JABAAT issue 1 (1) 60-70
DOI: 10.62981/SOFN6648

Assessing the Validity of a Dog Treat Delivery System: A Technical Note

Allyson R. Salzer & Derek D. Reed
University of Kansas

Abstract

This project sought to develop a new method of foraging research for canines by validating a commercial dispenser in basic behavioral research. With a decrease in funding opportunities, instructors and researchers alike should consider novel apparatus options to study basic behavioral mechanisms. The purpose of this study was to evaluate whether the Treat & Train® dispenser could function as a viable method to deliver treats on a variable-time schedule. Experimenters tested select schedules advertised on the Treat & Train® dispensers to determine how the rate of delivery corresponds with the advertised values. Results indicated the VT schedules tested on the Treat & Train® dispensers adequately matched the dispenser's advertised values. The average treat delivery across all three samples remained consistent at approximately three treats per delivery. Implications and future directions involve expanding the Treat & Train® dispenser's use to study other behavioral processes and extending foraging research in the domesticated canine.

Keywords: apparatus, canine, ideal free distribution, group foraging

Author Note
Allyson R. Salzer https://orcid.org/0000-0003-2021-0729
Derek D. Reed https://orcid.org/0000-0002-5854-3425
We have no known conflict of interest to disclose. Portions of this project were submitted towards the first author's master's degree requirements.
Allyson R. Salzer is now at MSPCA-Angell and Canine Behavioral Blueprints, LLC.
Derek D. Reed is now at Institutes for Behavior Resources, Inc.
Address correspondence to: Allyson Salzer, Canine Behavioral Blueprints, LLC.
E-mail: ally@caninebehavioralblueprints.com

Assessing the Validity of a Dog Treat Delivery System: A Technical Note

The purpose of the experiment was to identify the suitability of an affordable treat delivery system from the retail market (CattleDog Publishing® Treat & Train® dispenser; see ********treatandtrain.com/products/treat-and-train)1 to be used for scientific purposes related to Ideal Free Distribution (IFD) with nonhumans (see Arce & Stevens, 2020 or Byosiere et al., 2019, for examples of the Treat & Train's® utility in research). The Treat & Train® dispenser is a treat delivery system available on the retail market for approximately $169.99 USD. The dispenser is marketed to dog owners to help train dogs using positive reinforcement, namely through small rewards contingent upon appropriate behavior (Yin, 2004). The product includes the device, a target stick, and a remote control to deliver treats manually. Despite marketing to a lay audience, the product description explains positive reinforcement to train dogs to complete several obedience behaviors. The automation of treat delivery devices allows researchers to expand from applied animal training to understanding basic behavioral processes in canines using a mechanical tool that allows for a high degree of experimental control.

Prior research has utilized the Treat & Train® dispenser in behavioral studies. A number of these studies have assessed the functionality of the dispenser for applied animal behavior studies (Macpherson & Roberts, 2017; Mehrkam et al., 2020; Protopopova et al., 2016). For example, Macpherson and Roberts (2017) used the treat delivery system to assess interval timing in domestic dogs using a fixed time sequence with the Treat & Train®. Functional analysis procedures have also manually delivered treats using the Treat & Train® dispenser in tangible test conditions (Mehrkam et al., 2020). Yin and colleagues (2008), the designer of the Treat & Train®, taught dogs an alternative behavior to charging a door when guests arrive using the manual remote control on the dispenser to deliver treats contingent upon appropriate behavior. These studies have demonstrated the utility of the Treat & Train® dispenser and the included remote. Still other studies have retrofitted these treat dispensers to act as an experiment computation, data storage, and networking center (Arce & Stevens, 2020); however, barring advanced computational experience, an average dog trainer or researcher would benefit from understanding how commercially available products operate independent of manipulation of the machine's hard drive. Using and understanding the internal timing devices on the Treat & Train® dispenser rather than modifying the system could expand potential research questions to address those involving variable interval (VI) or variable time (VT) schedules such as the matching law (Baum, 1974; Herrnstein, 1970). Thus, the purpose of the current study was to evaluate the Treat & Train® dispenser's VT schedules under different times to determine the feasibility of using the dispenser in basic behavioral research.

---

[1] *Note:* Authors received no product support or financial compensation from CattleDog Publishing ® to use, evaluate, or report on the Treat & Train® (Yin, 2004). They thereby have no conflicts of interest with respect to this product.

Method

Materials

The Treat & Train® dispenser has dimensions of 40.64 x 26.67 x 25.91 cm and weighs 2.79 kg. The dispenser comes with two disks with different-sized holes through which kibble or treats fall. The product includes a target training wand with a detachable base to facilitate trick training, heel, or other targeting behavior. The included remote allows for distance training from a distance up to 30.48 m and runs on four separate channels, allowing multiple dispensers to be used at once, independent of each other. The machine includes two general settings for treat delivery: remote control to manually deliver a treat or a "down/stay" option which provides treats on predetermined schedules automatically (See Appendix A for images of the dispenser). The automatic option includes a fixed-time (FT) schedule and a VT schedule with treat rates from three seconds to 300 seconds. The treat dispenser also can deliver one treat at a time or multiple treats at once.

Procedure

We tested select schedules advertised on the Treat & Train® dispensers to determine how the rate of delivery corresponds with the advertised values. The VT schedules used for analysis were: 15 seconds, 30 seconds, and 45 seconds. We placed two cups of kibble-like training treats into the dispenser and turned the dispenser to the "on" position in each of the experimental VT schedules. The training treats were hard, approximately 1 cm in diameter, and in differing shapes (such as circles, hearts, or houses). One researcher set the Treat & Train® dispenser to the "down/stay" function with the multi-treat option selected. The "down/stay" function presented treats on the set schedules automatically, rather than with a button pressed by a researcher. Prior to every treat delivery, the machine emits an audible tone. On the down/stay function treats were presented without interference or additional control from the researchers. We tested the dispensers in 30-minute increments, and then recorded the time of each delivery, the number of treats delivered, and the number of times the machine malfunctioned (e.g., a jam of treats). The machine emitted a distinct audible tone and flashed a light located on top of the machine to indicate a jam had occurred. We recorded each schedule for a minimum of nine hours, with the 15, 30, and 45 second schedules recorded for 9, 10, and 9.5 hours, respectively.

Data Analysis

A Shapiro-Wilk test of normality determined whether parametric or non-parametric statistical approaches were most appropriate to analyze data. To compare the resulting values from the recorded deliveries with those advertised on the Treat & Train®, we conducted a one-sample Wilcoxon Signed-Rank Test to compare the median of the tested values from the dispenser against a hypothetical median; in this case, the hypothetical median was the advertised values of 15 seconds, 30 seconds, or 45 seconds.

To assess schedule fidelity and validate the apparatus's accuracy, we recorded the latency between each treat delivery to determine the VT schedule, number of treats delivered on a given trial, and number of times the dispenser malfunctioned in each session. We collected interobserver agreement (IOA) for each duration measure and the number of treats delivered. Two independent observers observed the dispensers and recorded the time of delivery and the number of treats delivered during 30-minute sessions. We calculated mean-duration-per occurrence for the VT schedules and trial-by-trial IOA for the number of treats delivered per trial. Inter-observer agreement was collected for both duration and treat delivery for VT-15, VT-30, and VT-45 at 24.91%, 31.34%, and 25.20% of sessions, respectively. Observers also reported the total number of malfunctions in all testing contexts.

Results

Results indicated the VT schedules tested on the Treat & Train® dispensers adequately matched the dispenser's advertised values. The VT-15 second schedule delivered treats with a median value of 13.54 seconds (see Table 1 for session-by-session data). The VT-30 second schedule delivered treats with a median of every 28.79 seconds (see Table 2), and the 45-second schedule delivered treats every 43.95 seconds as the median (see Table 3) in 10.5 and 9.5 hours of testing, respectively. Tables 1, 2, and 3 show the median amount of time (*t*) in seconds for each VT schedule with 95% confidence intervals. The hypothetical medians, or the advertised values, are depicted with a line. Figure 1 shows a cumulative record for a representative 30-minute session on each VT schedule.

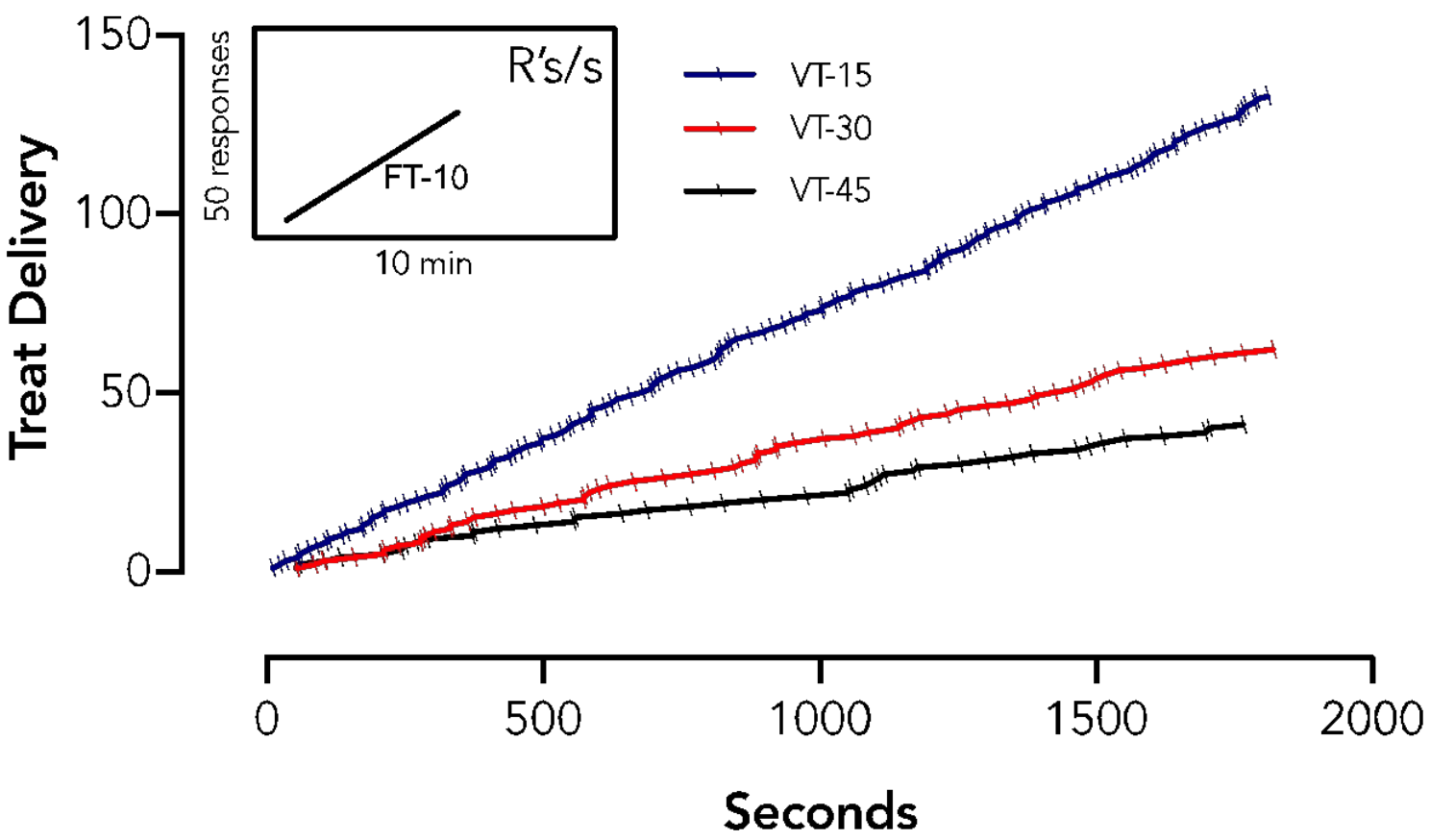

Figure 1. Cumulative Record of Representative Sessions during Treat & Train® Testing

The median number of treats delivered in the 27.5 hours of testing was three treats. Tables 1, 2, and 3 depict individual treat delivery amounts for each session. The mean number of treats for VT-15 was 3.02 (*SD* = 0.74), VT-30 was 3.14 (*SD* = 0.58) and VT-45 was 3.15 (*SD* = 0.50). Put simply, the dispenser consistently delivered around three treats across all sessions.

Session	Treats Delivered					
	1	**2**	**3**	**4**	**5**	**6**
1	2	30	92	15	2	0
2	3	20	86	19	2	0
3	4	13	95	12	1	0
4	0	19	90	17	1	0
5	10	33	53	21	4	3
6	6	20	65	26	5	0
7	9	18	70	32	7	1
8	6	13	58	35	10	1
9	1	18	99	15	0	0
10	10	17	78	22	3	0
11	4	21	88	14	3	0
12	1	18	90	22	2	0
13	0	11	81	26	0	0
14	0	18	87	25	1	0
15	0	17	87	24	5	0
16	2	18	76	27	6	0

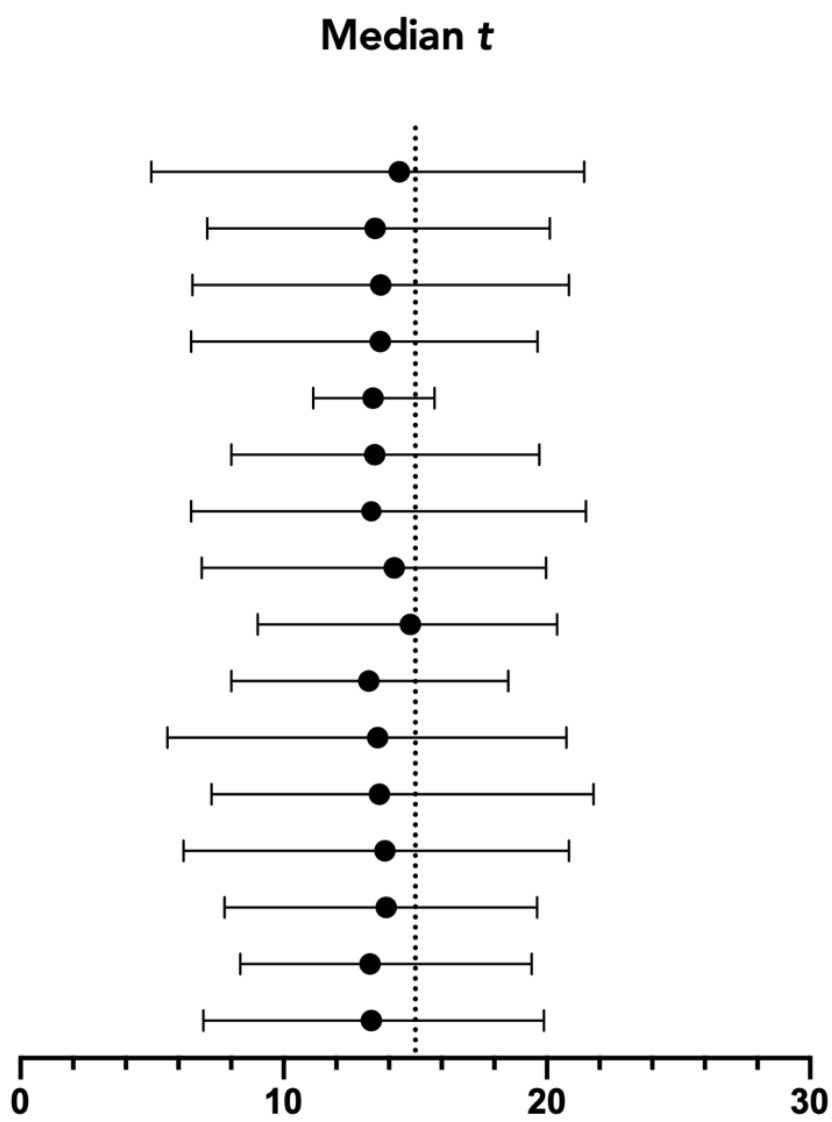

Table 1. Treat Delivery on VT-15 Second Sessions

Session	Treats Delivered					
	1	**2**	**3**	**4**	**5**	**6**
1	0	5	47	11	0	0
2	0	7	42	8	3	0
3	0	8	43	10	2	0
4	0	1	43	6	3	2
5	0	6	46	9	1	0
6	0	5	46	9	2	0
7	1	0	55	8	0	0
8	0	1	43	17	1	0
9	0	3	49	10	1	0
10	0	5	49	10	0	0
11	2	7	45	7	1	0
12	0	2	52	8	0	0
13	1	2	47	11	1	0
14	2	4	47	9	3	0
15	0	4	42	14	2	0
16	0	3	46	12	1	0
17	0	5	37	19	3	0
18	0	8	43	11	1	0
19	0	6	48	9	1	0
20	0	2	51	10	1	0

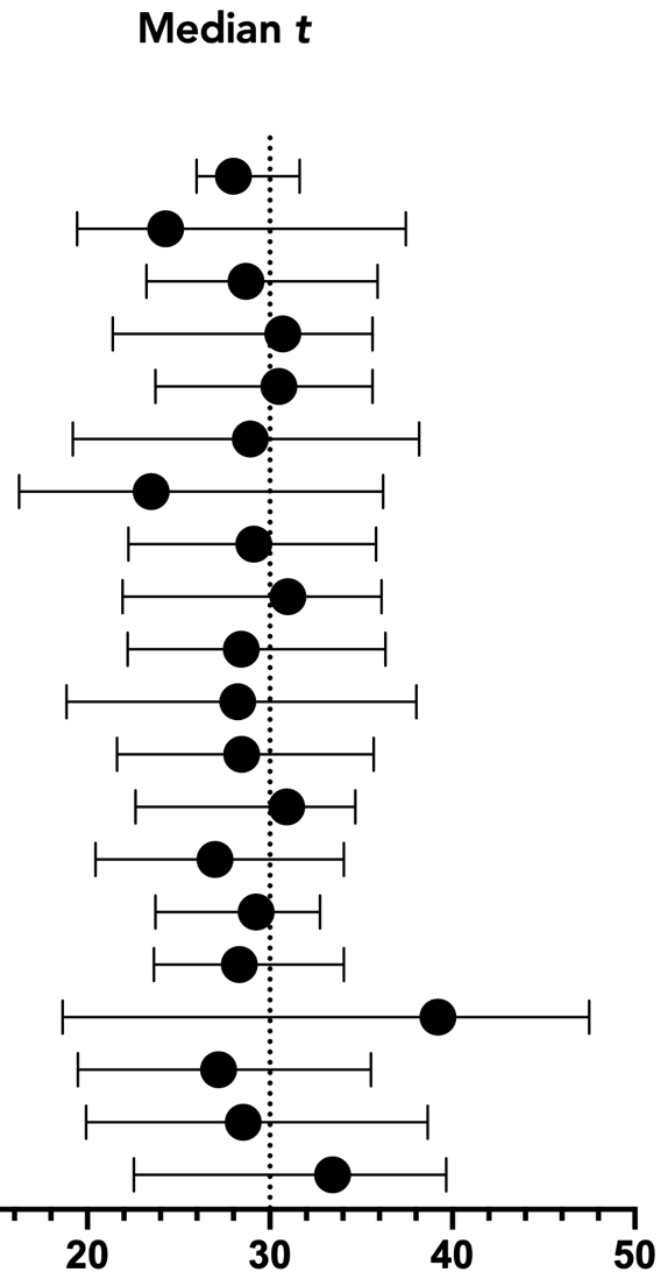

Table 2. Treat Delivery on VT-30 Second Sessions

Session	Treats Delivered					
	1	**2**	**3**	**4**	**5**	**6**
1	0	0	36	7	1	0
2	0	0	35	8	1	0
3	0	0	35	4	1	1
4	0	1	34	8	0	0
5	0	1	35	4	0	0
6	0	0	32	9	0	0
7	0	1	37	5	0	0
8	0	4	29	9	1	0
9	0	4	32	4	1	0
10	0	1	34	6	0	0
11	0	2	32	9	1	0
12	0	4	33	5	0	0
13	0	4	32	6	0	0
14	0	2	28	10	1	0
15	0	4	27	9	0	0
16	1	1	37	3	0	0
17	0	2	33	5	1	0
18	0	1	33	7	0	0
19	0	1	26	12	2	0
20	0	3	32	7	0	0

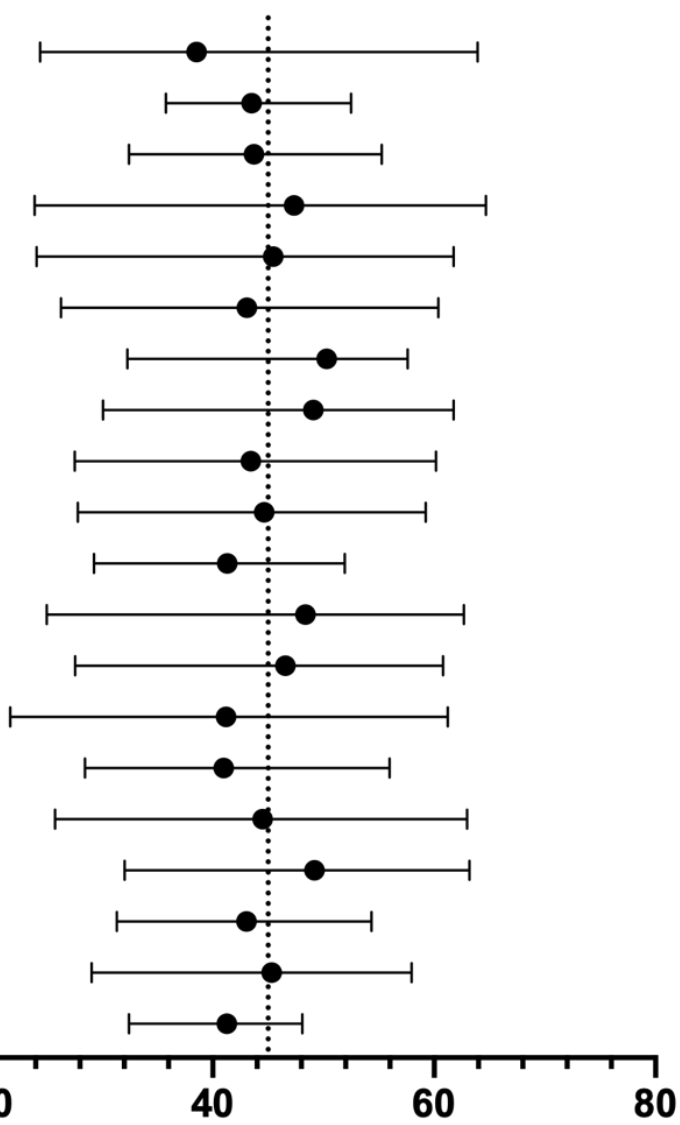

Table 3. Treat Delivery on VT-45 Second Sessions

Schedule Fidelity

Using visual analysis to observe and the Shapiro-Wilk test to confirm, VT 15-s, VT 30-s, and VT 45-s values did not follow a normal distribution. Therefore, the nonparametric Wilcoxon Signed-Rank Test assessed the difference between the sample values and the values on the Treat & Train®. The nonparametric Wilcoxon Signed-Rank Test indicated significant discrepancies in median duration for the assessed values than the hypothetical median of 15 seconds, and the actual median = 13.54, $p < 0.001$. The Wilcoxon Signed-Rank Test also indicated significant discrepancies in duration for the 30 second hypothetical median with the actual median = 28.79, $p = 0.04$. The Wilcoxon test did not show disparities for 45 second test with a hypothetical mean of 45 seconds and the actual median = 43.95, $p = 0.13$.

Inter-Observer Agreement (IOA)

Mean-duration-per-occurrence IOA was 96.61% across the three schedules (93.62% for VT-15, 98.43% for VT-30, and 97.77% for VT-45). We also calculated trial-by-trial IOA for treat delivery with a total IOA of 96.63% (97.21% for VT-15, 96.93% for VT-30, and 95.75% for VT-45).

We analyzed the Treat & Train® dispenser's mechanical reliability by recording the number of malfunctions or jams the device encountered during testing. On the VT-15 second trials, the device jammed seven times over 2,066 trials (i.e., 0.34% of trials). The VT-30 and VT-45 second trials were similar with six jams over 1,180 trials and four jams over 836 trials, or 0.51% and 0.47% of the trials, respectively.

Discussion

Prior to any scientific use, it is imperative to verify technical details of apparatuses to be used in research endeavors. The lack of significant difference in the larger of the tested duration value suggests that the Treat & Train® may be a viable behavioral research apparatus. However, the significant difference between the VT-15 second and VT-30 second sample with the advertised value suggests researchers should be cautious in how the Treat & Train® is used and researchers should report the actual durations obtained by the apparatus rather than reporting the advertised VT schedules.

The differences between the VI-15 second and VT-30 second samples and the hypothetical values may result from several factors. For example, the algorithm programmed for

delivery may not average to 15 seconds or 30 seconds within sessions as short as 30-minutes. Given many research designs involve 30-minute or shorter sessions, this would suggest researchers need to consider the types of studies using shorter durations and collect data on the individual treat deliveries to ensure high integrity within a study. Additionally, the percentage of difference in seconds for the VT-15 second and VT-30 second time are larger proportions than VT-45 second. A 1-second difference from 15 seconds is 6.66% of the total, whereas a 1-second difference between 45 seconds is 2.22%. This absolute difference alone may have resulted in statistically significant results from the Wilcoxin test, despite an average of a one-second shorter duration for all three samples.

Notwithstanding the possible limitations of the shorter durations with the Treat & Train®, results suggest the dispenser may have utility as an apparatus with behavioral research. The average treat delivery across all three samples remained consistent at approximately three treats per delivery. In addition, the percentage of times the dispenser jammed or malfunctioned was meager: less than half of one percent for each testing cycle. An advantage of using an apparatus to create VT schedules for behavioral research is reducing or eliminating human error through timing or delivery of the reinforcer. Using a machine to deliver treats on a VT schedule eliminates human error involved in this aspect of behavioral research.

Overall, results suggest the Treat & Train® dispenser offers a novel and effective method to study basic behavioral processes in canines without compromising data quality. In this study, we assessed the VT timers of specific durations and how many treats were delivered and how many times the device malfunctioned in a testing period. In addition to the VT timers, the Treat & Train® offers FT schedules, a target to teach analog responses, an ability to deliver treats manually, and additional durations ranging from three to 300 seconds.

References

Arce, W. & Stevens, J. R. (2020). Developing a computer-controlled treat dispenser for canine operant conditioning. *Journal of Open Hardware, 4*(1), 6. https://doi.org/10.5334/joh.27

Baum, W. M. (1974). On two types of deviation from the matching law: Bias and undermatching. *Journal of the Experimental Analysis of Behavior*, *22*(1), 231–242. ********doi.org/10.1901/jeab.1974.22-231

Byosiere, S. E., Chouinard, P. A., Howell, T. J. Bennett, P. C. (2019). Illusory contour perception in domestic dogs. *Psychonomic Bulletin & Review*, *26*, 1641–1649. ********doi.org/10.3758/s13423-019-01661-2

Herrnstein, R. J. (1970). On the law of effect. *Journal of the Experimental Analysis of Behavior*, *13*(2), 243–266. https://doi.org/10.1901/jeab.1970.13-243

Macpherson, K., & Roberts, W. A. (2017). On the clock: Interval timing and overshadowing in domestic dogs (Canis familiaris). *Journal of Comparative Psychology, 131*(4), 348–361. https://doi.org/10.1037/com0000083

Mehrkam, L. R., Perez, B. C., Self, V. N., Vollmer, T. R., & Dorey, N. R. (2020). Functional analysis and operant treatment of food guarding in a pet dog. *Journal of Applied Behavior Analysis, 53*(4), 2139-2150. https://doi.org/10.1002/jaba.720

Protopopova, A., Kisten, D., & Wynne, C. (2016). Evaluating a humane alternative to the bark collar: Automated differential reinforcement of not barking in ta home-alone setting. *Journal of Applied Behavior Analysis, 49*(4), 735-744. https://doi.org/10.1002/jaba.334

Yin, S. (2004). Treat and Train® remote reward dog trainer: Instructional manual. Premier®.

Yin, S., Fernandez, E. J., Pagan, S., Richardson, S. L., & Snyder, G. (2008). Efficacy of a remote-controlled, positive-reinforcement, dog-training system for modifying problem behaviors exhibited when people arrive at the door. *Applied Animal Behaviour Science, 113,* 123-138. ********doi.org/10.1016/j.applanim.2007.11.001

Appendix A

Images of the Treat & Train® treat delivery system.