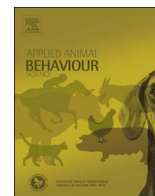




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Research Paper

Application of Free Choice Profiling to assess the emotional state of dogs housed in shelter environments

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ABSTRACT

Dogs housed in shelters may experience poor welfare. To ensure these dogs a good quality of life, welfare assessment tools should be sensitive not only to the animals' physical health but also to their mental state, including the assessment of positive and negative emotions. In this study, we focused on the assessment of shelter dogs' emotional expression using a Qualitative Behavioural Assessment (QBA) approach. Previous work successfully applied QBA to assess the emotional state of working and rescue dogs, and the observations were carried out on individual dogs in standardised settings with little or no stimulation. Results from such experiments might not be fully representative of the expressive demeanour that a dog could show in shelter conditions, where animals are exposed to a number of social and environmental stimuli. Thus, our aim was to apply QBA to a wider variety of shelter environments and social contexts than has been done so far, giving the animals the opportunity to express a wider repertoire of emotions and allowing for a more comprehensive assessment of dogs' affective state. A set of descriptive terms was generated using Free-Choice-Profiling methodology by a group of 13 observers. QBA was made by scoring 16 video clips of shelter dogs in very different contexts (e.g. single/pair/group housing, presence/absence of human activity). Generalised Procrustes Analysis showed a high consensus between observers' scoring patterns (75.7%; $p < 0.001$), and generated three main consensus dimensions explaining overall 66.6% of the variation between clips. The terms generated by the observers describing these consensus dimensions were semantically consistent, and characterised dogs as ranging: 1) from "playful/sociable/curious" to "bored/uncomfortable/apathetic", 2) from "relaxed/tranquil" to "nervous/alert/fearful" and 3) from "stressed/anxious" to "wary/timorous/hesitant". Overall, these broad dimensions are similar to those described in previous QBA studies on dogs. However, we detected differences in the type or frequency of the terms used, especially concerning three semantic spheres (i.e. "sociability", "fearfulness" and "boredom"). It appears that, compared to what has been reported previously, by presenting more complex contexts and thus giving the animals the opportunity to express different behaviours, we generated a richer list of terms representing a wider repertoire of emotions. Our results support the notion that QBA can be immediately sensitive to an animal's circumstances, integrating the ways in which animals experience the conditions in which they live into meaningful emotional indicators. This also highlights the importance of developing QBA tools that are species- and context-specific, especially for applied purposes.

1. Introduction

Rescue shelters for abandoned and stray dogs are a reality for thousands of dogs around the world. Conditions of confinement, especially over long periods of time, may have a severe impact on the quality of life of shelter dogs (Hewson et al., 2007). Several factors have proven to affect dogs' quality of life (Kiddie and Collins, 2014, 2015)

such as the length of time in shelter (Wells et al., 2002), the housing environment (Taylor and Mills, 2007; Wells, 2004) and the human-animal interaction (Coppola et al., 2006; Normando et al., 2009). There is increasing interest by the scientific community to provide easy-to-apply and reliable tools to assess the welfare and coping ability of shelter dogs in a confined environment (Barnard et al., 2016; Haverbeke et al., 2015). Previous studies have described physiological

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and behavioural parameters as useful to assess shelter dogs' welfare (Dalla Villa et al., 2013; Hennessy, 2013; Hiby et al., 2007; Rooney et al., 2007; Titulaer et al., 2013; Tyson, 2005). In particular, behavioural parameters give important information on the animal welfare state, being easily observable and quantifiable in a non-invasive manner (Dawkins, 2004).

It is now widely accepted that animal welfare is based not only on a good health status but also on good mental state (Broom, 2011). To have good welfare, domesticated animals should experience more positive (e.g. pleasure, happiness) than negative (e.g. fear, pain) emotions (Boissy et al., 2007). The emotional state has a great role in influencing animals' behaviour, communication, social bonding (Rolls, 2000) and cognitive functioning (Paul et al., 2005). Hence, an increased interest is shown in studying emotions in animals (Mendl and Paul, 2004) and, of relevance for this study, in dogs (Konok et al., 2015), with attention to assessing positive over negative emotions (Burghardt, 2005; Wemelsfelder et al., 2001; Zupan et al., 2016).

Previous studies indicate that dogs are good subjects for investigating how animals' emotions are perceived and described by humans. Two interesting studies, one by Morris et al. (2008) and the other by Konok et al. (2015), for example, suggest that humans regard emotional expression as something that can be shared between humans and dogs. Using a questionnaire, owners were asked which emotions they thought humans could recognise in their dogs choosing from a set of both primary and secondary emotions (Morris et al., 2008). In both studies, owners thought that people could recognise most of the listed emotions in dogs (72%), with fear, joy, jealousy, sadness and curiosity being those reported by the majority of people (> 90% of the owners, Konok et al., 2015). Tami and Gallagher (2009) asked a group of observers to classify the behaviour of a focal dog shown in different video clips by scoring a pre-fixed list of adjectives on a 6-point rating scale. Videos portrayed pet dogs during their first social interaction with a specifically trained dog. Results indicated that both experienced and inexperienced human observers agreed in interpreting most of dogs' emotional expressive behaviour through the use of adjectives, supporting the notion of a shared spontaneous human tendency to interpret animal behaviour in a holistic manner (Wemelsfelder, 1997).

Other studies have applied qualitative behaviour measurements based on pre-fixed descriptor lists for the assessment of acute and chronic pain in dogs. Holton et al. (2001), for example, developed a composite scale for assessing acute pain in dogs in a hospital setting on the basis of observations of their behaviour. Veterinary surgeons were asked to generate terms for describing behaviour expressions of animals, and finally the generated words and expressions were reduced and allocated into behaviour categories. Wiseman-Orr et al. (2004, 2006) developed and validated a structured questionnaire to measure the effects of chronic pain on health-related quality of life in dogs. Relevant domains were identified through semi structured interviews to dog's owners.

To formally address the use and validity of qualitative behaviour assessments as a measure of animal emotion, particularly to address concerns about anthropomorphism, Wemelsfelder et al. (2000, 2001) developed Qualitative Behavioural Assessment (QBA). QBA focuses on observation of the whole animal and characterises and quantifies the animal's dynamic demeanour as an expressive body language, using descriptors such as 'sociable', 'fearful' or 'nervous' (Wemelsfelder et al., 2000, 2001). In a growing number of studies QBA has been reported as generally reliable, and, cross-validated against quantitative behavioural and physiological measures, also as a valid measure of animals' emotional state (for recent reviews, see Wemelsfelder and Mullan, 2014; Fleming et al., 2016). It has been successfully applied to a range of different species (Grosso et al., 2016; Minero et al., 2009, 2015; Napolitano et al., 2012; Stockman et al., 2011; Walker et al., 2010; Wemelsfelder et al., 2001; Wickham et al., 2012), and has been described as a method suitable to assess an animal's affective state quickly, reliably and non-invasively (Minero et al., 2015), also under

on-farm conditions (Phythian et al., 2016). The descriptive terms used in QBA can be generated by a methodology known as Free-Choice Profiling (FCP) (Wemelsfelder et al., 2000, 2001). Walker et al. (2010) used the FCP method to assess the emotional state of a group of working dogs (all Beagles) in a standardised context i.e. a passive experimenter was sitting at the centre of an arena with the dog free to explore or interact with the human for a few minutes. More recently, Walker et al. (2016) assessed shelter-housed dogs and found significant and meaningful correlations between QBA dimensions and quantitative behavioural measures, demonstrating that QBA is a valid measure of dogs' expressions. When comparing the results of these two a good overlap between the dimensions extracted by applying the FCP method in the two different contexts (Walker et al., 2016). However, in both studies dogs were recorded while housed in the absence of conspecifics, and in standardised pens in just one or two locations per study.

From this brief overview of past research, it emerges that dogs' emotions have been studied mainly by asking the owners to describe the emotions of their dogs, or by assessing working or shelter dogs in standardised experimental settings. In the European legal framework, as well as many other countries around the world, there is a lack in setting housing system requirements for shelter dogs. This generates a large variability of infrastructures, management procedures and husbandry standards (Barnard et al., 2016). So, the question rises whether the emotional dimensions developed so far are representative of the large range of behavioural expressions that a dog could show in confined conditions, including social interaction with conspecifics, reaction to familiar and unfamiliar people and/or to environmental stimuli. QBA could potentially be applied for daily monitoring of dog mental state in shelter environments (Walker et al., 2016) but, because of its context-specific nature, it could be that more fit-for-purpose behavioural dimensions need to be created to fully represent the range of emotions potentially expressed by dogs in rescue shelters.

In light of these considerations, the aim of this study was to gain a broader understanding of dogs' expressive demeanour by assessing them in a wider variety of shelter environments and social contexts, (outdoor/indoor pen, single/pair/group housing, presence/absence of human activity etc.) than was done in previous studies.

2. Materials and methods

2.1. Animals and video recording

A convenience sample of four Italian shelters was selected to prepare the video-material for the project. The shelters were distributed along the north-south axis of the country: one in Northern Italy (Emilia-Romagna Region), two in the Centre (Abruzzi Region) and one in the South (Apulia Region). Shelters had different types of management: one was managed by the municipality, another was private and two were managed by charities. Eight pens per shelter were randomly selected among those hosting long-term confined animals (> 6 months). All the dogs present in the pens were video-recorded for 5 min with a mobile phone (Samsung GT-I9100P) mounted on a tripod positioned a few meters away. Each pen was randomly assigned to one of three groups: no stimulus, unknown person or familiar person. The social stimulus was introduced to elicit a range of expressions commonly shown by dogs in this environment. The unknown person could be one of three researchers (two females and one male) while the familiar person was a shelter operator. Unfamiliar people were asked to approach and stand in front of the fence ignoring the dog (30 s) and subsequently to crouch and talk gently (30 s). Shelter operators were asked to enter the pen and interact with the dogs (60 s).

All video-material was later analysed by the first author and 16 video-clips (four per shelter) were selected and prepared in such a way that they represented the widest possible variability of behavioural expressions. The video-clips were cut to a length of about 1.5 min (using the free video editor Avidemux 2.6.8) during which a focal dog

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