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Research

The role of environmental and owner-provided consequences in canine stereotypy and compulsive behavior

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ABSTRACT

The present study evaluated whether environmental variables can reinforce and maintain canine stereotypic behavior and whether the removal of these variables can reduce the rate of the behavior. We first present an online survey in which the owners were asked to report the environmental antecedent and consequent events related to stereotypic behavior in their dogs. The survey results indicated that stereotypic behavior, as reported by the owners, was not restricted to specific antecedents. Principal component analysis identified 4 ways that the owners usually responded to stereotypic behavior. In a case study of 5 dogs, functional analysis methodology was used to evaluate whether environmental or owner-provided consequences maintained stereotypic behavior. We demonstrate that owner-provided consequences maintained circling and licking in 2 of the dogs, light movement alone maintained light chasing in 2 of the dogs, and 1 dog showed little-to-no response during sessions preventing further analysis. We subsequently manipulated the consequences of the stereotypic behavior thought to maintain the behavior for 3 of the case study dogs, which led to a reduction in the behavior for all 3 dogs. This study provides evidence that the consequences of stereotypic behavior, such as attention from the owner, can reinforce and maintain high rates of the behavior. Our results suggest that the specific owner-dog dynamic might be an important influence on canine stereotypic behaviors, and that manipulating the relevant reinforcer found to maintain these behaviors leads to a reduction in the behavior.

Introduction

Canine compulsive disorder (CCD)/obsessive compulsive disorder (OCD) is diagnosed when dogs present with a variety of stereotypic behaviors including but not limited to repetitive licking or flank sucking, tail chasing or spinning, light or shadow chasing, fly biting at no apparent fly, or extended fixation or staring (Luescher, 2000; Overall & Dunham, 2002). Stereotypic behaviors are typically defined as repetitive behaviors that appear to serve no obvious function (for a review of terminology, see Low, 2003). These behaviors can range from a mild annoyance to owners to severe behavioral problems requiring veterinary intervention (Luescher, 2000). The focus of the present study is on the readily observable stereotypic behavior associated with CCD.

Several studies have found that in combination with behavioral modification, pharmaceuticals can reduce canine OCD (Overall & Dunham, 2002; Seksel & Lindeman, 2001; Veremie et al., 2010). Although CCD/OCD can be reduced pharmacologically, the etiology and motivation of canine stereotypic behavior remains unclear. Exploring the environmental conditions that may contribute to and exacerbate canine stereotypic behavior may enable improved forms of treatment.

Several hypotheses have been proposed to explain canine stereotypy. One hypothesis is that canine stereotypic behaviors is the result of frustration or conflict generalizing to situations where conflict is no longer apparent or appropriate (Luescher, 2000). This hypothesis provides a plausible explanation for the development of canine stereotypy; however, it remains unclear what exact mechanism leads to the conflict and frustrations generalizing to other situations, which thereby maintain canine stereotypic behavior.

An alternative account for canine stereotypy is that the underlying biological differences separate dogs with stereotypy from

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normal dogs (Overall & Dunham, 2002). Dodman et al. (2010) identified a candidate gene associated with compulsive behavior in Doberman pinschers (*CDH2*; for a review, see Hall and Wynne, 2012). Tiira et al. (2012) attempted to extend this finding in a population of Bull Terriers, Staffordshire Bull Terriers, and German Shepherds but found no significant genetic associations with tail chasing using candidate gene analysis with *CDH2*. Instead, they found a significant effect of vitamin intake: dogs that took a multivitamin were significantly less likely to develop tail chasing. Additional study with Doberman Pinschers has shown that dogs with CCD have structural brain differences from control dogs (Ogata et al., 2013). In addition, dogs with stereotypic behavior were shown to be, in general, more perseverative on an arbitrary task than dogs that do not show stereotypic behavior (Protopopova et al., 2014). Together, there is growing evidence for a genetic contribution to canine stereotypic behavior; however, no clear biological mechanism has been identified. More recent research investigating some forms of excessive licking may be associated with undiagnosed gastrointestinal disorders (Bécuwe-Bonnet et al., 2012). These results suggest that there are likely biological contributions to canine stereotypic behavior but leave open the question whether environmental factors may also play a causal role in the development and or maintenance of canine stereotypic behavior.

Few studies have investigated the potential influence of environmental variables on stereotypic behavior, although such a role is often assumed when behavior modification is recommended to help reduce stereotypies. Behavior modification can only work if the behavior is sensitive to environmental factors. One notable study exploring the potential role of environmental factors analyzed 400 videos of tail chasing in dogs (Burn, 2011). The author reported that owner encouragement of the dog was observed in 43% of the videos and one of the most common descriptors of the behavior by owners was "funny" (46%). These results suggest that humans may intentionally or unintentionally reinforce the behavior with attention and that changes in the owner's behavior might reduce the dog's stereotypic behavior.

Empirically assessing whether laughter and encouragement might actually reinforce tail chasing, as suggested by Burn (2011), requires additional evidence. Although people may provide attention contingent on tail chasing, this may have little or no effect on the dog's behavior. To assess the effects of human attention on stereotypic behavior, we must determine whether the attention serves as its maintaining reinforcer. Researchers working with humans with diverse developmental disabilities have pioneered a single-subject methodology to assess the environmental variables that reinforce an individual's problem behavior. This method, termed "Functional Analysis," was first reported by Iwata et al. in 1982 (reprinted in Iwata et al., 1994a) and has been successful in identifying the environmental determinants of behavior in many cases (Iwata et al., 1994b) and cited in more than 1200 publications in Google scholar. This technique has recently been extended to identify the reinforcers of problem behaviors in animal in zoos (Dorey et al., 2009; Martin et al., 2011), and unwanted jumping up in pet dogs (Dorey et al., 2012).

Functional Analysis was designed to identify how the consequences of problem behavior may influence the rates of that behavior. Reinforcers, for the purpose of this study, are any environmental stimuli that when presented as a consequence of a behavior, lead to increased rates of that behavior. To identify these reinforcers with a Functional Analysis, a single subject is exposed to several conditions. Each condition tests whether a putative reinforcer sustains a problem behavior or is unrelated to the rates of occurrence of that behavior. This is tested by delivering the putative reinforcer whenever the problem behavior occurs during the session. If delivering the putative reinforcer increases the rate of the behavior compared with a control condition, the consequence is confirmed as a reinforcer for the behavior. If, however, experimentally delivering a putative reinforcer when the problem behavior occurs does not increase rates of the behavior compared with a control condition, the putative reinforcer is considered not to be a reinforcer of the behavior. The control condition for a Functional Analysis is designed so that all putative reinforcers are delivered regardless of the occurrences of problem behavior. Thus, low rates of problem behavior are expected in the control condition because reinforcers are delivered without the subject needing to engage in problem behavior.

The aim of this set of studies is to evaluate the impact of environmental variables on canine stereotypic behavior. In the first study, we used a survey to assess owner-reported antecedents (events preceding a behavior) and consequences of stereotypic behavior in pet dogs. We then, in Study 2, used a single-subject assessment of reinforcers, a Functional Analysis, with 5 dogs to assess whether and which environmental variables maintain canine stereotypic behavior. Last, in Study 3, we manipulated the environmental variable found to reinforce behavior from the Functional Analysis in Study 2 for each dog, in an attempt to reduce canine stereotypic behavior.

Study 1

The aim of Study 1 was to identify owner-reported antecedent events to the stereotypic behavior and owner-reported responses to their dog's stereotypic behavior with a brief survey. Thus, this experiment was exploratory and cannot be taken to identify valid predictor variables of stereotypic behavior—only owner impressions.

Methods and materials

A custom survey was created using Google docs (www.docs.google.com, see Appendix A for the complete survey). Dog owners answered basic questions about their dog followed by questions on whether it engaged in stereotypic behaviors. These behaviors were described as follows: "spinning" or "circling" was defined as "repeated turning" (4 or more times in single bout) when the dog is not trained or commanded to do so or there was no apparent reason for the activity; "fixation" was defined as an excessive attention to an item or no apparent specific item; "light chasing" was defined as an intense focus or chasing of lights to which most dogs would not usually attend; "licking" was defined as the licking of objects for extended bouts with no obvious purpose or function; and "other" invited owners to report any other problem behaviors that were repeated at least 4 times in a single bout. Finally, the owners were asked to report on the conditions under which the behavior occurred and how they responded to it.

Owners were given multiple choice options (they could select more than 1) and an optional fill in box. To assess antecedent events that may lead to stereotypic behavior, the owners were asked to indicate under which conditions the behavior occurred: "only when crated, and never under other conditions," "when there is a lack of stimulation (i.e., bored). This can include when being crated but is not limited to crating," "when I give lots of attention," "after or during play," "after I give a command," "when I have something my dog wants (e.g., a toy or food)," "following a loud noise or after being startled," "when stressed or anxious," "under all conditions and/or does not seem predictable," and "other" with a textbox for an open-ended answer. To assess owner-reported consequent events that may reinforce stereotypic behavior, the owners were asked how they usually respond to such behavior and given the following options: "I give my dog attention;" "I try to block the repetitive behavior (e.g., prevent them from circling or engaging in