



Using judgement bias to measure positive affective state in dogs

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ARTICLE INFO

Article history:

Accepted 3 April 2011

Available online 7 May 2011

Keywords:

Positive affect

Dogs

Cognition

Animal welfare

ABSTRACT

Interest in the induction and measurement of positive affective states in non-human animals is increasing. Here, we used a test of cognitive (judgement) bias, based on the finding that individuals experiencing different affective states judge ambiguous stimuli differently, to measure whether a positive low arousal affective state (e.g. 'satisfaction'/'contentment') could be induced in domestic dogs as a result of their experiencing a food-based rewarding event. In this rewarding event, subjects (1 year old female Beagles) had to search for small amounts of food randomly placed within a maze arena. Using a balanced within-subjects design, the dogs ($N = 12$) received a cognitive bias test either without experiencing the rewarding event (the 'Neutral' treatment), or directly after experiencing the rewarding event (the 'Post-consumption' treatment). In the test, dogs were trained that one visual cue (e.g. dark grey card) predicted a positive event (food in a bowl) whilst a different cue (e.g. light grey card) predicted a relatively 'negative' event (empty bowl). We hypothesised that dogs tested after experiencing the rewarding event, and in a presumed post-consummatory positive affective state, would be more likely to judge visually ambiguous stimuli (intermediate grey cards) positively, compared to dogs in the 'Neutral' treatment. In contrast, we found that they took significantly longer to approach an intermediate ambiguous stimulus, suggesting that they were less likely to anticipate food (a negative judgement) compared to dogs in the 'Neutral' treatment group. Various explanations for the observed results are discussed, in particular how reward acquisition and consumption may influence positive affective state induction in animals.

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1. Introduction

There is an increasing acceptance that the study of affective states in non-human animals (henceforth animals) is a critical component in our understanding of animal welfare (e.g. Dawkins, 1990, 2000). Historically, there has been an emphasis on the study of negative, rather than positive, affective states (Reefmann et al., 2009), and in

animal welfare science this has resulted in a focus on indicators of poor welfare, such as abnormal behaviour (e.g. Mason, 1991; Garner et al., 2004; Moinard et al., 2003; McAdie and Keeling, 2000) and physiological 'stress' responses (e.g. Burman et al., 2008a; Rooney et al., 2007a; Dawkins et al., 2004). Such an emphasis is understandable, in that the first responsibility of animal care and management should be to minimize negative affective states such as suffering, fear, pain, and distress (e.g. the 'Five Freedoms': Farm Animal Welfare Council (FAWC), 1992). Whilst there has been a recent increase in interest in the assessment of positive affect (e.g. Boissy et al., 2007; Yeates and Main, 2008), and this change in focus acknowledges that animal welfare encompasses both positive and negative

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affective states/experiences (Farm Animal Welfare Council (FAWC), 2009), there remains a relative paucity of research not only concerning under what circumstances such positive affective states might occur, but also how they can be measured.

If affective states are states elicited by rewards and punishers, and rewards are “anything for which an animal will work” (Rolls, 2005), then different phases of reward acquisition and consumption can be identified, i.e. appetitive/anticipation of reward (e.g. food, drink, sex), consumption of reward, and post-consumption. Because these phases are all linked to acquiring rewards they are likely to induce positive affective states (e.g. Rolls, 2005) except when an anticipated reward is unexpectedly absent, in which case negative affective states of ‘disappointment’ and/or frustration may be generated (e.g. Burgdorf and Panksepp, 2006; Burman et al., 2008b). In the current study we decided to investigate whether or not a positive affective state associated with the post-consummatory phase of reward acquisition could be induced in dogs. Unlike the anticipatory and consummatory phases of reward acquisition that have both been the focus of some attention (e.g. Bos et al., 2003; Moe et al., 2006; Burgdorf and Panksepp, 2006), comparatively little research has been directed towards the positive affective states that might be experienced ‘post-consumption’. Such research is of particular interest because indicators of positive affective state induced ‘post-consumption’ may have more cross-species similarities compared to other phases of reward acquisition, thereby providing more convenient indicators of positive affect than those that are less applicable to a range of different species. For example, the behavioural expression of anticipation can differ between species (e.g. rats and cats (Bos et al., 2003)).

Measuring affect in animals is challenging and, as mentioned above, traditional measures tend to focus on negative affective states such as fear and anxiety, and some of these measures (e.g. heart rate, cortisol/corticosterone) may be better at detecting arousal rather than valence (positivity or negativity). Cognitive measures, in contrast, are particularly suited to detecting the valence of affective states (e.g. Paul et al., 2005), and hence are used in the current study. The particular cognitive measure selected for use, cognitive affective bias (henceforth cognitive bias), is based on empirical findings from humans, and theoretical predictions, that affective state influences cognitive processes including judgement, memory and/or attention. Specifically, individuals in a negative affective state pay more attention to threatening stimuli, retrieve more negative memories, and judge ambiguous stimuli more negatively (are relatively ‘pessimistic’) than happier individuals (e.g. Paul et al., 2005; Mendl et al., 2009, 2010a,b).

Cognitive bias studies based on the judgement of ambiguity have successfully been used to inform researchers about affective valence (generally negative) in a range of animal species, including rats (e.g. Harding et al., 2004; Burman et al., 2009), starlings (e.g. Matheson et al., 2007; Brilot et al., 2010), dogs (e.g. Mendl et al., 2010a) and sheep (e.g. Doyle et al., 2010). Here, we utilise a judgement bias technique to assess a putative positive affective

state, and use dogs as our subject species because they appear sensitive to the induction of positive affective states, e.g. via play interaction with humans (e.g. Rooney et al., 2001), are able to learn visual discrimination tasks (e.g. Pretterer et al., 2004) and are common companion animals (e.g. c. 10 million owned dogs in the UK in 2006 (Murray et al., 2010)). Our prediction is that, following the experience of a rewarding event (i.e. ‘post-consumption’), dogs tested in a cognitive bias task will be more likely to judge ambiguous stimuli positively, i.e. be more ‘optimistic’, due to experiencing a post-consummatory positive affective state (e.g. satisfaction/contentment), compared to when tested without experiencing the rewarding event.

2. Methods

2.1. Subjects, housing and husbandry

The subjects were 12 young female Beagles of between 11 and 12 months of age at testing (average body weight of 10.5 kg) housed at the Swedish University of Agricultural Sciences for use in behavioural observation studies of positive affective state (e.g. Rehn and Keeling, 2010; McGowan et al., 2010). Of the 12 dogs, there were four pairs of full sisters, two pairs of which were half-sisters with one other dog. The dogs were housed in indoor enclosures (9 m × 2.7 m) between 1600 and 0800 h in groups of three, and in outdoor enclosures (5.8 m × 25 m) between 0800 and 1600 in groups of between 6 and 12 animals. Food (Hill’s Adult Advanced Fitness) was provided at 0800, immediately before the dogs were taken outside, and at 1600, when the dogs returned indoors. Water bowls were available indoors and outdoors. Both indoor and outdoor enclosures were also provisioned with ‘enrichment’ items, including rawhide chews, footballs and soft toys. The outdoor enclosures also contained wooden chalets for shelter (these were also used as vantage points/resting places) and a water bath for thermoregulation (the study was carried out in the summer). Dogs were taken for walks on leads once a day in groups. This study was reviewed and approved by the Regional (Uppsala County) Ethical Committee on Animal Experiments.

2.2. Familiarisation period

Prior to the start of the study, the dogs were familiarised with the two test rooms, two ‘maze’ arenas (see Section 2.4), the researchers, and two different types of food reward (standard food pellets and Frolic™). This familiarisation consisted of five days during which each dog was allowed to explore individually the rooms and ‘maze’ arenas in the presence of the researchers for 5 min, followed by a 5 min period of training (e.g. to sit on command), once per day. This also allowed the dogs to become used to brief periods of separation from conspecifics. The dogs were familiar with both food types, receiving standard food pellets as their regular diet and being rewarded with Frolic during training.

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