of owner versus stranger | 2(s) > 2(o) | W = -2.298, P = 0.022 |
|  |  | 6 > 2(o) | W = -2.100, P = 0.036 |
|  | Visual orientation to owner | 1 > 2(o) | W = -2,590, P = 0.010 |
|  |  | 4 > 2(o) | W = -3.070, P = 0.002 |
|  |  | 7 > 2(o) | W = -2.909, P = 0004 |
|  | Visual orientation to owner versus stranger | 2(s) > 2(o) | W = -2.654, P = 0.008 |
|  |  | 3 > 2(o) | W = -2.812, P = 0.005 |
|  |  | 6 > 2(o) | W = -2.852, P = 0.002 |

**Table 3.** Summary of statistically significant results for protest at separation.

| Behaviors | Episodes | Statistical values |
|---|---|---|
| Whining | 5 > 1 | W = -2.448, P = 0.014 |
|  | 5 > 2 | W = -2.599, P = 0.009 |
|  | 5 > 3 | W = -2.666, P = 0.008 |
|  | 5 > 4 | W = -2.192, P = 0.028 |
|  | 5 > 6 | W = -2.666, P = 0.008 |
|  | 5 > 7 | W = -2.666, P = 0.008 |
| Locomotion | 5 > 2 | W = -2,184, P = 0.029 |
|  | 5 > 3 | W = -2.199, P = 0.028 |
|  | 5 > 6 | W = -2.521, P = 0.012 |
|  | 5 > 7 | W = -2.242, P = 0.025 |
|  | 3 > 6 | W = -2.383, P = 0.017 |
| Visual orientation to door | 3 > 1 | W = -2.207, P = 0.027 |
|  | 3 > 2 | W = -2.269, P = 0.023 |
|  | 3 > 4 | W = -2.674, P = 0.007 |
|  | 3 > 6 | W = -2.075, P = 0.038 |
|  | 3 > 7 | W = -2.458, P = 0.014 |
|  | 5 > 2 | W = -2.941, P = 0.003 |
|  | 5 > 4 | W = -2.075, P = 0.038 |
|  | 5 > 6 | W = -2.670, P = 0.008 |
|  | 5 > 7 | W = -2.675, P = 0.007 |
| Close to door | 5 > 4 | W = -2.197, P = 0.028 |
|  | 5 > 6 | W = -2.371, P = 0.018 |
|  | 3 > 4 | W = -2.214, P = 0.027 |
|  | 3 > 7 | W = -2.201, P = 0.028 |
| Behaviors against door | 5 > 1 | W = -1.963, P = 0.050 |
|  | 5 > 2 | W = -1.997, P = 0.046 |
|  | 5 > 3 | W = -2.201, P = 0.028 |
|  | 5 > 4 | W = -1.997, P = 0.046 |
|  | 5 > 6 | W = -1.997, P = 0.046 |
|  | 5 > 7 | W = -2.207, P = 0.027 |

## Discussion

In order to test the hypothesis that dogs form an attachment bond to people since puppies, we tested 2-months old puppies in the ASST with their human caregiver, i.e. their breeder, and we assessed if that relationship met the three main criteria of an attachment bond: protest at an involuntary separation from the attachment figure; seeking proximity with the attachment figure (especially upon reunion); and secure base effect.

Data reported in table 3 shows that puppies displayed behaviors indicative of protest at separation during episode 3 and 5, in which puppies were expected to show it because in these two episodes puppies were involuntarily separated from the presumed attachment figure, i.e. the breeder. In addition, dog puppies in this study showed more behaviors indicative of stress in a later episode, when completely alone (episode 5), than in a previous episode in which a stranger was present in the experimental room (episode 3). This is also an expected finding: in fact, the ASST is sometimes described as a "drama in miniature" in which the young animal is subjected to a mild and increasing stressful situation. It must be taken into account that, contrary to adult dogs,

puppies usually are not used to stay alone (or not for a long time), as the mother tends to spend much time with the litter, and littermates usually stay together. It is therefore likely that puppies show high distress at separation when completely alone, especially if the mother has provided a high amount of maternal care (Guardini et al., 2015; 2017). In addition, puppies are less used than adult dogs to visit novel environments, and these two conditions put puppies in a situation very similar to that of children tested in ASST (more similar than that of adult dogs). Finally, puppies here were tested when separated from the breeder in a condition that adds to the separation from the mother (never present during the test), thus creating a sort of double separation, as hypothesized for dogs tested with conspecifics in the ASST (Mariti et al., 2018). In view of the above, the findings on protest at separation are compatible with the presence of an attachment bond between puppies and their breeder.

As for the second requirement of an attachment bond, when analyzing the seeking proximity effect in the ASST, two results are expected: the tested subject prefers the proximity of the caregiver over a stranger; and proximity seeking increases after separation, due to the activation of the attachment behavioral system. The latter point was confirmed by an increase in proximity upon reunion with both the stranger (episode 6 > 2) and the breeder (episode 7 > 1 and 2). Instead, proximity to the caregiver was only partially found to be more displayed than proximity to the stranger (episode 7 > 2 and 3, but no difference between episode 6 and 7 nor between 3 and 4).

The lack of difference between the early episodes with the owner (1, 2 and 4) and early episodes with the stranger (2 and 3) seem to suggest that puppies did not prefer the breeder over a stranger. However, such findings must be discussed cautiously, considering the peculiarities of dog puppies compared to children tested in ASST.

As stressed by Rehn & Keeling (2016), literature on dog relationship with people is sometimes unclear about the difference between attachment behavior and attachment bond. Ainsworth & Bell (1970) defined attachment behavior as those behaviors aimed at promoting and restoring proximity and contact. Bowlby (1988) stated that almost all children, when distressed, go to the mother; in case she is absent, children fall back on somebody else. In such conditions the majority of children show a clear hierarchy of preferences and, in case nobody else is available, even a gentle stranger can be approached. So the Author stressed that, while the attachment behavior can be displayed in different conditions towards many subjects, a lasting attachment, or attachment bond, is reserved to very few people (Bowlby, 1988). However, it must be taken into account that dogs and children usually show a very different response to a stranger. Being *Canis familiaris* a highly social species (Tuber et al., 1996), domestic dogs naturally seek social interaction, unless they lack for socialization or had very negative experiences. Therefore, contrary to children tested in the ASST, at 2 months of age well-socialized puppies usually do not show fear of stranger. In particular, dog puppies at 8 weeks of age, as those we tested, show less fear than younger ones (Marshall-Pescini et al., 2017). Indeed, the findings of episode 2 (dog-owner-stranger) for seeking attention towards the stranger, social exploration and visual orientation suggest that puppies were not wary of the stranger, rather they sought more attention from the stranger than from the breeder. In other terms, in the current study puppies behave similarly to adult dogs, and differently from children (Mariti et al., 2013; Mariti et al., 2017), interacting with the stranger since her entrance. Social exploration and visual orientation suggest curiosity towards the stranger, compatible with neophilia (Kaulfuss & Mills, 2008), and it can hinder the expected difference in proximity seeking with the breeder over a stranger.

Similarly to what found for proximity seeking in early episodes, the lack of difference after a complete isolation, upon the second reunion with the stranger (episode 6) and with the breeder (episode 7), does not confirm a preference for the caregiver over a stranger. However, these findings need a deeper discussion that also takes into account the findings of attention seeking. Puppies spent statistically more time in attention seeking from the stranger after complete isolation compared to upon the first reunion with the breeder. Such result confirms that the presence

of a human, although stranger, has a strong ameliorative effect, as already found in young and adult dogs (Mariti et al., 2017, 2013; Palmer & Custance, 2008; Tuber et al., 1996; Pettijohn et al., 1977). However, adult dogs show a clear preference for the owner over a stranger (Mariti et al., 2013; Topál et al., 1998). Instead, the findings of the current study seem to suggest that dog puppies, when feeling distressed, do not clearly differentiate between a familiar and an unfamiliar human as a source for alleviation of distress. Further studies are needed to clarify if the relief obtained through the reunion with the stranger is sufficient to reestablish the homeostasis in the activated attachment behavioral system or if the presence of the breeder (or of the mother) is needed.

Generally speaking, many aspects of puppies' bond and social preferences need to be better investigated. According to Ainsworth & Bell (1970), although the presence of another individual with whom the human infant has an affectional bond (i.e. a same age play mate) may provide some comfort, the child will not usually be fully comforted or secure until she or he is reunited with the attachment figure. Previous studies on dog puppies do not show a clear picture. For instance, 8 weeks old puppies display signs indicative of an attachment bond towards the mother (Previde et al., 2009) but do not show a preference for the mother over littermates after a 10-sec isolation (May et al., 2009). Nor puppies prefer the mother over a human stranger for the alleviation of separation distress (Pettijohn et al., 1977). Once grown up, dogs prefer an unfamiliar person over an older female cohabitant dog, but behave similarly towards the mother and towards a human stranger (Mariti et al., 2017), underlying how difficult and complex is comparing dog-dog and dog-human relationships (Mariti et al., 2014).

The secure base effect is, according to Ainsworth, the feature that mainly distinguishes an attachment bond from other affectional ties. Owners can represent a secure base for their adult dogs in the ASST (Mariti et al., 2013) as well as in other situations (Gácsi et al., 2013; Horn et al., 2013), and recent studies suggest that dog-owner bond can present the all the styles found in child-mother attachment (Schöberl et al., 2016). The secure base in dog-human relationship is investigated through the analysis of exploration and play behavior, which should be more displayed in the presence of the attachment figure (Mariti et al., 2013). In the current study, as expected from previous studies in adult dogs (Prato-Previde et al., 2003), puppies showed higher levels of exploration when the environment was truly novel, i.e. in the first episode of ASST, and then decreased. The longer exploration in episode 2 compared to episode 6 can probably be included in the trend of reduction through the procedure, more than been explained by the fact that in episode 2 the puppy and the stranger were in the company of the owner.

In case the secure base effect is present, puppies should have felt safer when together with the owner, and therefore more prone to rest in the episodes with her. Although lower levels of resting were shown in episode 1, i.e. when the owner was in the room, this result may be the other side of the coin regarding explorative behavior: in the first episode puppies were curious of the new environment, so they did not rest. The increase of resting in the last episode may also be indicative of tiredness, that is more likely to occur in young animals than in adults.

In the current study, individual play was displayed for a statistically longer time in episode 1 than in episode 3. As for exploration, it is possible that such finding is not related to the presence of the owner bur rather to the order of episodes within the test. The results obtained for exploration, individual play and resting suggest that puppies were more active at the very beginning of the test and then their interest towards the environment was reduced, as occurs for adult dogs (Prato-Previde et al., 2003). Taken together, these results do not clearly indicate a secure base effect of the breeder for the puppy.

Considering the lack of evidence of a secure base effect, the findings of the current study do not fully support the hypothesis that 2-months old, normally raised dog puppies establish an attachment bond towards their human caregiver. This is partially in disagreement with previous literature, showing that the attachment system varies with age in domestic dogs, and in detail

young dogs tend to show more evident attachment behaviors (Carlone et al., 2014), whilst aged dogs show more evident physiological changes but less behavioral indicators after the activation of the attachment system (Mongillo et al., 2013).

The findings of this study should be regarded as preliminary, due to the novelty of the study and the relatively small sample. Anyway, they represent a starting point from which to explore the development of dog-man relationship.

Our findings are apparently in disagreement with those of Topàl et al., (2005), who found that 4 months old dog puppies (hand-raised and normally raised) behave differently from wolf cubs in the ASST, showing attachment behaviors towards the owner. However, the behavior of puppies at 8 and 16 weeks of age can be quite different, as well as the kind of relationship established with other individuals. In addition, a direct comparison of our results with that study cannot be done, as Topál et al. (2005) did not analyze single episodes and the human caregiver of pet puppies was not the breeder but the adopter (personal communication). The importance of owners' behavior in creating a relationship with a dog (Schöberl et al., 2016), including the shared activities and the time spent together (Carlone et al., in press), can be responsible for the discrepancy between conclusions drawn by Topál et al., (2005) with 4 months puppies, and our conclusions on 2 months old puppies.

Another possible explanation for our results is that 2 months old puppies have established a primary attachment bond towards the mother, still ongoing, and that bond may hinder the establishment of other bonds, e.g. towards the human caregiver. Further studies are needed to better understand this point. All young animals, including puppies, need to establish an attachment bond; so, if a person represents the primary caregiver, this person is likely to become the attachment figure. It is possible that a study focusing on hand-raised, 2 months old puppies may have led to different results. However, this pilot study was focused on puppies raised by their mother, as they represent the majority of puppies.

A possible practical implication of these preliminary findings is related to the age of adoption. If puppies are adopted by a new family when they are 2 months, probably they have to face a disruption from the mother and littermates but not from the breeder; when adopted at a later age, puppies may have to undergo also a disruption of the relationship with a human, which may cause higher stress in the short term and more difficulty in creating a secure bond with the new owner in the long term (Prato-Previde et al., 2007).

## Conclusions

The findings of this preliminary study do not fully support the hypothesis that dogs establish an attachment bond towards their human caregivers since puppies, provided that they are raised by their mother. It is likely that a longer time spent together is needed for this peculiar kind of bond to be formed and/or that the primary attachment bond towards the mother, still present in puppies, hinders the establishment of other bonds.

Further studies should focus on the relationship between puppies and adopting owners, in order to assess the time needed for establishing a bond that can be properly called attachment and which factors can facilitate its formation.

## Acknowledgments

## Ethical considerations

All procedures were performed in full accordance with the Directive 2010/63/EU of the European Parliament and of the Council of 22/09/2010 on the protection of animals used for scientific purposes and conformed to the "Guidelines for the treatment of animals in behavioral research and teaching" (Behaviour, 2016). As this study is observational in nature, it did not require an approval from an ethical committee.

Before starting the procedure, the participating owners were introduced to the study, their role, and what to expect by participating. They were then asked to complete a consent form authorizing the use of collected data in accordance with the Italian National Privacy Law valid at the time the study was carried out (Legislative Decree n. 196, June 30, 2003).

Before the tests owners were told that the purpose of the study was to analyze dog explorative behavior; the complete aim was disclosed after the participation at the test, in order to avoid that owners would modify their behaviour according to it.

## References

Ainsworth M.D., Bell S.M. Attachment, exploration, and separation: illustrated by the behavior of one-year-olds in a strange situation. Child Dev. 1970. https://doi.org/10.1111/j.1467-8624.1970.tb00975.x

Bard K.A. Distribution of attachment classifications in nursery chimpanzees. Am. J. Primatol. 1991; 24: 88.

Bard K.A. & Nadler R.D. The effect of peer separation in young chimpanzees (Pan troglodytes). Am. J. Primatol. 1983. https://doi.org/10.1002/ajp.1350050104

Behaviour A. Guidelines for the treatment of animals in behavioural research and teaching. Anim. Behav. 2016. https://doi.org/10.1016/S0003-3472(15)00461-3

Bowlby J. A Secure Base: Clinical Applications of Attachment Theory, 1988. London Routledge.

Bowlby J. Attachment and loss: Attachment, Attachment. 1969. https://doi.org/10.1177/000306518403200125

Carlone B., Ricci E., Votta E., Gazzano A., Guardini G., Mariti C. Intraspecific attachment in domestic dogs (Canis familiaris): Does it differ from young adults to adults? J.V. B. 2014; 9, e4. https://doi.org/10.1016/j.jveb.2014.09.014

Carlone B., Sighieri C., Gazzano A., Mariti C. The dog (Canis familiaris) as part of the family: a pilot study on the analysis of dog bond to all the owners. Dog Behavior. 2019; 5: 1-14.

Gácsi M., Maros K., Sernkvist S., Faragó T., Miklósi Á. Human Analogue Safe Haven Effect of the Owner: Behavioural and Heart Rate Response to Stressful Social Stimuli in Dogs. PLoS One. 2013.https://doi.org/10.1371/journal.pone.0058475

Grimm D. Dawn of the dog. Science 2015. https://doi.org/10.1126/science.348.6232.274.

Guardini G., Bowen J., Raviglione S., Farina R., Gazzano A. Maternal behaviour in domestic dogs: A comparison between primiparous and multiparous dogs. Dog Behavior. 2015; 1 :23-33.

Guardini G., Bowen J., Mariti C., Fatjó J., Sighieri C., Gazzano A. Influence of maternal care on behavioural development of domestic dogs (Canis familiaris) living in a home environment. Animals 2017. 7. https://doi.org/10.3390/ani7120093

Horn L., Huber L., Range F. The Importance of the Secure Base Effect for Domestic Dogs - Evidence from a Manipulative Problem-Solving Task. PLoS One. 2013. https://doi.org/10.1371/journal.pone.0065296

Kretchmer K.R., Fox M.W. Effects of domestication on animal behaviour. Vet. Rec. 1975. https://doi.org/10.1136/vr.96.5.102

Mariti, C., Ricci, E., Zilocchi, M., Gazzano, A., 2013. Owners as a secure base for their dogs. Behaviour 150, 1275-1294. https://doi.org/10.1163/1568539X-00003095

Mariti C., Carlone B., Ricci E., Sighieri C., Gazzano A. Intraspecific attachment in adult domestic dogs (Canis familiaris): Preliminary results. Appl. Anim. Behav. Sci. 2014. 152, 64-72. https://doi.org/10.1016/j.applanim.2013.12.002

Mariti C., Carlone B., Votta E., Ricci E., Sighieri C., Gazzano A. Intraspecific relationships in adult domestic dogs (Canis familiaris) living in the same household: A comparison of the relationship with the mother and an unrelated older female dog. Appl. Anim. Behav. Sci. 2017. https://doi.org/10.1016/j.applanim.2017.05.014

Mariti C., Carlone B., Sighieri C., Campera M., Gazzano A. Dog behavior in the Ainsworth Strange Situation Test during separation from the owner and from the cohabitant dog . Dog Behavior 2018; 4: 1-8. https://doi.org/10.4454/db.v4i1.v3i3.76

Marshall-Pescini S., Virányi Z., Kubinyi E., Range F. Motivational factors underlying problem solving: Comparing wolf and dog puppies' explorative and neophobic behaviors at 5, 6, and 8 weeks of age. Front. Psychol. 2017. https://doi.org/10.3389/fpsyg.2017.00180

May F., Depute B.L., Durand J.L. Whom do 8-week-old puppies (Canis familiaris) prefer, their mother or their littermates? J.V.B. 2009.; 4: 105-106. https://doi.org/10.1016/j.jveb.2008.10.011

McConnell M., Moss E. Attachment across the life span: Factors that contribute to stability and change. Aust. J. Educ. Dev. Psychol. 2011; 11: 60-71.

Miller L.C., Bard K.A., Juno C.J., Nadler,R.D. Behavioral responsiveness to strangers in young chimpanzees (Pan troglodytes). Folia Primatol. 1990. https://doi.org/10.1159/000156510

Miller L.C., Bard K.A., Juno C.J., Nadler R.D. 1986. Behavioral responsiveness of young chimpanzees (Pan troglodytes) to a novel environment. Folia Primatol. 1990. https://doi.org/10.1159/000156270

Mongillo P., Pitteri E., Carnier P., Gabai G., Adamelli S., Marinelli L. Does the attachment system towards owners change in aged dogs? Physiol. Behav. 2013. https://doi.org/10.1016/j.physbeh.2013.07.011

Palmer R., Custance D, A counterbalanced version of Ainsworth's Strange Situation Procedure reveals secure-base effects in dog-human relationships. Appl. Anim. Behav. Sci. 2008. https://doi.org/10.1016/j.applanim.2007.04.002

Payne E., DeAraugo J., Bennett P., McGreevy P. Exploring the existence and potential underpinnings of dog-human and horse-human attachment bonds. Behav. Processes. 2016. https://doi.org/10.1016/j.beproc.2015.10.004

Pettijohn T.F., Wong T.W., Ebert P.D., Scott, J.P. Alleviation of separation distress in 3 breeds of young dogs. Dev. Psychobiol. 1977. https://doi.org/10.1002/dev.420100413

Prato-Previde E., Custance D.M., Spiezio C., Sabatini F. Is the dog - human relationship an attachment bond ? An observational study using Ainsworth ' s strange situation. Behaviour. 2003. https://doi.org/10.1163/156853903321671514

Prato-Previde E., Valsecchi P. Effect of abandonment on attachment behavior of adult pet dogs. J.V.B. 2007; 2: 87-88. https://doi.org/10.1016/j.jveb.2007.04.015

Prato-Previde E.P., Ghirardelli G., Marshall-Pescini S., Valsecchi P. Intraspecific attachment in domestic puppies (Canis familiaris). J.V.B. 2009; 4: 89-90. https://doi.org/10.1016/j.jveb.2008.10.002

Rehn T., Keeling L.J. Measuring dog-owner relationships: Crossing boundaries between animal behaviour and human psychology. Appl. Anim. Behav. Sci. 2016. https://doi.org/10.1016/j.applanim.2016.07.003

Schöberl I., Beetz A., Solomon J., Wedl M., Gee N., Kotrschal K. Social factors influencing cortisol modulation in dogs during a strange situation procedure. J.V.B. 2016. https://doi.org/10.1016/j.jveb.2015.09.007

Topál J., Miklósi Á., Csányi V., Dóka A. Attachment behavior in dogs (Canis familiaris): A new application of Ainsworth's (1969) Strange Situation Test. J. Comp. Psychol. 1998. https://doi.org/10.1037/0735-7036.112.3.219

Topál J., Gácsi M., Miklósi Á., Virányi Z., Kubinyi E., Csányi V. Attachment to humans: A comparative study on hand-reared wolves and differently socialized dog puppies. Anim. Behav. 2005. https://doi.org/10.1016/j.anbehav.2005.03.025

Tuber D.S., Hennessy M.B., Sanders S., Miller J.A. Behavioral and glucocorticoid responses of adult domestic dogs (Canis familiaris) to companionship and social separation. J. Comp. Psychol. 1996. https://doi.org/10.1037/0735-7036.110.1.103

## L'attaccamento all'essere umano esiste già in cuccioli di due mesi allevati dalla madre? Uno studio pilota

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*Sintesi*

In base alle attuali conoscenze, i cani adulti sono in grado di stabilire un legame di attaccamento verso i proprietari e i cuccioli nei confronti delle proprie madri.

Lo scopo di questa ricerca è stato quello di verificare se nei cuccioli esiste già un attaccamento nei confronti delle persone.

Sono stati testati 14 cuccioli di due mesi di età, nel test di Ainsworth della Strange Situation, in cui il ruolo della persona che si era presa cura dei cuccioli era svolto dall'allevatore, essendo l'essere umano con cui i cuccioli avevano interagito maggiormente nelle prime loro settimane di vita.

Come previsto, i cuccioli protestavano alla separazione dall'allevatore, uggiolando, esibendo comportamenti orientati verso la porta e rimanendo nei pressi della porta.

Inoltre i cuccioli aumentavano la ricerca di prossimità dopo la separazione ma non mostravano una chiara preferenza per l'allevatore, rispetto ad una persona estranea.

La durata dell'esplorazione, del gioco e del rimanere fermo sembrano essere correlati all'ordine degli episodi piuttosto che all'effetto base sicura.

I risultati di questo studio preliminare non confermano completamente l'ipotesi che i cani, da cuccioli, stabiliscano nei confronti della persona che si prende cura di loro, se è presente la madre. È verosimile che sia necessario che gli animali trascorrano con la persona un periodo di tempo più perché questa particolare forma di legame si formi.

# A pilot study on the qualitative assessment of the impact of human-canine relationships on dogs' susceptibility to stress

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*Abstract*: The aim of the study was to determine the impact of canine-human relationship on dogs' susceptibility to stress during tests that evaluate a dog's suitability for canine-assisted therapy. Twenty-four dogs and their owners were included in the study. Dogs from all groups were most likely to manifest stress by nervous tail wagging/hugging, which could suggest that tail movements and the position of the tail are the key markers of emotional states in dogs. An analysis of pooled results revealed that dog-owner relationships influenced the animals' susceptibility to stress. These findings indicate that human-canine bonding plays an important role in dog behaviors. In this study, stress levels were higher in dogs that were less bonded with their owners. Apparently, dogs that have good contact with humans are better equipped to cope with stress than animals which are less reliant on their owners.

## Introduction

Therapy dogs are exposed to numerous stress factors. Their owners should be able to read the common signs and symptoms of stress manifested by dogs. Dogs should be closely monitored, and their working time and work difficulty should be modified accordingly. Similarly to Germany and Norway, Poland does not have legal regulations concerning dogs for canine-assisted therapy (Wohlfarth & Sandstedt, 2016). Consequently, an official examination system for therapy dogs does not exist. Canine-assisted therapy is provided mostly by non-profit organizations, most of which evaluate the animals. Some organizations subject therapy dogs to preliminary tests to ensure that they are fit for the job. These tests aim to determine whether the dog copes well with stress, and whether it should undergo professional training. In addition to evaluating the dog's behavior, these tests also provide ample information about the animal's relationship with humans. Dogs need to bond with their owners to perform their tasks well, and the established relationship has to be based on trust and a sense of security (Serpell, 2017). The way dogs are trained, the tone of the human voice, human attitudes, and the demands placed on dogs affect each party in the relationship. In positive training, dogs will be more eager to cooperate, they will feel relaxed and more willing to trust their owners when their guardians use a gentle tone of voice, have balanced requirements and adopt a strong, but not overtly strict attitude. Coercion and physical punishment may cause dogs to withdraw and fear the handler (Sjösten, 2006; Owens & Eckroate, 2007).

Dogs communicate with each other and with other animals, including humans, based on olfactory, visual, acoustic and tactile signals which are mutually interconnected. Dogs manifest joy, peace, but also fear. The owners should closely observe their dogs in order to correctly interpret their companions' intentions. Experienced dog owners know when to intervene and break the

tide of anxiety to prevent the dog from attacking a third party in a self-defense (Wilde, 2006).

It is believed that a dog's behavior reflects the owner's emotional state. In other words, dogs are relaxed when their owners feel peaceful, whereas anxious owners will stir the same emotions in their animals. The owner's erratic behavior (punishing or rewarding the dog for the same behavior) can also be a source of stress for a dog.

The impact of human emotions and attitudes on canine behavior has been widely discussed in cynological literature (Sjösten, 2006; Donaldson, 2007; Owens & Eckroate, 2007; Rugaas 1997). However, to the best of our knowledge, the impact of canine-human relationships on the incidence of stress responses in dogs has never been investigated experimentally. In view of the above, the aim of this study was to determine the impact of canine-human relationship on dogs' susceptibility to stress during tests that evaluate a dog's suitability for canine-assisted therapy.


## Materials and methods

Twenty-four dogs and their owners were included in the study. The animals were purebred and mixed breed male and female dogs of different age and origin. The dogs' suitability for canine-assisted therapy was assessed by an experienced trainer, referred to as the test leader (TL). Fifteen assistants also took part in the test. The test was performed in a closed room measuring 10 x 15 m, with a ceramic tile floor and large windows. The test consisted of nine subtests (stages):

1. The owner walks a leashed dog diagonally across the room from the entrance door.The assistants stand still at various points in the room.
2. The owner walks a leashed dog back to the entrance door. The assistants walk around the room.
3. The owner walks a leashed dog diagonally across the room from the door. The assistants walk around the room, and approximately every second, one of the assistants hits the floor loudly with a stick.
4. The dog is unleashed, the owner remains neutral, and the assistants stand still at various points in the room.
5. The owner calls the dog and puts it on the leash. The assistants stand still at various points in the room.
6. The owner gives the dog a "sit down" command. The assistants stand still at various points in the room.
7. The TL crouches and touches the dog's sides, back, fore and hind paws, and head.
8. The TL stands approximately 2 m in front of the dog, squeezes a squeaking toy, and drops it before the dog. The assistants stand still at various points in the room.
9. The TL throws a hard object which lands approximately 1 m behind the dog with a loud a noise; the assistants stand still at various points in the room.

The entire test was recorded with a video camera, and the video footage was evaluated independently by two canine behavior experts (COAPE certified animal behaviorists). The first expert assessed the quality of dog-owner relationships based on observations of eye contact between the dog and the owner, and the dog's compliance with the recall command. The observations were graded on the following scale: good (group I), average (group II) and poor (group III). Each group consisted of eight dogs. The second expert assessed the severity of stress responses in dogs based on the animals' general behavior and stress response indicators such as nervous tail wagging/ hugging, pulling and jerking on the leash, sniffing the ground, fur shaking, and licking (Table 1). These observations were graded a scale of 0 to 5 points, where 0 denoted the lowest and 5 – the highest stress response.

**Table 1.** Dog's stress response indicators analyzed in the study.

| Behavior | Description |
|---|---|
| Nervous tail wagging/hugging | The dog slowly wags its tail which is held much lower than its natural position or tucks it under the body |
| Pulling and jerking on the leash | The dog pulls/jerks the leash to move away from the stressor |
| Sniffing the ground | The dog sniffs the ground (for less than 2 seconds*) |
| Fur shaking | The dog slightly shakes off or involve the entire body as if it was wet |
| Licking | The dog licks the nose or the lips |

*adapted from Mariti et al., 2017

The results were expressed as means ± standard error of the mean (SEM). The data were processed statistically using the Kruskal-Wallis test, and the significance of differences between groups was verified by Nemenyi's post-hoc test. The stress response of every animal was presented separately for each stage of the test to illustrate the diversity of canine behaviors. The results were then pooled and used in the calculations together with external variables. All calculations were performed in R software (R Core Team, 2015).

## Results

Group I dogs (that made good eye contact with their owners) where characterized by a lower stress response to the auditory stimulus in stage 3 of the test than group III dogs (poor eye contact) (Table 2). The stress responses to the auditory stimulus in stage 9 of the test (object thrown behind the dog) was higher in group II dogs (average eye contact) (3.00) than in group III animals (0.50). Surprisingly, the stress responses of group III dogs were moderate (2.00) in the above procedure. In general, group I dogs were less susceptible to auditory and tactile stimuli than group II and group III animals (0.43 vs. 1.84 and 2.00, respectively).

**Table 2.** Associations between dog-owner eye contact and stress responses to auditory and tactile stimuli (mean ± SEM, n=8).

| Stress response to | Dog-owner eye contact | | | *P-value* |
|---|---|---|---|---|
| | Group I (good) | Group II (average) | Group III (poor) | |
| Auditory stimulus (stage 3) | $0.00\pm0.00^B$ | $1.25\pm0.53$ | $2.38\pm0.60^A$ | *0.001* |
| Tactile stimulus (stage 7) | $0.88\pm0.48$ | $1.50\pm0.63$ | $2.38\pm0.53$ | *0.099* |
| Auditory stimulus (stage 8) | $0.38\pm0.38$ | $1.50\pm0.63$ | $2.38\pm0.53$ | *0.219* |
| Auditory stimulus (stage 9) | $0.50\pm0.38^b$ | $3.00\pm0.82^a$ | $2.00\pm0.73$ | *0.048* |
| Total for stages 3, 7, 8, 9 | $0.43\pm0.19^b$ | $1.84\pm0.39^a$ | $2.00\pm0.48^a$ | *0.007* |

Means within a row followed by a different superscript differ significantly, where lower-case superscripts differ at P<0.05, and upper-case superscripts differ at P<0.01.

The above results corroborate the observations concerning dog-owner relationships and stress responses to auditory and tactile stimuli (Table 3). Dogs with strong bonds to their owners (group I) were less stressed in response to auditory stimuli in stages 3, 8 and 9. Similarly to previous test

stages, no significant differences were noted in the dogs' responses to tactile stimuli. In general, group I animals were less susceptible to stress than group II and group III dogs (0.34 vs. 1.72 and 2.21, respectively).

**Table 3.** Associations between dogs' general relationship with their owners and stress responses to auditory and tactile stimuli (mean ± SEM, n=8).

| Stress response to | Dog's general relationship with owner | | | P-value |
| --- | --- | --- | --- | --- |
| | Group I (good) | Group II (average) | Group III (poor) | |
| Auditory stimulus (stage 3) | $0.00\pm0.00^B$ | $1.13\pm0.44$ | $2.50\pm0.63^A$ | 0.001 |
| Tactile stimulus (stage 7) | $0.88\pm0.48$ | $1.38\pm0.38$ | $2.50\pm0.71$ | 0.139 |
| Auditory stimulus (stage 8) | $0.00\pm0.00^b$ | $2.00\pm0.80$ | $1.25\pm0.53^a$ | 0.039 |
| Auditory stimulus (stage 9) | $0.50\pm0.38^b$ | $2.38\pm0.84$ | $2.63\pm0.75^a$ | 0.050 |
| Total | $0.34\pm0.13^{Bb}$ | $1.72\pm0.40^a$ | $2.21\pm0.44^A$ | 0.001 |

Means within a row followed by a different superscript differ significantly, where lower-case superscripts differ at P<0.05, and upper-case superscripts differ at P<0.01.

The stress response indicators determined during the test and the associations with dog-owner eye contact are presented in Table 4. No significant differences between groups were observed in an analysis of single traits, but nervous tail wagging/ hugging and pulling and jerking on the leash appeared to increase with worsening eye contact between the dog and its owner (P=0.064 and P=0.077, respectively). In general, group I dogs were characterized by lower stress indicator values than group III animals (0.55 vs. 1.13).

**Table 4.** Associations between dog-owner eye contact and stress response indicators during the test (mean ± SEM, n=8).

| Stress response indicator | Dog's eye contact with their owner | | | P-value |
| --- | --- | --- | --- | --- |
| | Group I (good) | Group II (average) | Group III (poor) | |
| Nervous tail wagging/hugging | $0.88\pm0.44$ | $1.63\pm0.56$ | $2.75\pm0.56$ | 0.064 |
| Jerking on the leash | $0.38\pm0.38$ | $0.50\pm0.27$ | $1.25\pm0.37$ | 0.077 |
| Sniffing | $0.63\pm0.26$ | $0.25\pm0.16$ | $0.38\pm0.18$ | 0.516 |
| Fur shaking | $0.50\pm0.19$ | $0.50\pm0.19$ | $0.38\pm0.18$ | 0.851 |
| Licking | $0.38\pm0.18$ | $0.88\pm0.35$ | $0.88\pm0.52$ | 0.658 |
| Total | $0.55\pm0.20^b$ | $0.75\pm0.17$ | $1.13\pm0.11^a$ | 0.033 |

Means within a row followed by a different lower-case superscript differ significantly at P<0.05

As shown in Table 5, stress levels were lower in dogs that complied with the recall command (group I) than in the least obedient animals (group III) (0.38 vs. 1.20). In particular, nervous tail

wagging/hugging was determined at 0.63 in group I and 3.13 in group III. Certain differences, although statistically not significant (P=0.077), were also noted in pulling and jerking on the leash. This indicator was determined at 0.13 in group I, 0.75 in group II and 1.25 in group III.

**Table 5.** Associations between compliance with the recall command and stress response indicators during the test (mean ± SEM, n=8).

| Stress response indicator | Compliance with the recall command | | | P-value |
|---|---|---|---|---|
| | Group I (good) | Group II (average) | Group III (poor) | |
| Nervous tail wagging/hugging | 0.63±0.42[B] | 1.50±0.50 | 3.13±0.44[A] | 0.006 |
| Jerking on the leash | 0.13±0.13 | 0.75±0.37 | 1.25±0.41 | 0.077 |
| Sniffing | 0.50±0.27 | 0.50±0.27 | 0.25±0.16 | 0.617 |
| Fur shaking | 0.25±0.16 | 0.75±0.16 | 0.38±0.18[a] | 0.124 |
| Licking | 0.38±0.18 | 0.75±0.31 | 1.00±0.53 | 0.727 |
| Total | 0.38±0.12[B] | 0.85±0.16 | 1.20±0.12[A] | 0.003 |

Means within a row followed by a different upper-case superscript differ significantly at P<0.01.

The associations between dog-owner relationships and stress response indicators in dogs during the entire test are presented in Table 6. Stress levels manifested by nervous tail wagging/hugging (0.58 in group I vs. 1.10 in group III) were influenced by the strength of dog-owner relationships. The difference between group I and group III was close to being statistically significant (P=0.056).

**Table 6.** Associations between the general dog-owner relationship and stress response indicators during the test (mean ± SEM, n=8).

| Stress response indicator | General dog-owner relationship | | | P-value |
|---|---|---|---|---|
| | Group I (good) | Group II (medium) | Group III (poor) | |
| Nervous tail wagging/hugging | 0.75±0.41[b] | 1.75±0.62 | 2.75±0.49[a] | 0.039 |
| Jerking on the leash | 0.50±0.38 | 0.50±0.27 | 1.13±0.40 | 0.306 |
| Sniffing | 0.75±0.25 | 0.13±0.13 | 0.38±0.18 | 0.109 |
| Fur shaking | 0.50±0.19 | 0.50±0.19 | 0.38±0.18 | 0.851 |
| Licking | 0.38±0.18 | 0.88±0.35 | 0.88±0.52 | 0.658 |
| Total | 0.58±0.20 | 0.75±0.18 | 1.10±0.11 | 0.056 |

Means within a row followed by a different lower-case superscript differ significantly at P<0.05.

## Discussion

So far, studies have been conducted on the bond between a dog and his owner (reviewed by Payne et al., 2015) or a dog and all human members of his family (Carlone et al., 2019). On the other hand, various stress-related signals in dogs were analyzed (Firnkes et al., 2017; Mariti et al., 2017). The novelty of the current study is that it analyzes the impact of the relationship between a dog and his owner on dogs' susceptibility to stress. The results contribute to a better understanding of this matter and can help to improve welfare of dogs. They confirm the common view among cynologists that the dog's bond with his owner is of great importance for the former. However, only a qualitative analysis was carried out and no inter-rater reliability assessment was made, therefore the results should be seen as preliminary.

Owners can tell when their dogs experience discomfort or fear by observing their body language (Firnkes et al., 2017). Dogs often communicate stress through calming signals to avoid a certain stimulus or to change the behavior of another animal (Rugaas, 1997). Dogs generally use many signals at the same time, and some signals are ambiguous. Innate behaviors, such as scratching the ground with fore paws, vocalization, hair licking, panting, tail wagging, urinating, running around in circles, and rapid body movements, can also act as calming signals (Pastore et al., 2011). All dog behaviors in response to auditory and tactile stimuli were evaluated in this study (Tables 2 and 3), and the examined stress indicators were nervous tail wagging/hugging, pulling and jerking on the leash, short sniffing, shake off behavior, and licking (Tables 4, 5 and 6). Dogs from all groups were most likely to manifest stress by nervous tail wagging/hugging, which could suggest that tail movements and the position of the tail are the key markers of emotional states in dogs. An analysis of pooled results revealed that dog-owner relationships influenced the animals' susceptibility to stress. These findings indicate that human-canine bonding plays an important role in dog behaviors.

Deficient socialization is one of the key causes of anxiety and susceptibility to stress in dogs (Wilsson, 2016). Dogs that become familiar with various auditory and tactile stimuli at an early age are more resistant to stress and respond to it in a less agitated manner in adulthood (Dietz et al., 2018). Anxious behavior can also be modulated by training to increase the dog's confidence in the owner and to strengthen human-canine bonds (Protopopova et al., 2012). A dog's willingness to obey the recall command is a good measure of success in basic training. According to Dennison (2007), dogs do not come when called if they are weakly or inadequately bonded with their owners, and the owners' behavior (attitude or tone of voice) can in itself be a source of stress for dogs. A dog that trusts its owner and has bonded with its owner will be always ready to obey the recall command. Owens & Eckroate (2007) have argued that at least 50% of dog behaviors are related to the owner's emotional state. However, the above claim was not backed by experimental results. In the present study, group I dogs (which scored high in the obedience test) were less stressed during the test than group III animals (which scored lowest in the obedience test) (Table 5). The frequency and duration of eye contact between the dog and the owner is also a robust indicator of human-canine bonding. Dogs that maintained good eye contact were also less stressed during the evaluation than animals that had poor eye contact with their owners (Tables 2 and 4).

The expert assessment was conducted on the assumption (adapted from Mariti et al., 2017) that short sniffing (up to 2 seconds) is a calming signal. Sniffing is one of the favorite dog activities. Sniffing is a form of canine cognition, but it can also manifest stress. Sniffing can be an innate behavior that enhances a dog's olfactory perception, but dogs also sniff to modify the behavior of other animals, for example, to calm down an aggressive dog or to make contact with a shy dog. In this study, dogs that were well bonded with their owners and were generally less stressed, were also somewhat more likely to engage in short sniffing behavior than the animals from the remaining groups (Tables 4, 5 and 6). Sniffing could also be a way to establish dialogue with the humans present in the test room. Interestingly, group I dogs were also more likely to engage in prolonged sniffing that the remaining animals (data not shown in tables).

Dogs rarely engage in "shake off" behavior when they feel relaxed, but this bodily movement is frequently observed in stressful situations. Fur shaking is often taken into consideration in analyses of stress-dependent parameters (Pastore et al., 2011). Dogs shake their fur to alleviate stress and return to a positive emotional state. This behavior is frequently observed in dogs characterized by high levels of general self-satisfaction, including many terriers. For this reason, dogs that shake their fur under similar stress conditions are not always more stressed.

In this study, stress levels were higher in dogs that were less bonded with their owners. Apparently, dogs that have good contact with humans are better equipped to cope with stress than animals which are less reliant on their owners.

## References

Carlone B., Sighieri C., Gazzano A., Mariti C. The dog (*Canis familiaris*) as part of the family: a pilot study on the analysis of dog bond to all the owners. Dog Behavior. 2019; 1, 1-14. https://doi.org/10.4454/db.v5i1.90

Dennison P. The Complete Idiot's Guide to Positive Dog Training, 2nd edition. Alpha Books, London. 2007.

Dietz L., Arnold A.M.K., Goerlich-Jansson V.C., Vinke C.M. The importance of early life experiences for the development of behavioural disorders in domestic dog. Behaviour. 2018; 155: 83-114. https://doi.org/10.1163/1568539X-00003486

Donaldson J. Culture clash: a new way of understanding the relationship between humans and domestic dogs. James & Kenneth Publishers, Berkeley. 1996.

Firnkes A., Bartels A., Bidoli E., Erhard M. Appeasement signals uded by dogs during dog-human communication. J.V.B. 2017; 19: 35-44. https://doi.org/10.1016/j.jveb.2016.12.012.

Mariti C., Falaschi C., Zilocchi M., Fatjó J., Sighieri C., Ogi A., Gazzano A. Analysis of the intraspecific visual communication in the domestic dog (Canis familiaris): a pilot study on the case of calming signals. J.V.B. 2017; 18: 49-55. https://doi.org/10.1016/j.jveb.2016.12.009.

Owens P., Eckroate N. The Dog Whisperer, 2nd edition. Sand Castle Enterprises LLC, USA. 2007.

Pastore C., Pirrone F., Balzarotti F., Faustini M., Pierantoni L., Albertini M. Evaluation of physiological and behavioral stress-dependent parameters in agility dogs. J.V.B. 2011; 6(3): 188-194. https://doi.org/10.1016/j.jveb.2011.01.001.

Payne E., Bennett P., McGreevy P. Current perspectives on attachment and bonding in the dog-human dyad. Psychol. Res. Behav. Manag. 2015; 8, 71. https://doi.org/10.2147/PRBM.S74972.

Protopopova A., Gilmour A.J., Weiss R.H., Shen J.Y., Wynne C.D.L. The effects of social training and other factors on adoption success of shelter dogs. Appl. Anim. Behav. Sci. 2012; 142: 61-68. https://doi.org/10.1016/j.applanim.2012.09.009

R Core Team. R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing. 2015. https://www.R-proje ct.org/

Rugaas T. On talking terms with dogs: calming signals. Dogwise Publishing, Wenatchee, WA. 1997.

Serpell J. The Domestic Dog: Its Evolution, Behaviour and Interactions with People, 2nd Edition. Cambridge University Press, Cambridge. 2017.

Sjösten I. General obedience. SRI Publication AB, Kallinge. 2006.

Wilde N. Help for your fearful dog: A step-by-step guide to helping your dog conquer his fears. Phantom Publishing, USA. 2006.

Wilsson E. Nature and nurture - how different conditions affect the behavior of dogs. J. Vet. Behav. 2016; 16: 45-52. https://doi.org/10.1016/j.jveb.2016.10.002

Wohlfarth R., Sandstedt L. Animal Assisted Activities with Dogs. Guideline for basic requirements & knowledge. Publishing House ELIPSA, Warszawa. 2016.

# Uno studio pilota sulla valutazione qualitative dell'impatto della relazione uomo-cane sulla suscettibilità allo stress

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*Sintesi*

Lo scopo dello studio è stato quello di determinare l'impatto della relazione uomo-cane sulla suscettibilità del cane allo stress, durante test che valutano l'adeguatezza del cane per essere utilizzato in Interventi assistiti.

Nel presente studio sono stati inclusi 24 animali ed i loro proprietari. L'analisi dei risultati ha dimostrato che la relazione uomo-cane influenza la suscettibilità dell'animale allo stress, indicando che il legame con il proprietario esercita una influenza importante sul comportamento del cane. I livelli di stress più alti sono stati trovati in cani meno legati al loro proprietario. Apparentemente i cani che hanno una buona relazione con le persone sono meglio equipaggiati a fronteggiare lo stress, rispetto ad animali meno legati ai loro proprietari.

# Barking and its meaning in inter and intra-specific language

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*Abstract*: In intra and interspecific communication, barking is the most used and known sound and is the most studied. There are different types of bark: for excitement, alarm, fear, guard, defense, frustration and others that can be identified according to the phonographic structure and the context.

The bark has different shades, low, medium, high and also varies in intensity, duration and frequency. The tone reveals the basic emotion, the duration has to do with communicative urgency and frequency with the level of excitement. Generalizing, the high tones call attention and the low tones convey threat.

It is possible to identify the various parameters using a vocal spectrograph. Research shows that regardless of their direct experience, most people correctly identify the vocalizations of aggression and alert.

Moreover, the acoustic parameters of the tonality, the intensity and frequency influence people in correctly describing the emotions to the base of the vocalizations (aggression, fear, play ...). In intraspecific language, research shows that dogs recognize the barks emitted in different situations, react more to the barks of familiar dogs, can distinguish between barks issued in different contexts and discriminate between different individuals who bark in the same context.

*Key Words*: dog, behavior, bark, communication of dog.

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## Introduction

An alternative channel to visual communication, widely used in dogs (Mariti et al., 2017), is the acoustic one. The bark is surely the most common sound emitted by dogs, with many other functions besides attracting attention (e.g. a signal of presence, identification of an individual, territorial signal) that differs according to the context and whose meaning must also be interpreted in dependence on the body's attitudes (posture and motor sequences) of the dog.

Among the wolves the bark is used by stranger individuals approaching to the pack; stray dogs, instead, rarely bark (Overall, 2001). In the ritual of invitation to play, barks and growls can be emitted with joking value (Colangeli, 2004).

Quantifying the frequency and duration of barking episodes is important to distinguish between normal and abnormal episodes. On average, when the owners are at home, the dogs bark 3.1 times (from 0 to 8) for a total of 198 seconds (from 0 to 430) in 24 hours.

While the dogs are sleeping, they remain more alert to barks than to other stimuli, even if the other stimuli may be more significant for the owner. Dogs living in a group have a greater probability to bark than those living alone (Beaver, 2009).

Many animals bark, growl and whine: for example, squirrels, elephants and monkeys bark and even the peeps of some birds follow the basic patterns of the bark, probably because the common evolutionary origin of the barking signal is simply an alarm call (Coren, 2004).

In dogs there is a type of bark that communicates excitement, one for the alarm, one for fear, one for guard or defense, another that expresses states of frustration and others that will described later.

The barking propensity may also be different according to the breeds: in general, the dogs that bark less are those selected for race competitions, such as the Greyhounds and the Whippets and other breeds such as the Husky and the Greenland dog (Rugaas, 2011).

## The sound structure of the bark

According to a study by Molnar et al. (2008) the barks have phonic characteristics related to the specific context and individual acoustic traits. In the various types of bark, we find different tones (low - medium – high); also, the intensity, duration and frequency or the rhythm can vary.

Tones have to do with the basic emotion: the high tones indicate excitement or insecurity, while the low tones are detectors of assertiveness and security.

Sound duration instead indicate how much the dog considers urgent what he wants to communicate.

The frequency will be proportional to the excitement or better to the agitation of the moment (Dalla Valle, 2014).

In general, the bark is classified as a complex, broadband, segmented sound, between 200 and 6000 Hz, with an average of 650 Hz (Beaver, 2009). Therefore tone, duration and frequency of the bark and of other sounds of the vocal communication, are modulated by the dog to express different meanings. In addition, the messages that the dog is sending with body language, the context in which the dog is located and the relationship with the individual to whom that sound is sent must also be considered. (Dalla Valle, 2014).

According to Dehasse (2011) the barks are often a symptom of excitement, referring both to a positive and negative emotional state. These vocal emissions begin to be emitted at 2-4 weeks of age, especially in the contexts of invitation to play; since the age of 8 weeks they can be also produced in aggressive contexts. The barks signaling pleasant emotions have more acute and modulated tones than those produced in contexts of distress (Dehasse, 2011).

According to Beaver (1999), the meaning of the bark is different depending on the context in which it is issued: for example, the high tone alternating with whining is an attention seeking, low tones have, instead, a threatening value (Shepherd, 2004).

Yin & McCowan (2004), testing 10 domestic dogs in three specific contexts (play, isolation, noise), demonstrated that the vocalizations emitted were similar.

Another study on canine vocalizations compared the bark of dogs affected by separation anxiety with that of normal dogs. Barking of normal dogs was an alert signal, with a single high frequency note like that emitted during the play; dogs affected by separation anxiety emitted barking complexes, repetitive and atonal (Overall, 2013).

## The bark in the communication with man

Dogs do not bark continuously in response to any stimulus and do not use the same type of bark in all circumstances. The various aspects of vocalizations can be measured using a phonogram / spectrogram, a vocal spectrograph.

Molnar et al. (2006, 2008, 2009) have shown that, regardless of their experience with dogs, most of human beings correctly identify the vocalizations emitted during a fight and when a stranger approach. There was instead a lower correspondence for the vocalizations issued during the walks, the play or when dogs are alone. This means that people can recognize an aggression

or an alert vocalization, but they do not correctly identify the information contained in barks in other situations (Overall, 2013).

Pongrácz et al. (2005) have examined the ability of people to identify the barks of dogs recorded in various situations and to associate them with the related emotional circumstances. The answers had a high percentage of correspondence, without depending on the direct experience of the person with canine vocalizations. Emotions were well correlated with peak, frequency and vocal emission intervals, instead there was no correlation with tonality (harmonic / noisy relationship).

A 2006 research conducted by Molnár et al. examined people's ability to recognize their dogs from their barks. The aspects under investigation were represented by: (1) how accurately humans discriminate between dogs by hearing only their barks, (2) the impact of the eliciting context of calls on these discrimination performances, and (3) how much such discrimination depends on acoustic parameters (tonality and frequency of barks, and the intervals between the individual barks). The results confirmed that discrimination between individuals was more successful when listeners were listening to low harmonic-to-noise ratio (HNR) barks. The contexts in which barks were recorded affected significantly the listeners' performances: if the dog barked at a stranger, listeners were able to discriminate the vocalizations better than if they were listening to sounds recorded when the dog was separated from its owner. It is rendered probable that the bark might be a more efficient communication system between humans and dogs for communicating the motivational state of an animal than for discrimination among strange individuals.

A research by Pongrácz and colleagues (2010) revealed that in the vocalization repertoire of dog, the bark is unique in producing wide ranges of acoustic parameters, such as frequency, tone and rhythm.

It has been demonstrated that the type of bark is related to the context, shows precise acoustic characteristics according to the specific context and conveys to people information about the dog's inner condition; in fact people of different ages and with different levels of knowledge of canine communication, are able to recognize from a recording the context in which the dog is barking and the basic emotional condition that caused it.

A study by Molnár et al. (2009a), proposed listening to recordings of barks of domestic dogs to three groups: one of congenitally blind people, one of blind people with previous visual experience and one of sighted people; none of these people had ever owned a dog.

The research showed that congenitally blind people can accurately classify the various types of bark registered in different contexts and describe their emotional contents, with results very close to those of sighted people.

These findings suggest that humans can recognize in barks some of the most important motivational states (fear, aggression ...) although they have no previous visual experience.

From a study (Pongrácz et al., 2010) it emerged that humans can correctly identify dog barks, recorded in various circumstances. Acoustic parameters, such as tone, intensity and time intervals between one bark and another, seem to have a clear effect on how people describe the emotionality underlying these vocalizations (aggression, fear, despair, playful moment, happiness).

The selection of the barks was made based on the values of the tone and of the frequency peak, such as low, medium and high. To classify the sequences of the intervals between the various artificial barks, the short, medium and long values were used.

People with different levels of dog experience have described the emotional contents of the bark sequences in a similar way. The score of the emotional contents of the bark sequences was in accordance with the "Structural-Acoustic Rules of Morton" (1977). (The low intensity barks were described as aggressive; the tonal and high intensity barks were reported as scary and / or despair).

The intervals between the various barks have a strong impact for human listeners: the bark sequences with short intervals are identified as aggressive, instead the bark sequences with longer intervals between them are read with low values of aggression.

High intensity barks with long intervals between them are considered happy and playful, regardless of their tone. It follows that in accordance with Morton's rules, the communication between humans and dogs is probably based on the characteristics of the basic mammary homology and that the acoustic signals of barking of the dog are correctly recognized by humans.

A study by Pogràcz et al. (2011) compared the ability of children (between the ages of 6-8 and 10 years) and that of adults in the distinction of the barks registered in three different contexts.

Most children have succeeded in classifying dog barks in the actual corresponding situations. Lakestani et al. (2005) had reported that children tend to neglect the body language of dogs by giving much more importance to their facial expression.

These results have also shown that the sounds of dog barking are less ambiguous for children, who easily distinguish the acoustic characteristics of aggressive or friendly vocalizations (Pongrácz et al., 2011).

## The bark in intraspecific communication

Maros et al. (2008) investigated the possibility that dogs can distinguish the bark of another individual registered in two remarkably different situations: the first, when a stranger enters the property where the dog lives; the second, when the dog is tied to a tree and left alone.

The experiment was carried out using an adaptation-mismatch paradigm detected by measuring variations in the dog's heart rhythm to which was made to listen to the recording. The experiment showed that dogs can perceive the difference between the barks emitted in different situations, so it is possible to establish that the bark is a means of communication addressed to both humans and conspecifics.

A research by Szabò et al. (2008) has exposed family dogs listening to barks recorded in two contexts: when the dog was left alone and when the dog barked in response to the arrival of a stranger. Were chosen owners who had at least two dogs.

Each dog has undergone 4 tests in which he has been exposed to both, barks of a known and not known dog. Dogs have more frequently issued an alternation of the gaze between the sound source and the owner when they were exposed to listening to familiar dog barks.

It has been concluded that dogs react to the barks of other dogs and that their responses depend in some way on both the familiarity and the context of the barks.

In the study conducted by Molnár et al. (2009b) it has been evaluated whether dogs are able to distinguish between barks issued in different contexts both by different subjects and by the same subjects in the two classic contexts: a) the presence of a stranger near the enclosure; b) the circumstance in which the dog is left alone.

It was discovered that the dogs, listening to the recordings, were able to distinguish between the barks emitted in the two contexts and were also able to discriminate between different individuals who barked in the same context. These results indicate that, through barking, the dog can transmit and receive information on the context of the issue and specific individual information of the issuer.

In an experiment conducted by Pongracz et al. (2014) pet dogs were exposed to pre-registered barks of both a familiar dog and an unfamiliar dog, played outside their home gate. The barks used for the reproductions were recorded in two different contexts: when the dog was left alone and when he was barking at a stranger present near the fence.

The subjects, exposed to listening to the recordings, remained at the gate (closer to the origin of the sound), longer when they heard the bark of an unfamiliar dog turned to a stranger, instead they were closer to the house during the barking of an unfamiliar dog left alone.

In addition, the dogs were longer directed towards the house (where the familiar dog was during the experiment) when they heard the bark of an unknown dog left alone. The subjects ex-

amined barked more often when they heard the barks addressed to a stranger, regardless of the familiarity they had with the dog they were listening to.

It has been deduced that dogs distinguish barks both based on familiarity with the issuing subject and the context of the bark, that is that dogs are able to extract detailed information from the barks.

A study by Larrañaga et al. (2014) compared four types of computerized acoustic analysis by evaluating which was most reliable to identify, through the analysis of the bark, the sex, age, identity and context of the subject that issues the bark. The classifications were correct for 85.13% in the determination of sex, for 80.25% in age attribution (schematized in: young, adult, old), for 55.50% in the classification of contexts (seven types) and for 67.63 % in identity recognition (8 dogs), so the results were encouraging.

The method with the best performance was that of the k-nearest neighbors ("wrapper feature selection"). In this study for the first time, the sex and age of domestic dogs were identified with the help of sound analysis.

This study shows that dog barks transmit important information about the characteristics of the issuer and provide the indirect proof that the barks can serve as a great resource of indications also at the intraspecific level (Larrañaga et al., 2014).

## The main types of bark

By integrating some literary sources, (Rugaas 2007, 2011; Dehasse 2011; Coren 2004; Dalla Valle 2014), we can outline the structures of the main types of bark:

– Bark as welcome greeting of known people arriving home: a single bark or followed by another, with high or medium intonation, also used as a request bark when the dog wants to attract attention or look for the contact.
– Excitement bark: it has a very high tone, high frequency, with constant sound or in series with small pauses; it can be interspersed with whimpers, in a context of excitement, joy, stress, waiting. It is emitted by the dog while he is moving and if he is forced to remain still, he can bite the leash or someone close to him.
– Warning bark: with a medium intonation the dog shows interest or curiosity; if it becomes medium-high indicates surprise or startle and is a single bark, clear and short; if the dog repeats it two or three times with intervals, the meaning turns into alert. When the bark becomes less short and slower it takes the value of an imperative call, as when the dog claims food. The warning bark has a medium-high tone, fast barks, a short, high-pitched sound that is sometimes repeated.
This type of bark gives the alarm to the rest of the pack to signal a possible danger and warns the intruder that the dog is controlling his territory.
With a string of barks of high pitch, the dog gives the alarm to indicate that the intruder is entering into the territory. When the sequence is slower and the pitch decreases, the danger is imminent. When the distance is wide, the dog uses the warning bark; instead over the safety distance emits the defense bark.
– Bark of defense / guard: it is a short and deep bark with a medium-low tonality and guttural sounds like a growl; often it begins with the growl and it continues with the bark interspersed with growl, it is repeated quickly. However, if the dog in the defense lives also emotions of fear, the defense bark will be more acute, the tone becomes medium-high and the bark is interspersed with sounds like yelps. In the sequence if the dog feels confident, he can make jerky movements towards the stimulus, he leaps forward to make it move away, showing teeth, growling, pinching, barking and even biting. If the dog feels insecure, he performs escape movements without losing sight of what scares him.

If the bark has the meaning of threat or warning it has a severe sound and it is associated with high and rigid postures. The bark, during an aggression aimed at keeping the receiver at a distance, is produced in semi-acute tones while the dog is fast approaching the intruder.

– Instead to reprimand the puppies the mother uses a single net bark and short with medium-low intonation (Guardini, 2015; 2017). An adult dog emits it if he feels discomfort, then if it has a slightly lower intonation it can have the value of threat to signal the receiver to interrupt his action.

– Play and excitement bark: it is made with high-pitched sounds. A high or medium-high pitch is associated with whining, repeated quickly, exhibiting low postures and uncoordinated movements. If the dog plays fight it can contain nervous whimpers and guttural sounds. When it is short and with a slightly lower pitch and more relaxed rhythm it signals a state of joy. Usually the dog during the play bow emits a stuttering bark with medium pitch. During the play there is a growing bark, a series of barks each with a medium pitch that quickly grow in tone going on high pitched sounds. The sound is similar to that of the yelp, but with a less high and less strident tone.

From a context of excitement, it is possible to move to a state of stress where the bark has very high tones and it is repeated many times with a regular and rapid rhythm; it can be emitted when an expectation is betrayed.

– Bark of despair: It is produced in separation or isolation contexts, characterized by acute, repeated sounds, sometimes associated with panic attacks. The bark of despair can turn into a bark of fear, in a state of fear that can lead to panic; it represents a request for help, it has high tone and it consists of a long series of barks that can end with a howl. The dog is probably in constant movement and can chew on objects or bite itself.

– Bark of frustration and stress: A state of serious frustration and prolonged stress corresponds to a rhythmic bark. It has a medium-high tone with static and monotonous sound, short and continuous that sometimes ends with a howl and it can turn into a stereotypical behavior (Mariti et al., 2012). It is a succession of long barks, with moderate-long intervals. With a high level of stress, we have a higher pitch, resembling a combination of yelp and bark. It is typical of kennels and dogs that are isolated in the box or who are alone for a long time

## Discussion

The dog's bark contains in its various forms of tonality and rhythms precise information that are clearly and unambiguously received by other dogs and that can be correctly recognized by people even if they are not used to the relationship with the dog. This observation opens the possibility of deepening the dog's vocal communication as a tool for better understanding of canine behavior.

## Bibliography

Abrantes R. Il linguaggio del cane. 2000. Editoriale Olimpia S.p.A. Firenze.
Andics A., Gàcsi M., Faragó T., Kis A., Miklósi A. Voice-sensitive regions in dog and human brain are revealed by comparative. Current Biology. 2014; 24: 574-578 doi.org/10.1016/j.cub.2014.01.058)
Beaver B.V. Canine behavior, insight and answers, 2009. 2th ed., Saunders (USA).
Bekoff M. Dalla parte degli animali - Etologia della mente e del cuore. 2003. Franco Muzzio Editore, Roma.
Capra G. Il Bassethound. 1994 Giovanni De Vecchi Editore. Milano.
Colangeli R., Giussani S. Medicina comportamentale del cane e del gatto. 2004. Poletto Editore srl. Milano.

Cordt M. Seminario di: "L'aggressività nel cane, come riconoscerla, gestirla e rimediare", Livello II (Pistoia, 2-3 ottobre 2010), Scuola cinofila Zampe in giro.

Cordt M. Seminario di: "L'aggressività nel cane, come riconoscerla, gestirla e rimediare", Livello III (Pistoia, 24-25 Marzo 2012), Scuola cinofila Zampe in giro.

Cordt M. Seminario di: "Il cane timido" (Prato, 28-29 Novembre 2015a), Scuola cinofila Zampe in giro.

Cordt M. Seminario di: "La difesa delle risorse" (Prato, 12-13 Settembre 2015b), Scuola cinofila Zampe in giro.

Cordt M. Seminario di: "Leggere, interpretare e comprendere il linguaggio del cane" (Prato, 16-17 Maggio 2015c), Scuola cinofila Zampe in giro.

Coren S. Capire il linguaggio dei cani. 2004. Franco Muzzio Editore, Roma.

Csányi V. Se i cani potessero parlare. 2007. Franco Muzzio Editore, Roma.

Dalla Valle S. Come parla il tuo cane e come tu parli con lui. 2014.TEA. Milano.

Dehasse J. Tutto sulla psicologia del cane. 2011. PVI Le Point Vétérinaire Italie srl. Milano.

Faragó T., Pongrácz P., Range F., Virànyi Z., Miklósi A., 2010, The bone is mine: affective and referential aspects of dog growls. Animal Behaviour. 2010 :(1-9); (doi:10.1016/j.anbehav.2010.01.005)

Feddersen- Petersen D., "Le vocalizzazioni come indicatori di emozioni, motivazioni e contesti comunicativi in varie razze di cani". (Forte dei Marmi, 08 marzo 2015). Villa Bertelli.

Fogle B. La mente del cane. 1990. Geo Gruppo Editoriale Armenia S.p.A, Milano

Fogle B. Il cane, razze, comportamento, salute. 2004. Fabbri Editori, Milano.

Gergely A., Topàl J., Dòka A., Miklósi A. Dogs are able to generalize directional acoustic signals to different context and tasks. Appl. Behav. Sci. (http//dx.doi.org/10.1016/j.applanim.2014.04.005).

Guardini G., Bowen J., Raviglione S., Farina R., Gazzano A. Maternal behaviour in domestic dogs: A comparison between primiparous and multiparous dogs. Dog Behavior. 2015; 1 :23-33.

Guardini G., Bowen J., Mariti C., Fatj J., Sighieri C., Gazzano A. Influence of maternal care on behavioral development of domestic dogs (Canis familiaris) living in a home environment. Animals 2017. 7. https://doi.org/10.3390/ani7120093

Guidi G., 2007, in "La pragmatica della relazione uomo-cane: il problema è l'uomo o il cane", Seminario di Il rapporto uomo animale tra omeopatia e co-evoluzione, (Firenze, 27 ottobre 2007), Scuola di omeopatia Lycopodium.

Houpt K. A. The Veterinary clinics of North America: Small Animal Practice, Volume 27, Number 3, May 1997, WB Saunders, Philadelphia, USA.

Houpt K.A. Il comportamento degli animali domestici. 2000. E.M.S.I. - Edizioni Mediche Scientifiche Internazionali. Roma.

Jensen P. The Behavioural Biology of Dogs. 2007. IFM Biology, CABI; Cambridge, Massachusetts.

Larrañaga A., Bielza C., Pongrácz P., Faragó T., Bálint A., Larrañaga P. Comparing supervised learning methods for classifying sex, age, context and individual Mudi dogs from barking. Animal Cognition, 2015; 18: 405-421.

Lorenz K. E l'uomo incontrò il cane. 1989. 19th ed., Adelphi edizioni S.p.A., Milano.

Marchesini R. L'identità del cane. 2004. Apèiron Editoria e Comunicazione S.r.l. Bologna.

Mariti C., Gazzano A., Moore J., Baragli P., Chelli L., Sighieri C. Perception of dogs' stress by their owners. J.V.B. 2012; 7: 213-219.

Mariti C., Falaschi C., Zilocchi M., Fatj J., Sighieri C., Ogi A., Gazzano A. Analysis of the intraspecific visual communication in the domestic dog (Canis familiaris): A pilot study on the case of calming signals. J.V.B. 2017; 18: 49-55.

Maros K., Pongrácz P., Bàrdos G., Molnár C., Faragò T., Miklósi A. Dogs can discriminate barks from different situations. Appl. Anim. Behav. Sci. 2008; 114: 159-167.

Miklósi A., Polgàrdi R., Topàl J., Csàny V., 2000, Intentional behaviour in dog-human communication: an experimental analysis of "showing" behaviour in the dog. Anim. Cogn. 2000; 3: 159-166.

Miklósi A. Dog Behaviour, Evolution, and Cognition. 2009. Oxford University Press, NY, USA.

Morris D. Il cane. Tutti i perché. 1993. Arnoldo Mondadori Editore S.p.A, Milano.

Molnár C., Prognàcz P., DòKa A., Miklósi A. Can humans discriminate between dogs on the base of the acoustic parameters of barks? Behavioural Processes. 2006; 73: 76-83.

Molnár C., Kaplan F., Roy P., Pachet F., Prognàcz P., DòKa A., Miklósi A. Classification of dog barks: a machine learning approach. Anim. Cogn. 2008; 11: 389-400.

Molnár C., Prognàcz P., Miklósi A. Seeing with ears: sightless humans' perception of dog bark provides a test for structural rules in vocal communication. The quarterly journal of experimental psychology. 2009 10.1080/17470210903168243).

Molnár C., Prognàcz P., Faragò T., DòKa A., Miklósi A. Dogs discriminate between barks: the effect of context and identity of the caller. Behav. Processes. 2009; 82: 198-201.

Morton E. On the occurrence and significance of motivation-structural rules in some bird and mammal sounds. The American Naturalist. 1977; 111:855-869.

Nowak S., Myslajek R., Jedrzejewski W. in: Why Wolves Howl? Of "On dogs and related Canidis: from genes through behaviour to society". Proceedings of Canine Science Forum, 5-9 July 2008, (p. 1112), Budapest, Hungary.

O'Hara S.J., Reeve A.V. A test of the yawing contagion and emotional connectedness hypothesis in dogs, Canis Familiaris. Animal Behaviour 2011; 81: 335-340.

Overall K.L. La clinica comportamentale del cane e gatto. 2001. Edizioni Medico Scientifiche. Torino.

Overall K.L. Manual of Clinical behavioral medicine for dogs and cats. 2013. Elsevier, St. Louis, MO.

Pageat P. Patologia comportamentale del cane. 1999. Le Point Vètèrinaire Italie. Milano.

Pageat P. Seminario di "I feromoni negli animali domestici" (Pisa, 24 e 25 novembre 2007), Facoltà di Medicina Veterinaria, Università di Pisa.

Pageat P. in "Treatment of behaviour problems" Lezione del Mater di Etologia clinica veterinaria, (Pisa, 8 e 9 maggio 2015), Facoltà di Medicina Veterinaria, Università di Pisa.

Pongrácz P., Szabò E., Kis A., Miklósi A. More than noise? Field investigations of intraspecific acoustic communication in dogs (Canis familiaris). Appl. Anim. Behav. Sci. http://dx.doi.org/10.1016/j.applanim.2014.08.003

Pongrácz P., Miklósi A., Csányi V. Owners beliefs on the ability of their pet dogs to understand human verbal communication: a case of social understanding. Current Psychology of Cognition. 2001; 20: 87-107.

Pongrácz P., Molnár C., Miklósi A., Csányi V. Human listeners are able to classify dog (Canis familiaris) barks recorded in different situations. J. Comp. Psychol. 2005; 119: 136-144.

Pongrácz P., Molnár C., Miklósi A. Acoustic parameters of dog barks carry emotional information for humans. Appl. Anim. Behav. Sci. 2006;100: 228-240.

Pongrácz P., Molnár C., Miklósi A. Barking in family dogs: an ethological approach. Veterinary Journal. 2010; 183:141-147.

Pongrácz P., Molnár C., Dòka A., Miklósi A. Do children understand man's best friend? Classification of dog barks by pre-adolescent and adults. Appl. Anim. Behav. Sci. 2011; 135: 95-102.

Pongrcz P., Szab É, Kis A., Pter A., Miklsi Á. More than noise? Field investigations of intraspecific acoustic communication in dogs (Canis familiaris). Appl. Anim. Behav. Sci. 2014;159: 62-68.

Range F., Viranyi Z., Huber L. Selective imitation in domestic dogs. Current biology 2007;17: 1-5.

Rugaas T. Aiuto, il mio cane tira! 2004. Haqihana s.r.l. Cormano (Milano).

Rugaas T. L'intesa del cane: i Segnali Calmanti. 2005. Haqihana s.r.l. Cormano (Milano).

Rugaas T. Seminario di: I segnali calmanti, stress e abbaio, (Prato, 20-21-22 Aprile 2007), Centro di educazione cinofila Sundog.

Rugaas T. L'abbaio il suono di un linguaggio. 2011. Haqihana s.r.l. - Fenegrò (CO).

Serpell J. The domestic dog. Its evolution, behaviour, and interactions with people. 1995. Cambridge University Press, U.K., Cambridge.

Shepherd K. "Sviluppo del comportamento, comportamento sociale e comunicazione del cane", in Horwitz D.F., Mills D.S., Heath S., Terapia comportamentale del cane e del gatto. 2004. UTET Scienze Mediche, Milano.

Simonet, P.R. (1997). Environmental enrichment in captive Asian elephants: Importance of novelty. In the published proceedings of the Third International Conference on Environmental Enrichment, Orlando, Florida.

Simonet, P.R., Murphy, M., & Lance, A. (2001, July). Laughing dog: Vocalizations of domestic dogs during play encounters. Paper presented at the meeting of the Animal Behavior Society, Corvallis, OR.

Simonet, P.R., 2004. Laughter in animals. In M. Bekoff (Ed.), Encyclopedia of Animal Behavior, (vol 2) (pp. 561-563). Westport: Greenwood Press.

Simonet P., Versteeg D., Storie D., 2005, Dog-laughter: Recorded playback reduces stress related behavior in shelter dogs., Animal Behavior Center, Proceedings of the 7th International Conference on Environmental Enrichment, (July 31 - August 5).

Szabò E., Borgi M., Molnár C., Pongrácz P., Miklósi A. in: Do Dogs Talk to Each Other? Field Investigations on Dog-Dog Acoustic Communication, of "On dogs and related Canidis: from genes through behaviour to society". Canine Science Forum, 5-9 July 2008, (p. 1131), Budapest, Hungary.

## Sitography

Andics A., Gàcsi M., Faragò T., Kis A., Miklósi A., 2014, Voice-sensitive regions in dog and human brain are revealed by comparative, Elsevier (http://dx.doi.org/10.1016/j.cub.2014.01.058).

Faragó T., Pongrácz P., Range F., Virànyi Z., Miklósi A., 2010, The bone is mine: affective and referential aspects of dog growls, Science Direct, Elsevier (doi:10.1016/j.anbehav.2010.01.005).

Gergely A., Topàl J., Dòka A., Miklósi A., 2014, Dogs are able to generalize directional acoustic signals to different context and tasks, Science Direct, Elsevier (http//dx.doi.org/10.1016/j.applanim.2014.04.005).

Larrañaga A., Bielza C., Pongrácz P., Faragó T., Bálint A., Larrañaga P., 2014, Comparing supervised learning methods for classifying sex, age, context and individual Mudi dogs from barking (doi:10.1007/s10071-014-0811-7).

Molnár C., Prognàcz P., Faragó T., DòKa A., Miklósi A., 2009, Dogs discriminate between barks: the effect of context and identity of the caller, Science Direct, Elsevier (www.elsevier.com/locate/beavproc).

Molnár C., Prognàcz P., Miklósi A., 2009, Seeing with ears: sightless humans' perception of dog bark provides a test for structural rules in vocal communication (doi: 10.1080/17470210903168243); (http://www.psypress.com/qjep).

Péter A., Pongrácz P., Szabò E., Kis A., Miklósi A., 2014, More than noise? Field investigations of intraspecific acoustic communication in dogs (Canis familiaris) (http://dx.doi.org/10.1016/j.applanim.2014.08.003).

Range F., Viranyi Z., Huber L., 2007, Selective imitation in domestic dogs, Elsevier (doi:10.1016/j.cub.2007.04.026).

Simonet P., Versteeg D., Storie D., 2005, Dog-laughter: Recorded playback reduces stress related behavior in shelter dogs (http://thebark.com/content/laughing-dogs).

## L'abbaio ed i suoi significati nel linguaggio inter ed intra specifico

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*Sintesi*

Nella comunicazione intra ed interspecifica l'abbaio  il suono maggiormente utilizzato e conosciuto ed  peraltro il più studiato. Ci sono diverse tipologie di abbaio, per eccitazione, allarme, paura, guardia, difesa, frustrazione ed altri ancora che  possibile identificare in base alla struttura fonografica ed al contesto.

L'abbaio ha diverse tonalità, bassa, media, alta e varia anche di intensità, durata e frequenza. La tonalità rivela l'emozione di base, la durata ha a che fare con l'urgenza comunicativa e la frequenza con il livello di eccitazione. Generalizzando, i toni alti richiamano attenzione e quelli bassi veicolano minaccia. È possibile identificarne i vari parametri utilizzando uno spettrografo vocale. Dalle ricerche emerge che indipendentemente dalla loro esperienza diretta, la maggior parte delle persone identifica correttamente le vocalizzazioni di aggressione e di allerta. Inoltre, i parametri acustici di tonalità, l'intensità e frequenza influenzano le persone nel descrivere correttamente l'emotività alla base delle vocalizzazioni (aggressività, paura, gioco…) Nel linguaggio intraspecifico le ricerche dimostrano che i cani riconoscono gli abbai emessi in situazioni diverse, reagiscono maggiormente agli abbai di cani familiari, sono capaci di distinguere tra abbai emessi in contesti diversi e di discriminare tra individui differenti che abbaiano nello stesso contesto.

# Pain or anxiety: the case of a 12-year-old German Shepherd

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*Abstract*: A 12-year-old, 25 kg (BCS 3/5), intact female German Shepherd was evaluated for sudden manifestations of intense fearful behavior with no apparent triggering stimulus. The dog had a history of aggressive behavior towards conspecifics and, more recently, fearful behavior in response to loud noises. Furthermore, the dog suffered from bilateral hip dysplasia and had recently been diagnosed with multiple severe spinal compressions at both lumbar and thoracic level. Various attempts to treat pain were made, with no success. Soon after, the dog began to display intense fearful behavior without apparent reason. At first, this behavior occurred only in unfamiliar indoor environments. However, it rapidly generalized to other contexts, to the point of being displayed almost constantly. A behavioral evaluation was requested. CBC, serum biochemical analysis, thyroid profile and echocardiographic examination were unremarkable. The dog's behavioral diagnosis consisted of pain, generalized anxiety and noise sensitivity. Gabapentin dosage was doubled (24 mg/kg BID) and a Fentanyl patch was applied to the dog's back for three consecutive days. No improvement was observed. Hence, Clomipramine was added to Gabapentin at a starting dosage of 0.6 mg/kg BID and titrated to 1 mg/kg after 21 days. After 1 week the owner reported an initial reduction in the frequency and intensity of the fearful behavior which completely disappeared after 1 month of treatment. Mild urinary retention was observed as a possible collateral effect of Clomipramine. Gabapentin dosage was decreased to 20mg/kg BID. With due monitoring of behavioral and physiological parameters, Clomipramine and Gabapentin administration will not be interrupted.

*Key Words*: dog, anxiety, pain.

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## Presentation

A 12-year-old, 25 kg (BCS 3/5), intact female German Shepherd was evaluated for sudden manifestations of intense fearful behavior with no apparent triggering stimulus.

## History and presenting signs

The dog was adopted at 5 years of age. The owner found her as she lived as a stray in a semi-rural environment. No information on her history before adoption is available. At the time of adoption she was visibly ill. She appeared extremely emaciated (BCS 1/5), sensory depressed, with diffused alopecia and mucocutaneous erosive-ulcerative lesions, as well as bilateral purulent lesions on her ear pinnae. The dog was diagnosed with Leishmaniosis. Treatment with Meglumine antimoniate (100 mg/kg/die SC for 40 days) and Allopurinol (10 mg/kg PO q12h for 12 months) and local cleaning and disinfection of skin lesions were effective at normalizing the electrophoretic curve and resolve the clinical signs of the disease.

The owner described a very inhibited dog at the beginning. However, her behavior changed during her physical recovery. She started to display defensive aggressive behavior towards other dogs. She would actively approach other dogs as if she was willing to interact, but she would growl and snap if they got too close, were too aroused, or try to insistently sniff her genital area. With the help of a dog trainer, the owner progressively learned in what circumstances he could let the dog interact with conspecifics and the aggressive behavior eventually disappeared.

During the third New Year's Eve after adoption, the dog displayed extreme signs of emotional distress in response to fireworks. She trembled, hyperventilated and tried to hide in different rooms of the house. During the same period, the dog began to show the same fearful behavior in response to thunderstorms.

Over time, she began to display avoidance behavior towards open windows and indoor air currents. However, since the fearful behavior was mainly manifested during spring and summer season and could be partially prevented by keeping the windows closed, the owner did not seek professional advice.

Starting from the dogs 11th year of age, her behavioral reactions to loud noises became progressively less frequent and intense. The owner reported that such improvement could be chronologically correlated with an overall decrease in the dog's auditory perception. Nonetheless, the dog kept showing hypervigilance and avoidance behavior when windows were open, as well as a mild state of alert during New Years' Eve fireworks.

At 9 years of age, Rx exams were performed because of intolerance to physical exercise and lameness. Bilateral hip dysplasia and several vertebral osteophytic proliferations at lumbar and thoracic level were found. In addition, from the neurological evaluation a cauda equina syndrome was suspected. Further diagnostic tests were recommended in order to confirm the diagnosis, but they were declined by the owner for financial reasons. Therefore, Firocoxib 7 mg/kg/die was prescribed to relieve pain in the short term, alongside with nutritional supplementation with PEA, Quercetin, Omega-3 fatty acids, VIT. E, Glucosamine and Chondroitin sulfate for chronic pain management. After 2 weeks lameness had disappeared and physical activity was back to previous levels.

At 12 years of age, a neurological evaluation was performed because the dog was unable to maintain standing position for long periods of time and started to show ataxic ambulation. The physical examination revealed hind-limb muscle atrophy and proprioceptive deficit, as well as lumbar and coxo-femoral pain. The DNA test for degenerative myelopathy was negative. Prednisolone was prescribed at 0.5 mg/kg/die for 8 days. However, no therapeutic effect was observed. Therefore, a MRI was performed. Three severe medullar compressions at T13-L1, L1-L2 and L2-L3, plus multiple smaller compressions throughout the column were observed. Since a spinal surgery presented high risks for the dog's quality of life and was unlikely to lead to resolution, the owner was advised to start a chronic pain management therapy and prevent the dog from having long walks, as well as performing sudden and unusual movements. The drug therapy consisted of CBD oil 10% solution (8 drops q12h), Gabapentin (12 mg/Kg BID) and Firocoxib (7 mg/kg/die for 10 days).

However, after 30 days the dog had only inconsistently improved. In addition, she started to display behaviors indicative of acute fear such as trembling, tachypnea, hypersalivation and restlessness, ears pulled back, crouched position, hiding behavior and attention seeking. At first, these events occurred exclusively in unfamiliar indoor environments (friends' houses, restaurants, hotel rooms) and the dog would usually calm down once back at home. However, their frequency increased rapidly and after two weeks the dog would display these behaviors almost constantly, both indoor – including her own house- and outdoor. In addition, she would wake up in the middle of the night panting and seeking for proximity and physical contact. The owner reported that there was no association between fearful behavior and presence of open windows or loud noises.

## Physical and laboratory evaluation

During the first behavior consultation, the dog remained seated in the same place for most of the time. Body language was characterized by crouched position, hypervigilance, ears pulled backwards, trembling, tachypnea, and hypersalivation. A few times the dog seemed to try to lie down, but quickly returned to a seated position. Posterior lameness, hind limb ataxia and rigid gait and movements were also observed. CBC, serum biochemical analysis, protein electrophoresis, thyroid profile (TT4, FT4 and TSH) and echocardiographic examination were unremarkable.

## Diagnosis

There is little doubt that the dog of this report felt pain. Signs of pain were clinically evident and they could be easily elicited by mild manipulation of the back and the hind limbs. All the behavioral signs the dog manifested have been linked with pain in previous studies (Mills et al., 2020). It has been suggested that pain may play a role in the development of aggressive behavior towards other dogs (Camps, 2012), sound sensitivity (Lopes Fagundes et al., 2018), and in the onset of anxious states (Camps et al., 2019) and sleep-wake cycle disorders (Camps et al., 2019).

Although this dog was unsuccessfully treated for pain, there are many conditions in which the analgesic treatment may not lead to a behavioral change, even when pain is somehow involved. In some cases pain may have caused a certain behavior to develop, but may no longer be present. Nonetheless, even when pain is still present, the dog may have developed, over time, negative associations with pain-inducing stimuli. In such cases, the psychological component may mask the effect of a pain management therapy or, at least, longer treatment times may be required in order to extinguish the negative association and lead to behavioral resolution. Sometimes, pain may just be a concurrent cause of the behavior or may be responsible for exacerbating a pre-existing behavioral problem (Mills et al., 2020). In such cases, partial behavioral improvement may be observed if pain medications are administered. Furthermore, not all types of pain and not all individuals equally respond to all types of analgesic medications. This means that we have to assess the type of pain involved as accurately as possible in order to choose the right analgesic drug or combination of drugs (Epstein et al., 2015). Secondly, we may need several attempts with different molecules before we can observe a behavioral response. Lastly, as in the present case, if a positive effect is not achieved, we may still not be able to exclude pain from our differential diagnoses.

The link between pain and anxiety is widely recognized in human medicine (Asmundson & Katz., 2009). It has been suggested that chronic pain may alter an individual's associative learning processes. Individuals in pain may have a reduced ability to identify and discriminate specific pain-eliciting stimuli and may rely, instead, on overall contextual cues. This loose and inaccurate association between pain and perceived threat may not only generate a constant sense of hypervigilance and emotional distress, but may result in an overgeneralization process of the threatening stimuli (Harvie et al., 2013), which in turn promotes anxiety (Meulders et al., 2013). Furthermore, both human and non-human animals that feel pain have been reported to show a pessimistic judgment bias. That is, they tend to perceive a neutral stimulus as potentially negative (Weary et al., 2019). Indeed, this may induce a state of constant fear and emotional distress. Regardless of the mechanism through which anxiety develops, anxious individuals may have an amplified perception of the intensity of pain, caused by constant somatic tension and augmented attentional focus towards painful stimuli (Rhudy & Meagher, 2000).

The quick increase of the contexts in which the dog of this report would display signs of fear was believed to be caused by a pain-induced overgeneralization of the threatening stimuli, which led to a state of generalized anxiety.

In the last few years, noise reactivity was limited to New Years' Eve fireworks. This was possibly due to an aging-related decrease in auditory acuity. However, the dog still manifested hypervigilance and avoidance towards open windows and indoor air currents, which most likely developed as an anticipatory response to the subsequent loud noise of the window banging. Therefore, although not presented at the time of the evaluation, noise sensitivity was diagnosed based on the dog's history and noise-related anticipatory behavior.

Noise sensitivity, pain and anxiety may be strongly related (Lopes Fagundes et al., 2018). A recent study found that the age of onset on noise sensitivity for dogs with painful conditions was higher than that in dogs with no painful conditions. For the former, it was 6.6 years on average, which is approximately the same as that of the dog of this report. Furthermore, amongst dogs with painful conditions there was a higher tendency to generalize their response to a wide range of contexts (Lopes Fagundes et al., 2018), which, as mentioned above, may result in chronic emotional distress.

Despite the dog's age, cognitive dysfunction syndrome was deemed unlikely, as no clinical signs of cognitive impairment could be observed.

## Treatment

A last attempt to see whether pain treatment could alleviate behavioral symptoms was made by applying a 75 mcg/h Fentanyl patch at the base of the dog's shaved neck for three consecutive days. In addition, Gabapentin dosage was increased to 24 mg/kg BID, in an attempt to alleviate signs of anxiety and further reduce pain (Crowell-Davies et al., 2019; Lansdberg et al., 2013). Fentanyl is potent mu opioid receptor agonist used for the treatment of spinal and osteoarticular pain in dogs (Egger et al., 2007; Bellei et al., 2011). Gabapentin is a GABA analogue used for neuropathic pain, seizures and anxiety, in dogs (Landsberg et al., 2013). It may have different dose ranges in relation to the purpose of its use. The dose range for neuropathic pain may be slightly narrower (10-20 mg/kg q8-12h) (Moore, 2016) than that for anxiety (10-30 mg/kg q8-12h) (Landsberg et al., 2013).

Behavioral intervention focused on preventing exposure to known threatening stimuli, reduce physical activity and make routine predictable. Windows had to be kept closed at all times. Whenever windows had to be opened (i.e. house-cleaning procedures), the dog had to be brought in a room predisposed with a dog's bed, food-filled toys or problem solving games. Walks had to be kept short and limited to place known to the dog. The owner was also advised not to take the dog to unfamiliar indoor places, such as restaurants or friends' house. Car trips also had to be avoided.

## Follow-up

After 10 days the owner reported only mild improvement in the duration of the signs of anxiety, mostly related to a quicker onset of sleep after the administration of Gabapentin. No positive effect of the Fentanyl patch was observed, neither on behavior nor ambulation. Management therapy was implemented but did not appear to be effective at reducing signs of anxiety in any circumstances. Since improvement was not satisfactory and the dog's quality of life was still poor, Clomipramine was started at 0.6 mg/kg BID and increased to 1 mg/kg BID after 3 weeks. Clomipramine is a Tryciclic Antidepressant (TCA) used for the treatment of noise phobia and different forms of anxiety, in dogs (Crowell-Davies et al., 2003; Landsberg et al., 2013). Furthermore, in human medicine, TCA have a demonstrated analgesic effect on peripheral neuropathic pain (Dharmshaktu et al., 2012). Their effect is synergistic if administered in conjunction with Gabapentin (Gilron et al., 2009).

After 7 days from the first Clomipramine administration the dog's behavior had already improved. Overall, her signs of anxiety had decreased in frequency and intensity. She would no longer show any sign of emotional distress when outside for routine walks. When anxious behavior occurred inside the house, the owner would take her to her room, ask her to lie on her bed and remain in her proximity for a few minutes. That appeared sufficient to calm her down.

After 4 weeks the owner reported that the dog's anxious behavior had completely disappeared and ambulation had also improved. However, the owner was reminded that the dog suffered from both a degenerative articular disease and severe spinal compressions that could only worsen over time, and that preventative measures concerning physical activity had to be implemented for the rest of the dog's life. Night awakenings would still occur constantly but only to change posture or go to drink.

Since no signs of anxiety had been observed for 10 weeks, the owner was suggested to leave the door of the room open during cleaning procedures to see whether the dog still reacted to wind currents or open windows. The dog did not show any sign of interest nor alert to open windows. She would finish her food-filled toys and go to bed. Gabapentin dosage was reduced to the maximum dosage reported for neuropathic pain treatment (20 mg/kg BID). Mild urinary retention appeared as a probable collateral effect of Clomipramine administration. Since it was not considered risky no adjustment of the dosage were made.

After approximately 3 months from the beginning of the therapy a first attempt to take the dog to a friend's house was made. The owner was recommended to provide the dog with her own bed once in the car and in the unfamiliar environment. Fortunately, no signs of distress were observed.

At the last follow-up visit, about 5 months after the beginning of the therapy, the dog's ambulation had slightly worsened, compatibly with her pathological condition. However, CBC, serum biochemical analysis and urinalysis were still unremarkable. Signs of anxiety had no longer been observed, neither in outdoor nor in indoor spaces, even if unfamiliar to the dog. Again, the owner was recommended to keep levels of activity to a minimum. With due monitoring of behavioral and physiological parameters, this dog will remain under psychopharmacological treatment for the rest of her life.

## Conclusion

There may be a strong relationship between pain and emotional disorders. Although we cannot be certain about it, it is likely that the pathogenesis of the anxious behavior of this dog involved pain at some level. Complete resolution of behavioral signs was achieved by treating the dog with the TCA Clomipramine. Gabapentin was only mildly effective at reducing anxiety symptoms. However, its administration was continued as an additional mangament therapy for neuropathic pain.

## References

Asmundson G.J. & Katz J. Understanding the co-occurrence of anxiety disorders and chronic pain: state-of-the-art. Depression and anxiety. 2009; 26: 888-901.

Bellei E., Roncada P., Pisoni L., Joechler M., Zaghini A. The use of Fentanyl-patch in dogs undergoing spinal surgery: plasma concentration and analgesic efficacy. J. Vet. Pharm. Ther. 2011; 34: 437-441.

Camps T., Amat M., Manteca X. A review of medical conditions and behavioral problems in dogs and cats. Animals. 2019; 9:1133.

Camps T., Amat M., Mariotti V.M., Le Brech S., Manteca X. Pain-related aggression in dogs: 12 clinical cases. J.V.B. 2012; 7: 99-102.

Crowell-Davis S.L., Murray T., de Souza Dantas L.M. Veterinary psychopharmacology. 2019. Wiley-Blackwell.

Crowell-Davis S.L., Seibert L.M., Sung W., Parthasarathy V., Curtis T.M. Use of Clomipramine, alprazolam, and behavior modification for treatment of storm phobia in dogs. J.A.V.M.A. 2003; 222: 744-748.

Dharmshaktu P., Tayal V., Kalra B.S. Efficacy of antidepressants as analgesics: a review. J. Clin. Pharmacol. 2012; 52: 6-17.

Egger C.M., Glerum L., Haag K.M., Rohrbach B.W. Efficacy and cost-effectiveness of transdermal Fentanyl patches for the relief of post-operative pain in dogs after anterior cruciate ligament and pelvic limb repair. Veterinary Anaesthesia and Analgesia. 2007; 34: 200-208.

Epstein M.E., Rodan I., Griffenhagen G., Kadrlik J., Petty M.C., Robertson S.A., Simpson, W. AAHA/AAFP pain management guidelines for dogs and cats. J. Feline Med. Surg. 2015; 17: 251-272.

Gilron I., Bailey J., Dongsheng T. Combined treatment with Gabapentin and nortriptyline improves pain control in peripheral neuropathy more than either agent alone. J.C.O.M. 2009; 16: 12-17.

Landsberg G., Hunthausen W., Ackerman L. Behavior Problems of the Dog and Cat-E-Book. 2011. Elsevier Health Sciences.

Lopes Fagundes A.L., Hewison L., McPeake K.J., Zulch H., Mills, D.S. Noise sensitivities in dogs: an exploration of signs in dogs with and without musculoskeletal pain using qualitative content analysis. Frontiers Vet. Sci. 2018; 5: 17.

Meulders A. & Vlaeyen J.W. The acquisition and generalization of cued and contextual pain-related fear: an experimental study using a voluntary movement paradigm. Pain. 2013; 154: 272-282.

Mills D.S., Demontigny-Bédard I., Gruen M., Klinck M.P., McPeake K. J., Barcelos A.M., Hewison L., Van Haevermaet H., Denenberg S., Hauser H., Koch C., Ballantyne K., Wilson C., Mathkari C.V., Pounder J., Garcia E., Darder P., Fatjó J., Levin E. Pain and Problem Behavior in Cats and Dogs. Animals. 2020; 10: 318.

Moore S.A. Managing neuropathic pain in dogs. Frontiers Vet. Sci. 2016; 3: 12.

Rhudy J.L. & Meagher M.W. Fear and anxiety: divergent effects on human pain thresholds. Pain. 2000; 84: 65-75.

Weary D.M., Lecorps B., von Keyserlingk M., Ludwig B.R. Pain-induced pessimism and anhedonia: evidence from a novel probability-based judgment bias test. Frontiers Behav. Neurosci. 2019; 13: 54.

# Dolore o ansia: il caso di un Pastore Tedesco di 12 anni

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*Sintesi*

Un Pastore Tedesco di 25 Kg (BCS3/5) e di 12 anni di età è stato valutato per manifestazioni di paura improvvisa senza apparenti stimoli elicitanti.

Il cane presentava una storia pregressa di aggressioni verso conspecifici e, più recentemente, paura nei confronti di rumori forti. Il cane soffriva inoltre di displasia bilaterale delle anche e gli erano state recentemente diagnosticate compressioni multipli ed importanti a livello delle vertebre toraciche e lombari.

Diversi tentativi furono eseguiti in passato per trattare il dolore ma senza successo. Subito dopo il cane cominciò a manifestare segni di paura senza apparente ragione. All'inizio questo comportamento si manifestava in ambiente interni non familiari ma rapidamente si generalizzò ad altri contesti, fino a mostrarlo praticamente in modo costante.

A questo punto fu richiesta una valutazione comportamentale. CBC, analisi biochimiche, profilo tiroideo e esame ecocardiografico risultarono nella norma.

La diagnosi comportamentale consisteva in sindrome da dolore, ansia e sensibilità ai rumori. Il dosaggio del Gabapentin fu raddoppiato (24 mg/kg BID) e un cerotto di Fentanyl fu applicato sulla schiena dell'animale per tre giorni consecutivi.

Non fu osservato nessun miglioramento e quindi fu aggiunta al Gabapentin la Clomipramina, ad un dosaggio iniziale di 0,6 mg/kg BID, aumentato poi a 1 mg/kg dopo 21 giorni.

Dopo una settimana di trattamento il proprietario riportò un'iniziale riduzione nella frequenza ed intensità dei comportamenti di paura che scomparvero completamente dopo un mese di trattamento. Una lieve ritenzione urinaria fu osservata come effetto collaterale della Clomipramina. Il dosaggio del Gabapentin fu ridotto a 20 mg/kg BID. Con il dovuto monitoraggio dei parametri fisiologici e comportamentali, a somministrazione di Clomipramina e Gabapentin non fu interrotta.

**Associazione Veterinari Esperti in Comportamento**

# La gestione del cane durante l'emergenza coronavirus

La pandemia in corso e le restrizioni imposte dai decreti per contrastare l'emergenza sanitaria, hanno comportato in tutti noi una improvvisa rottura di schemi e di abitudini con conseguenti effetti emotivi e comportamentali che interessano, necessariamente, anche gli animali domestici con cui conviviamo.

Secondo il DPCM, i cani possono essere condotti all'esterno per lo stretto tempo necessario all'espletamento delle esigenze fisiologiche e in prossimità dell'abitazione dove ci si trova, rispettando la distanza interpersonale qualora si incroci un'altra persona.

Questo si traduce, per i nostri cani in:

- perdita di interazioni sociali con gli altri cani,
- ridotta possibilità di soddisfare il bisogno di scaricare energie fisiche e mentali,
- impoverimento degli stimoli e delle sollecitazioni,
- ridotta possibilità di esprimere se stessi in ambiente esterno,
- percezione di messaggi sociali diversi ("il mio proprietario sembra preoccupato delle persone, devo preoccuparmi anche io?")

Soprattutto nei cuccioli in fase di socializzazione o nei soggetti giovani in generale, la perdita della possibilità di fare esperienze sociali e di essere esposti a contesti vari potrebbe determinare delle difficoltà di adattamento quando la situazione ambientale sarà tornata alla normalità.

Il momento stressante che stiamo vivendo, legato alle preoccupazioni sulla salute nostra e dei nostri cari e l'incertezza sul futuro e su quello che ci aspetta, può portarci a stati di tensione e di disagio che si ripercuotono necessariamente sugli animali.

I cani si trovano, inoltre, a vivere anche in casa una situazione familiare anomala e un contesto di relazioni improvvisamente cambiate. La nostra permanenza continua in casa, per quanto possa essere vissuta con positività dalla maggior parte dei cani, può ridurre il loro bisogno di privacy e di spazio personale. Ma soprattutto, i cani saranno sottoposti ad un nuovo cambio di routine quando ritorneremo a lavorare fuori casa: trovandosi improvvisamente di nuovo soli, potrebbero vivere stati di disagio e manifestarli con sintomi vari quali abbaiare, grattare la porta, urinare o defecare in casa, tremare e sbavare.

Come possiamo affrontare al meglio questo momento?

- **Mantenere le routine**: i cani sono animali fortemente abitudinari. In questo momento in cui tutto è nuovo, è importante scandire la giornata, mantenendo degli orari almeno in relazione ai pasti, alle uscite ed ai momenti di gioco.
- Aumentare la **prevedibilità delle interazioni sociali**: incorniciare i momenti di interazione attraverso l'utilizzo di chiari segnali di inizio e di fine (ad esempio uso di parole come "giochiamo" e "basta"), scegliere insieme al cane delle "**regole di convivenza**" e rispettarle.

- **Non stare continuamente insieme al cane**: pur rimanendo in casa, creare quotidianamente delle separazioni dal cane, ad esempio stando in stanze diverse per qualche tempo, in modo da simulare le normali uscite.
- Influenzarli con le nostre emozioni: se siamo tesi o preoccupati il nostro cane lo capirà. Soprattutto durante le passeggiate, cerchiamo di rilassarci e mantenere le distanze sociali senza che questo si traduca in continue strattonate al guinzaglio e improvvisi cambi di direzione.
- **Stimolare i cani mentalmente** attraverso giochi di ricerca olfattiva e di attivazione mentale
- Giocare con loro ma solo se abbiamo davvero voglia anche noi di giocare.
- **Attenzione alla salute fisica e alla nutrizione**: il cambio di routine potrebbe determinare dei diversi fabbisogni ed è necessario discutere di questo aspetto, così come di eventuali segni fisici, con il proprio veterinario. Inoltre dobbiamo evitare di eccedere con cibo appetitoso, da usare per fare attività, esercizi…

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