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More than noise?—Field investigations of intraspecific acoustic communication in dogs (*Canis familiaris*)

Pongrácz Péter[a,*], Szabó Éva[a], Kis Anna[a,b], Péter András[a], Miklósi Ádám[a,c]

[a] *Department of Ethology, Biological Institute, EötvösLoránd University, Budapest, Hungary*
[b] *Institute of Cognitive Neuroscience and Psychology, Hungarian Academy of Sciences, Budapest, Hungary*
[c] *MTA-ELTE Comparative Ethological Research Group, Budapest, Hungary*

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ABSTRACT

Besides being a widely investigated behavioural phenomenon, barks of dogs often represent a factor of nuisance for people. Although some argue that dog barking has no or only minimal communicative function, it was shown recently that these acoustic signals carry various information that humans can decipher. However, apart from a few laboratory studies, until now no targeted research has been done about the communicative role of barks in the intraspecific domain. In this field experiment companion dogs were tested with bark playbacks at home, in a suburban environment. From a hidden sound system, placed near to the gate outside of the property, each subject was exposed to pre-recorded barks of an unfamiliar and a familiar dog. Barks for the playbacks were recorded in two different contexts: when the dog was either left alone or when it was barking at a stranger at the fence. We found differences in the behaviour of dogs depending on both the familiarity and context of the playback barks. The position of the dogs (near the house or near the gate) was mainly influenced by the context of the barks ($p = 0.011$), in a significant interaction with the familiarity of the barking dog ($p = 0.020$). Subjects stayed at the gate (nearest to the source of the sound) the longest when they heard an unfamiliar dog barking at a stranger ($p_{adj} = 0.012$). Meanwhile they stayed at the house mostly during the barks of a lonely unfamiliar dog ($p_{adj} = 0.001$). Dogs oriented more towards the house (where the familiar dog stayed during the experiment) when they heard the familiar dog's barking ($p = 0.019$). Subjects barked more often when they heard the 'stranger' barks, independently of the familiarity of the caller ($p = 0.035$). As a conclusion, dogs seemingly distinguished among the callers based on familiarity and between the contexts of the barks. This is the first study on companion dogs in their natural environment that found evidence that dogs are able to extract detailed information from the barks. The relevance of our findings for the management of excessive bark is discussed.

1. Introduction

Barking is considered as the most typical vocalisation of dogs (Pongrácz et al., 2010, 2011). During the last decade barking drew a considerable interest from ethologists, and several studies dealt with the acoustic features (e.g. Pongrácz et al., 2006; Yin and McCowan, 2004), the possible function in communication (e.g. Lord et al.,

* Corresponding author. Tel.: +3613812179; fax: +3613812180.
E-mail addresses: peter.pongracz@ttk.elte.hu, peter.celeste.pongracz@gmail.com (P. Péter).

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2009; Pongrácz et al., 2005; Yin, 2002), and the evolution (Coppinger and Feinstein, 1991; Feddersen-Petersen, 2000; Pongrácz et al., 2011) of dog barks. Besides the biological relevance that inspires scientific interest, dogs' bark has less favourable features, too. Bark-related problems usually manifest themselves in the phenomenon called 'excessive barking' (e.g. Kobelt et al., 2003). Considering a vocalisation as excessive is obviously a relative decision, however it has a great relevance both in the veterinary diagnostics, like in the case of the symptoms of separation anxiety (e.g. Lund and Jørgensen, 1999); or probably even more commonly when the barking of a dog is becoming a nuisance. Nuisance barking is among the leading behavioural problems with dogs (e.g. Cross et al., 2009) that elicit considerable friction between inhabitants of any densely inhabited (mostly urban) areas (e.g. Fielding, 2008). In spite of the relevance of nuisance barks on the human and animal welfare and legislation, there are only very few empirical studies dealing with the biological characteristics and occurrence of dog barks as potential disturbance for the human living environment (see for example Flint et al., 2013). For a better understanding of the phenomenon of barking behaviour in dogs, it would be necessary to investigate the possible role of this vocalisation among field conditions, preferably in the natural environment of companion dogs in a (sub)urban habitat.

Hypotheses about the function and evolution of dog barks differ mostly in the extent and complexity of information that dog barks are supposed to carry. According to Coppinger and Feinstein (1991) it is unlikely that a single selective effect acted during the evolution of dogs that resulted in such diverse forms of bark signals. They argued that barks are 'meaningless' vocalisations, and have very little context-specificity (see also Lord et al., 2009). Other authors hypothesized that various barks may be connected to the contextually different situations they were produced in (Pongrácz et al., 2005, 2006; Yin and McCowan, 2004). Several studies seem to support the later notion by showing that dog barks have consistent situation-dependent acoustic features (e.g. Pongrácz et al., 2005; Yin, 2002).

According to Feddersen-Petersen (2000) the highly variable ecological niche of domestic dogs and the increased complexity of their social life led to an increase of their communicative social interactions via the differentiation of their barks. Based on this hypothesis Pongrácz et al. (2005, 2006, 2011) and Molnár et al. (2006, 2010) conducted several playback experiments, where human listeners of different age, experience with dogs, and seeing abilities (i.e. sighted vs. sightless) were asked to rate the inner state of the barking dogs and categorize the context of the bark samples. In general, the results showed that humans could reliably identify the context of most dog barks, and rate the inner states of dogs with emotions corresponding to the context of the barks (e.g. high scores of aggression for barks directed towards a stranger at the gate or high scores of 'happiness' and 'playfulness' for barks emitted while playing).

For humans dog barks may serve as source of information about the dog's inner state, and indirectly about the context in which the bark was emitted, but this still does not answer the question whether dogs are able to extract this information from barks during intraspecific communication. Observations on feral dogs provide a good source of information here, as the social interactions of these animals are not restricted, altered, or channelled by humans, as in the case of companion or working dogs. Boitani et al. (1995) reported that feral dogs bark less and more rarely than dogs living with humans that could suggest that the primary function of barks is to communicate with humans. A study of ownerless village dogs in Ethiopia revealed that dogs barked more often when being alone than when being accompanied by other dogs (Ortolani et al., 2009) which could hint towards barks serving as a recruitment call (see also Lord et al., 2009). Unfortunately, no systematic experimental studies have been conducted on the vocal communication of feral dogs, which leaves open the question about the function of barks in intraspecific communication.

In a heart rate based habituation–dishabituation experiment Maros et al. (2008) found that dogs show dishabituation when hearing barks recorded in different contexts. In a behaviour (orientation) based habituation–dishabituation study Molnár et al. (2009) found that not only could dogs discriminate between barks recorded in different contexts but also between barks recoded in the same context but from different individuals. However until now no experiment was carried out to verify whether dogs react differently to barks recorded in different contexts outside a laboratory setup. Thus our first aim was to carry out a conceptual replication of these studies and to test if dogs react differently in their natural environment to bark playbacks of different contexts and from familiar versus unfamiliar individuals. Replication of previous results is essential before building on them in further experiments as this is the only way to ascertain if the phenomena to be studied is robust enough (see e.g. Bakker et al., 2012; Koole and Lakens, 2012).

While habituation–dishabituation experiments shed light onto the just-noticeable difference between stimuli, field playback experiments focusing on natural responses tell us about the just-meaningful difference (Nelson, 1988). The subjects' responses to playback experiments would therefore elucidate whether the perceived difference between stimuli is also relevant to the animals in their everyday environment (Fischer et al., 2013). Previous research has also shown that laboratory studies do not necessarily yield the same results as observations in natural environments (e.g. Anderson and Brown, 1984; Ladouceur et al., 1991), thus both of these approaches need to be used in order to obtain solid conclusions. Consequently we designed a field playback experiment to investigate how dogs react to pre-recorded barks of their canine home companions as opposed to barks of unknown individuals. We also wanted to see whether dogs showed different reactions to contextually different barks recorded in the 'being left alone' and the 'stranger approaches the gate' situations. We selected these two contexts because (1) it was found that the barks recorded in these are clearly distinct regarding their acoustic features (Pongrácz et al., 2005); (2) previous habituation–dishabituation experiments have shown that dogs can reliably distinguish between these contexts (Maros et al., 2008; Molnár et al., 2009); and (3) it