Assessing Use of a Visual Tracking Test and Questionnaire for Predicting Abnormal Behavioral Development in Puppies

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Introduction

Highly problematic behaviors such as aggressive behaviors, fearful or anxious behaviors, and hyperactive or impulsive behaviors have a prevalence as high as 32-56% among domestic dogs[1-2]. Behavioral issues put young dogs at increased risk of euthanasia and are a leading cause of relinquishment to animal shelters[3-4].

Creating an accessible method for both dog guardians and veterinarians to identify predictive behaviors and risk factors for the development of problematic behaviors at 3 months of age may enable earlier behavioral modification and management to prevent development of fully-developed pathology and create a safer outcome for dogs and their families.

This study utilized a behavioral test referred to as "the tracking test" to evaluate two executive functions in dogs, attention and inhibitory control. Attention and inhibitory control are significantly involved in management and regulation of inappropriate behavioral responses to stressors[5-6]. A standardized method of evaluating these executive functions in young dogs may provide predictability of behavioral trajectory as adults.

The purpose of this project is to determine if and how the tracking test can be analyzed alongside 6 other behavioral tests and a detailed questionnaire (WDQ-Pet) to predict behavioral pathologies in puppies.

Methods

Thirty-nine puppies were enrolled in the study and tested at 3-, 6-, 9-, and 12-months of age.

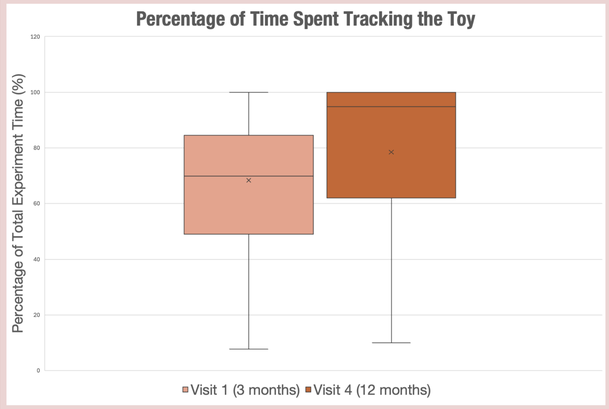
The WDQ-Pet is a pet dog adaptation of the Working Dog Questionnaire and was completed by the puppy's guardian at 3-, 6-, 9-, and 12-months of age. The WDQ-Pet is a 32 page document that inquires in depth about the puppy's origin, health information, training history, and behavior under a variety of different social and environmental circumstances.

The tracking test was performed at 3- and 12- months of age. The test protocol involves holding a stuffed toy in front of the puppy and moving it in a singular cross formation. Parameters such as time spent tracking the toy, time spent stationary, number of jumps, and whether or not fearful behavioral cues were exhibited were tracked. The tests were recorded from two camera angles for scoring purposes.

At the 3-month test, the guardians performed the test using a novel yellow giraffe toy. The experimenter performed a demonstration for the guardians beforehand using a different toy.

At the 12- month test the experimenters performed the test using the same yellow giraffe toy. The yellow giraffe was selected as it is a color dogs could see and had never been played with by another dog.

Results



The box and whisker plots (Figures 1 and 3) show the means (x) and the medians (lines). The box contains 50% of the scores, and the values for 75% of index scores (whiskers) for each group.

Figure 1. Percentage of time spent tracking the toy (%TT). At 3-months, the average %TT was 23.86 and the SD was 68.4. At 12-months, the average %TT was 28.5, and the SD was 78.5. There was a significant effect of age on % TT in the direction predicted (increased tracking with age) (Mann-Whitney U Test:U =563.5, z-score=2.24886; p=0.02).

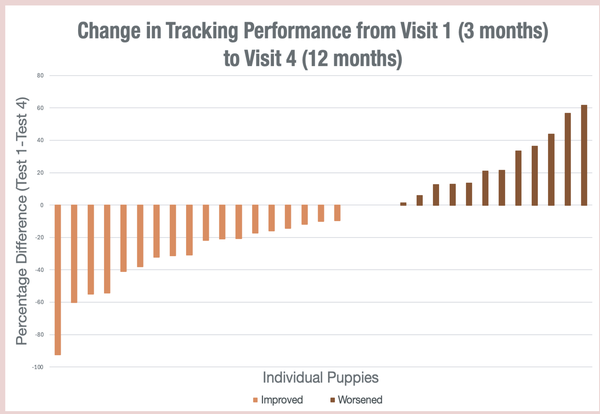


Figure 2. Percentage of time spent tracking the toy at Visit 1 minus Visit 4.
Percentage of time spent tracking (%TT) was calculated by dividing the total number of seconds where the puppy made eye contact with the toy by the total measured experiment time. This value at Visit 1 was subtracted from Visit 4 to yield a percentage difference between the two visits. 18 puppies (54.5%) improved tracking performance, 3 puppies with %TT=100 (9.1%) did not change, and 12 puppies (36.4%) performed worse with age.

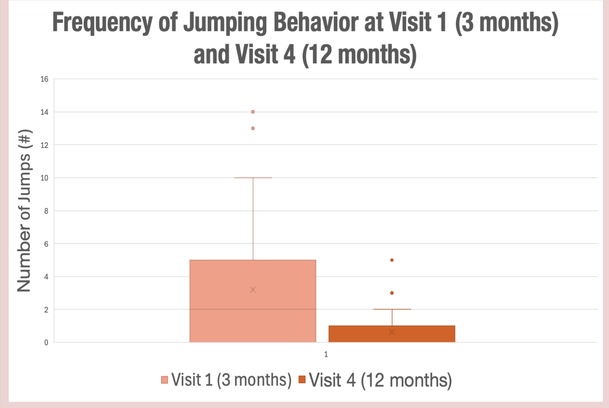


Figure 3. Total number of jumping behaviors across all Visit 1 and Visit 4 experiments.
The most common incidental behavior exhibited during this study was jumping in an attempt to reach the toy. At 3-months, the average number of jumps during the experiment was 3.2 (SD=3.7), whereas at 12-months the average was 0.63 events (SD=0.71). There was a significant effect of age on the average number of jumps in the direction predicted (Mann-Whitney U test; U=312; z-score=3.52; p=0.00044).

Neither number of jumps, nor %TT at 3-months, correlated with behavior at 12-months (Spearman's rho: jumps: rs = 0.2026; p (2-tailed) = 0.25813; %TT: rs = 0.17676, p (2-tailed) = 0.3251).

While 39 puppies were originally enrolled, 3 puppies declined to complete both the 3- and 12- month tracking tests. **This provided us with a sample size of 33 puppies for final analysis.**

There was no significant association between percentage of time spent tracking (%TT) or puppies with exceptional tracking performance (%TT >/=90) and training history, nor was there an association with age at adoption, use of toys for rewards, use of any other rewards, reactions to noises as reported by owners on the WDQ-Pet at 12-months, or fear scores with respect to approaches by strangers as reported by owners on the WDQ-Pet at 12-months.

Discussion

The percentage of dogs that improved (54.5%) vs. worsened (36.4%) from 3- to 12-months was similar to most of our other tests. However, unlike other tests, only 2 of 33 dogs at Visit 1 and 5 of 33 dogs at Visit 4 displayed signs of fear of the toy throughout the test. These low numbers may be due to early experience with interactive play with toys. Puppies exhibiting any signs of fear toward the toy spent a lower percentage of time tracking the toy than puppies who showed no signs of fear toward the toy. This result seems intuitively expected, but it may warrant further investigation with a larger sample size. Ultimately, there was no significant association between %TT and fear scores as reported by owners on the WDQ-Pet at 12-months, suggesting that %TT and number of jumps are not sufficient to discriminate later behavioral profiles.

Although the tracking test has the advantage of being a short test involving few resources, it is difficult to fully standardize. Additionally, the majority of puppies (63.6%) improved or maintained perfect tracking performance with age. Given this and the history these puppies had of exposure to toys, further exploration of factors associated with the dogs who did not improve and who worsened (>1/3 of all dogs tested), is warranted.

Nonetheless, our results from this test inform and shape the larger study at hand as we seek to understand what behavioral tests and history questions can reliably predict behavioral pathology in puppies.

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