ANIMAL BEHAVIORAL INTERVENTIONS: VALIDATED VERSUS "SCIENCE-BASED" PROCEDURES

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Objectives

- Describe the different research categories and identify experimental designs
- Understand how we test interventions for validity
- Identify various tested interventional studies (“validated” vs. “science based”)
- If time: Discuss what you’d like to see validated

Research study types

- **Descriptive** ← for developing interventions
- **Correlational** ← for developing interventions or developing experimental studies
- **Experimental** ← for validating interventions

Requirements for “validated” interventions

- Methods which you believe are valid!
  - Appropriate interventional design (randomization, reversals, baselines, comparisons)
  - Relevant population sampling
  - Relevant measures with validity and reliability
  - Analyses
  - IOA
  - Fidelity measures
  - Social validity
- Technological description of the intervention for replication

Single subject vs. group design

Similar

Both look to determine causal relationship between IV and DV:

- Experimental (manipulate IV)
- Controlled (try to control for extraneous variable)
- Measure the DV

Different

- Population sizes
- Opportunities for intervention modifications for individuals
- Data analyses
  - Statistics (group) vs. visual
  - Clinical significance, not statistical significance

What is validated NOW in companion animals?

- Functional analyses
- Preference assessments
- Behavior reduction protocols
- Skill acquisition protocols

ALL MOSTLY DOGS!

Paired stimulus preference assessment

Waite & Kodak, 2023

Behavior reduction protocols in dogs

Behaviors	Identified/Assumed Function(s)	Intervention Tested	Citation
Aggression to conspecifics N=4	Undetermined	**DRA:** Food delivered contingent on aggression precursor behavior on concurrent FR1 and FI 1s schedules; escape delivered contingent on aggression	Echterling-Savage et al. (2014) Savage (2011)*

Aggression to strangers
N=2
	Escape from stranger	*Compared two interventions:*
		• **Respondent counterconditioning + DRA:** Food delivered contingent on:
		  ○ Doorbell
		  ○ Door opening
		  ○ Dog engaging in attending behaviors in presence of stranger (SD)
		• **DRA:** Food delivered contingent on stationing on bed; response blocking and guided compliance were delivered contingent on moving off bed
			Savage (2010)*

Guarding (food) N=1	Escape Attention Tangibles	**Escape (DRO):** 15 s of escape delivered contingent on meeting delay fading criteria starting at 1 s **Attention (DRO):** Attention delivered contingent on the absence of behavior (DRO 0 s) **Tangible (DRA):** Food items delivered for gazing behavior and allowing experimenter to pick up bowl for 3 s	Mehrkam et al., (2020)
Guarding (object) N=4	Escape	**DRA:** Treat delivered contingent on releasing the object; caretaker continued to try and remove item contingent on guarding behavior (extinction)	Pfaller-Sadovsky et al. (2017)
Jumping N=3	Attention Tangibles	**Multiple schedule DRO:** Functional reinforcer delivered contingent on jumping absence when caretaker first walks through door, then for every 20 s interval thereafter	Dorey et al. (2012)

DRA = differential reinforcement of alternative behavior; DRO = differential reinforcement of other behavior; EXT = extinction. An * indicates the study was a thesis or dissertation and not a peer-reviewed publication.

Behavior reduction protocols in dogs

Behaviors	Identified/Assumed Function(s)	Intervention Tested	Citation
Mouthing N=3	Attention Attention Tangibles Attention	**DRA (FCT):** 15-s tug game (attention/tangible) delivered contingent on engaging in alternative behavior; mouthing put on extinction **DRI**: 15-s tug game (attention/tangible) delivered contingent on 5-s duration sit; mouthing put on extinction **Multiple schedule NCR/EXT:** Non-contingent attention provided for 60-150 s, followed by signaled extinction for 60-150 s. Used with 10-s changeover delay	Waite & Kodak, (2021)
Vocalizing (barking while alone) N=5	Undetermined	**DRO:** Food delivered contingent on absence of vocalizations (minimum 5-s interval) by automated feeder	Protopopova et al. (2016)
Leash pulling N=26	Undetermined	**Punishment:** Four different putative punishers compared: martingale collar, front-connection harness, polymer prong-style collar, and metal prong collar	Johnson & Wynne (2024a)
Retreat N=3	Escape from human	**Differential DNRA with shaping:** Aversive stimulus (human) removed contingent on acceptable alternative behaviors (eye contact, approach, remain in proximity, remain for petting, remain for leashing); retreat put on extinction	Katz & Rosales-Ruiz (2022)

DRA = differential reinforcement of alternative behavior; DRI = differential reinforcement of incompatible behavior; DRO = differential reinforcement of other behavior; EXT = extinction; NCR = noncontingent reinforcement. An * indicates the study was a thesis or dissertation and not a peer-reviewed publication.

Aggression to dogs

Echterling-Savage et al., 2014

N = 4 dog/caregiver dyads

Aggression = vocalization or lunging toward stimulus dog

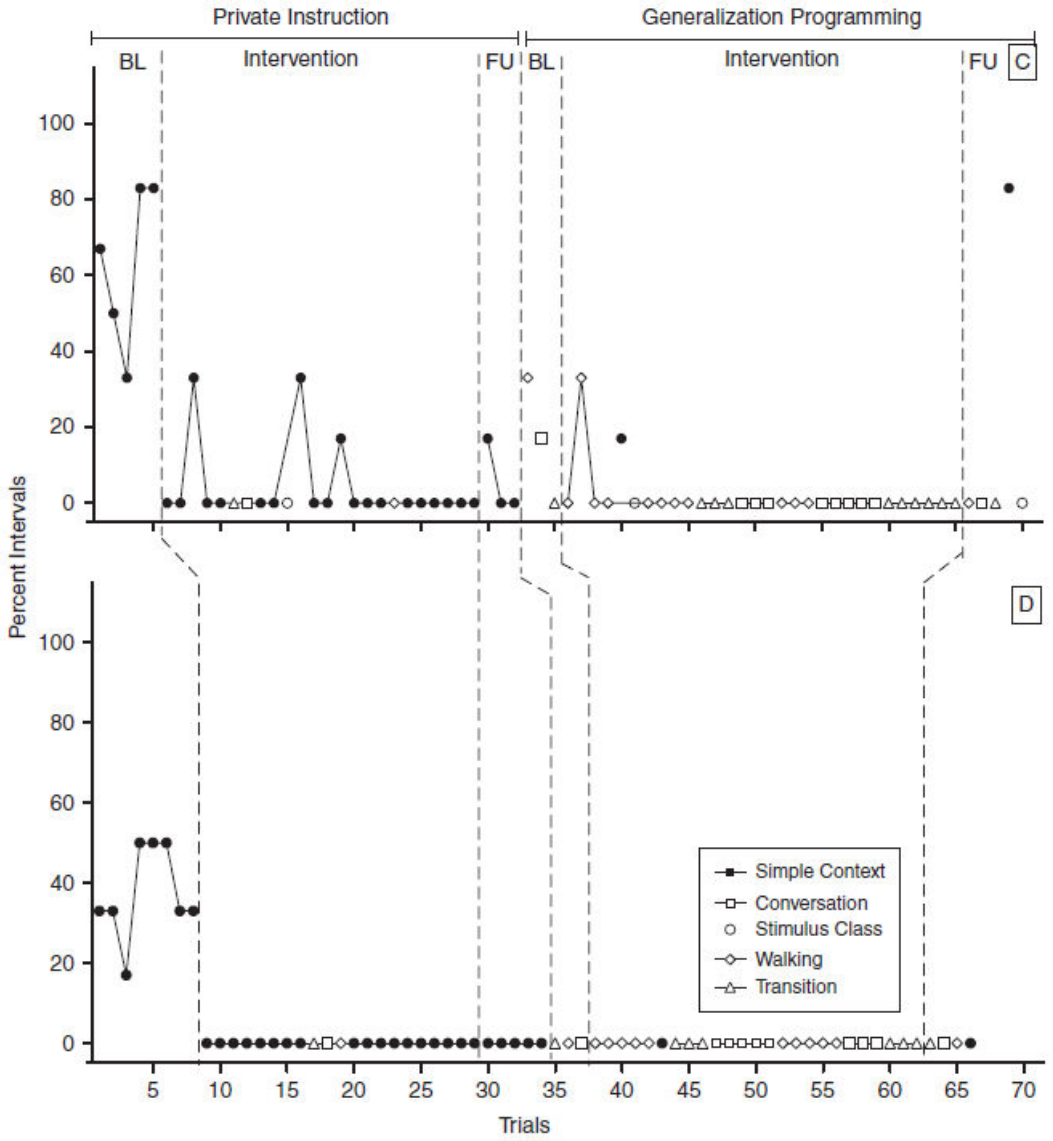
Precursor behavior = behavior immediately prior

Intervention: DRA

- "Yes" and edible within 1 s of precursor behavior, plus for every 1 s of precursor behavior. If dog looked at stimulus dog and back, delayed delivery of marker and the edible until 2 s of precursor behavior.
- Halter

Effort: 10+ hr. Feedback given in person and via email.

Fidelity: 82.9% (range = 0%–100%)



Aggression to strangers

Compared two interventions:

- **CC + Stimulus Discrimination Training:** Food delivered contingent on:
  - Doorbell → treat
  - Dog engaging in attending/orienting behaviors in presence of stranger (SD) → treat

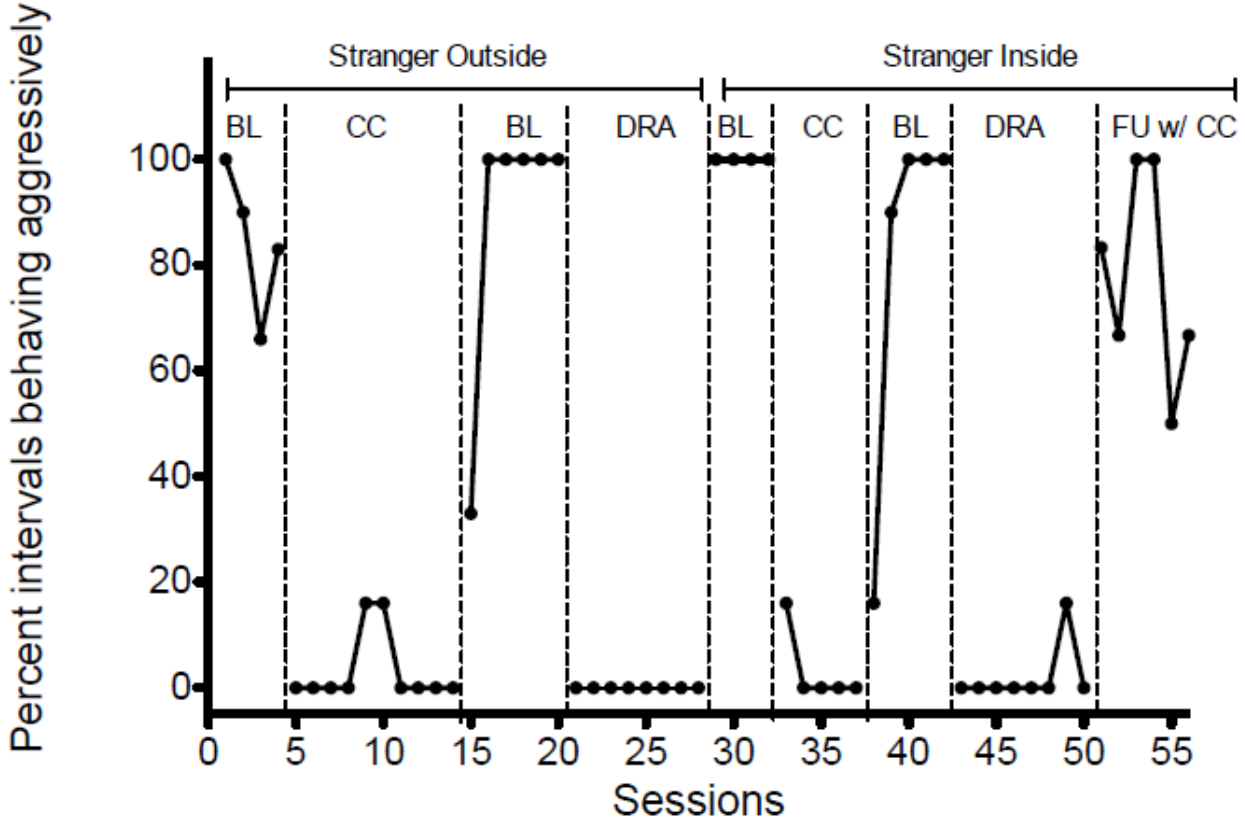
- **DRA:**
  - RFT: Food delivered contingent on stationing on bed upon presentation of stranger
  - EXT: response blocking and guided compliance contingent on moving off bed

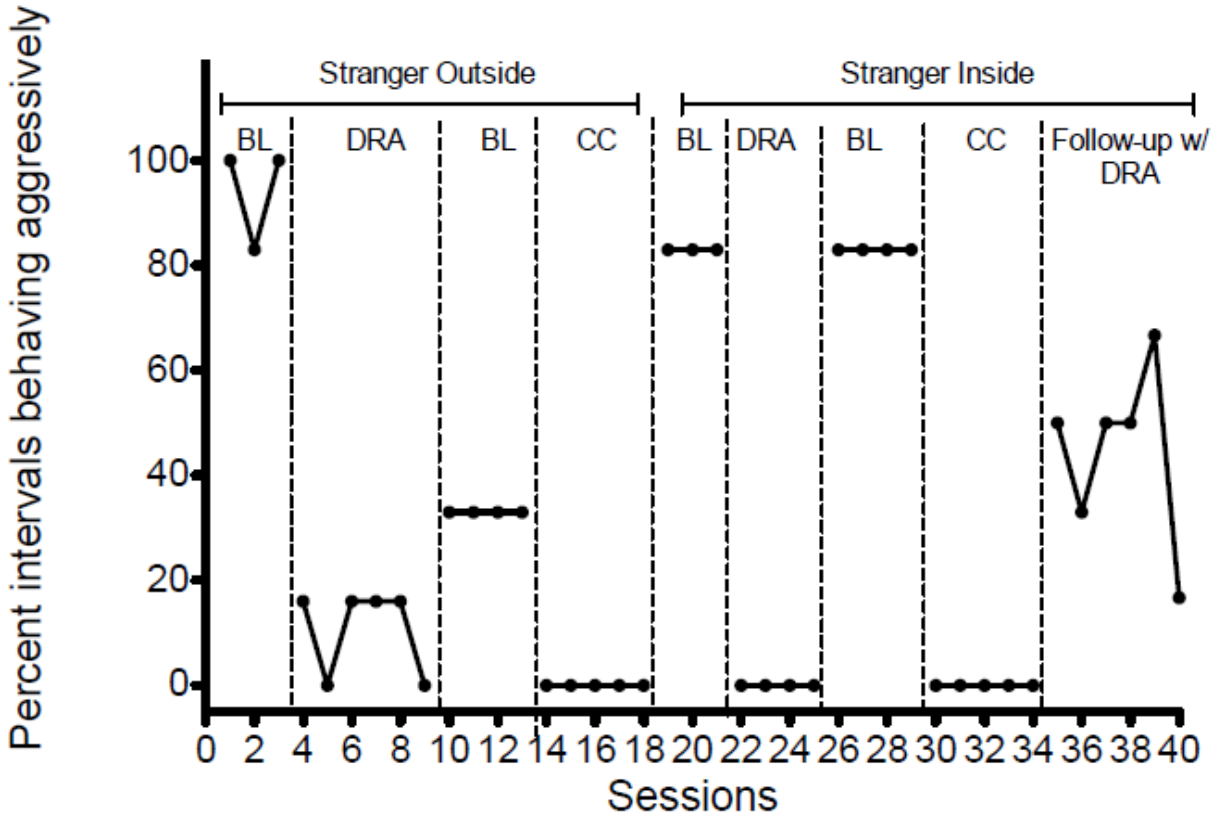
Savage, K. (2010). *A comparison of classical counterconditioning and differential reinforcement of alternative behavior on aggressive behavior in dogs*

Aggression to strangers

Follow up =

1. Owner implementing
2. At weeks 4, 6, 7, 9





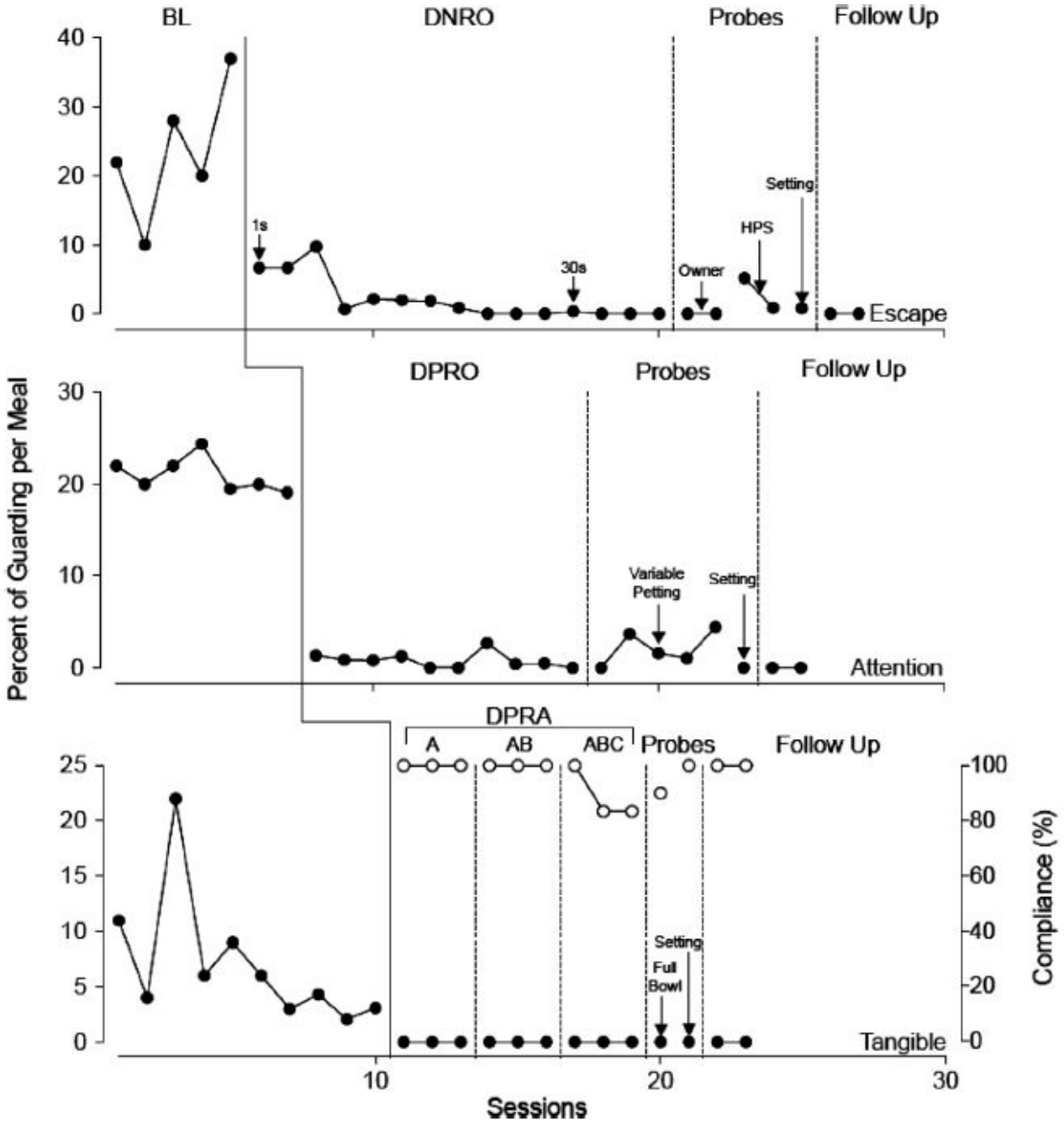
Food guarding

N = 1 dog

Escape (DRO): 15 s of escape delivered contingent on meeting delay fading criteria starting at 1 s; aggression on EXT

Attention (DRO): Continuous attention contingent on the absence of behavior (DRO 0 s); aggression on EXT

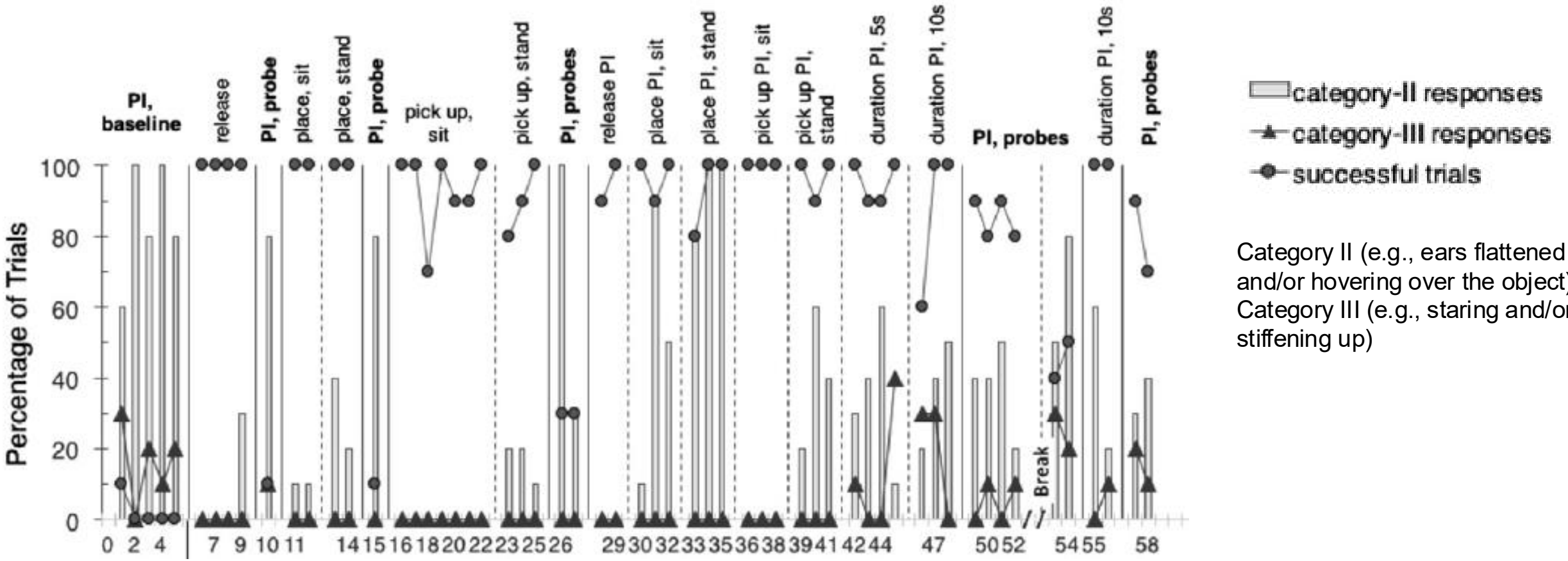
Tangible (DRA): Food items delivered for gazing behavior and allowing experimenter to pick up bowl for 3 s (within 3 s of vocal SD); aggression on EXT



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*.

Object guarding

Backward chaining for picking up neutral object and delivering **EXT** for problem behavior (item is removed from mouth)



Category II (e.g., ears flattened and/or hovering over the object)
Category III (e.g., staring and/or stiffening up)

Table 2
The backward chaining procedure comprises 5 sequentially ordered steps/conditions (i.e., task analysis), which are listed

Number of steps	Task	Description
1	Release	Opening mouth and releasing item while owner was sitting on a chair and delivering a verbal vocal cue
2	Place, sit	Taking item from the owner's hand, which was located approximately 10 cm above the floor, placing item into owner's hand, and releasing it on the height of the sitting owner's lap
3	Place, stand	Same as condition 2, only the owner was standing
4	Pick up, sit	Picking up the item from the floor, placing it into owner's hand at lap height, and releasing it while owner was sitting on a chair
5	Pick up, stand	Same as condition 4, only the owner was standing

Pfaller-Sadovsky et al., 2017

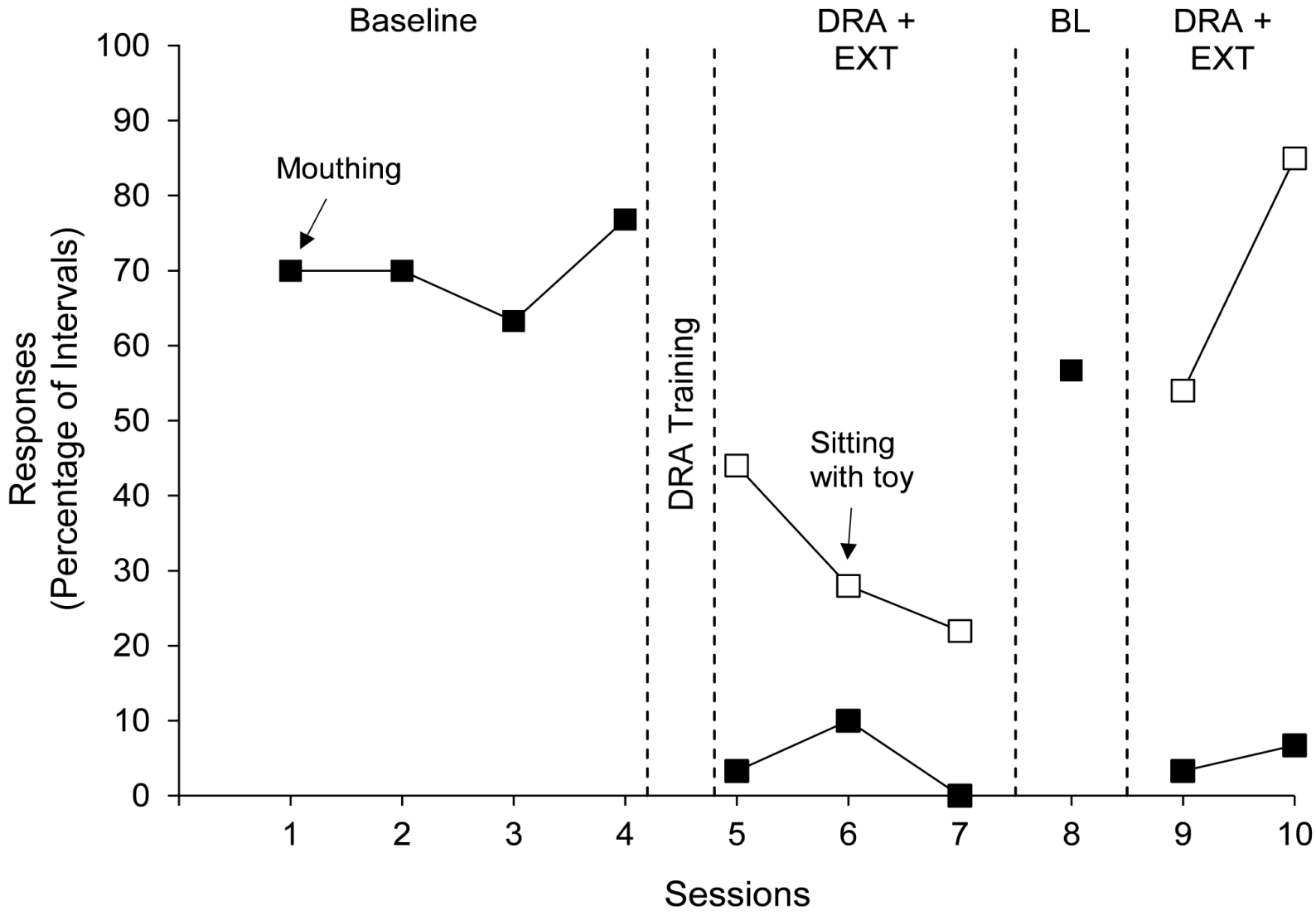
Mouthing

DRA

Alternative behavior = pick up toy and sit within 0.33 m of owner

Reinforcer = 15-s tug game

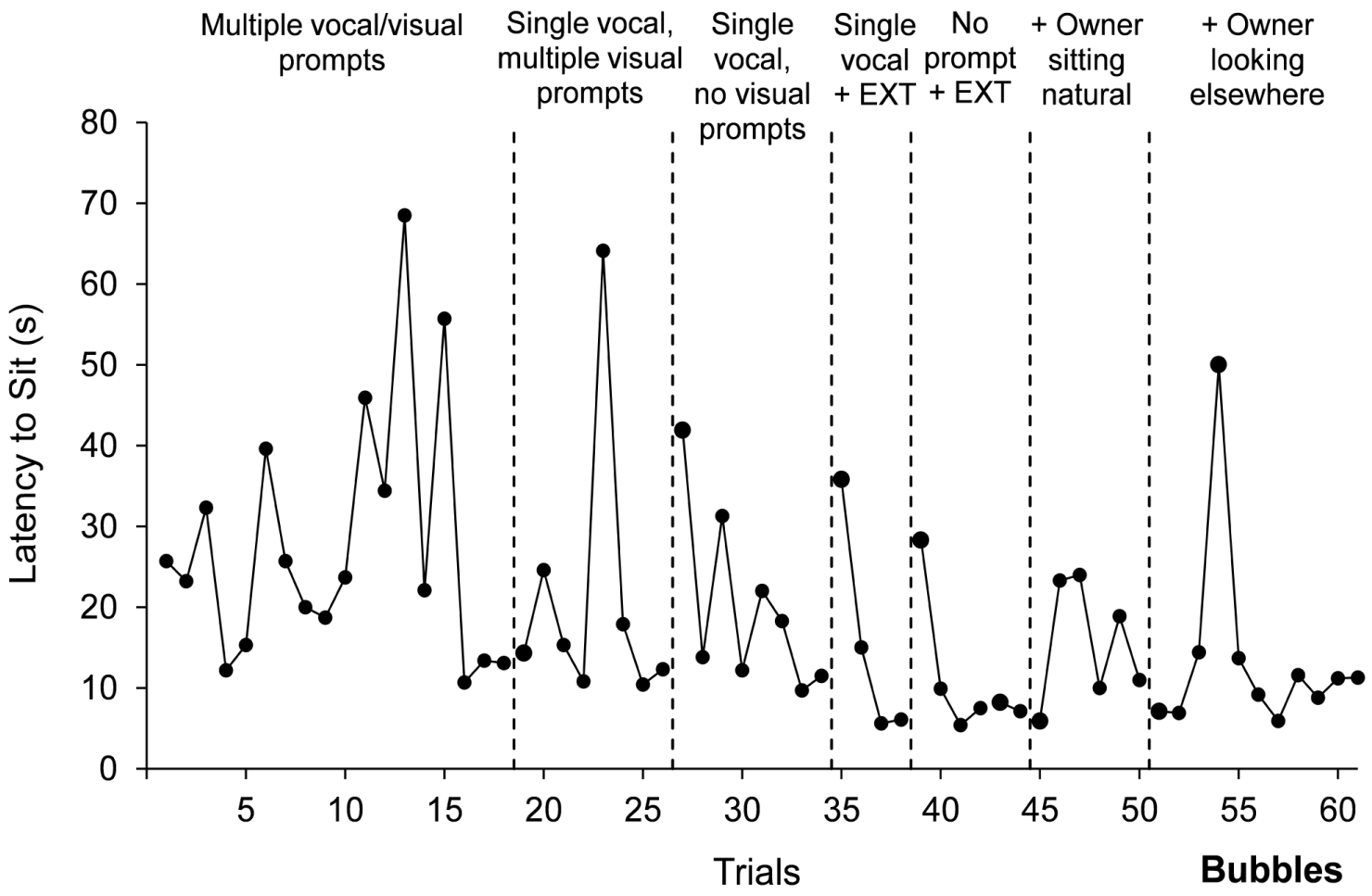
EXT = 10-s ignore



Waite & Kodak, 2021

Mouthing: Alternative behavior training

Skill acquisition: Changing criteria and prompt delay for picking up toy, bringing toy to owner, and sitting in front of owner with toy in 0.33-m radius



Waite & Kodak, 2021

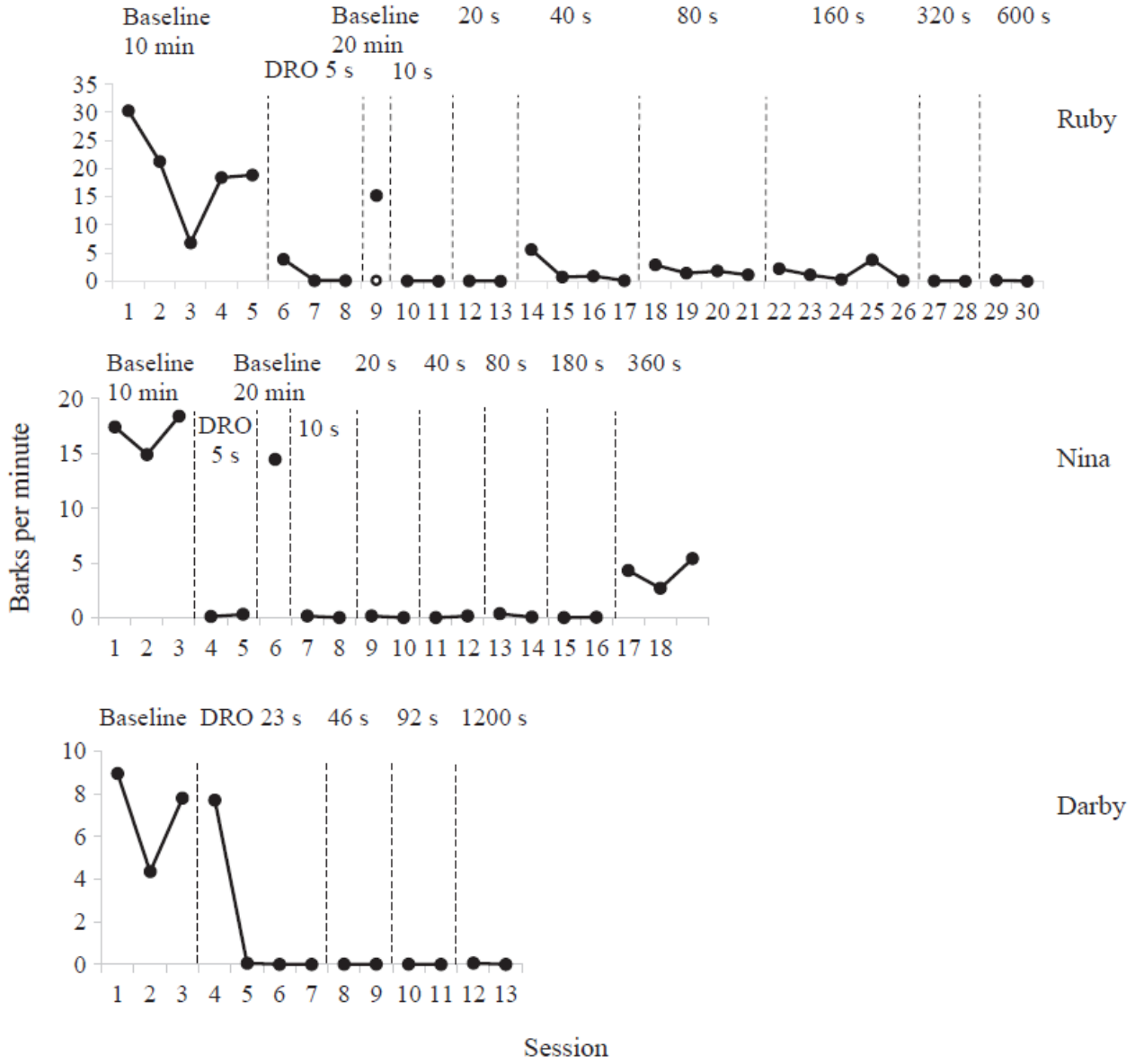
Alone barking

N = 5

DRO: Food delivered contingent on absence of vocalizations (minimum 5-s interval) by automated feeder

+

Schedule thinning



Protopopova et al., 2016

Leash pulling

N=26

Dogs went on 5 min walk with four different equipment

Measured: Pulling force and stress-associated behaviors

Figure 1 **Images of leash-walking equipment used in the study.** (A) Martingale collar, photo credit: own photo. (B) Front-connection harness, photo credit: own photo. (C) Starmark collar, photo credit: own photo. (D) Prong collar, photo credit: polymath38 *via* Wikimedia Commons.
Full-size DOI: 10.7717/peerj.18131/fig-1

Johnson & Wynne, 2024

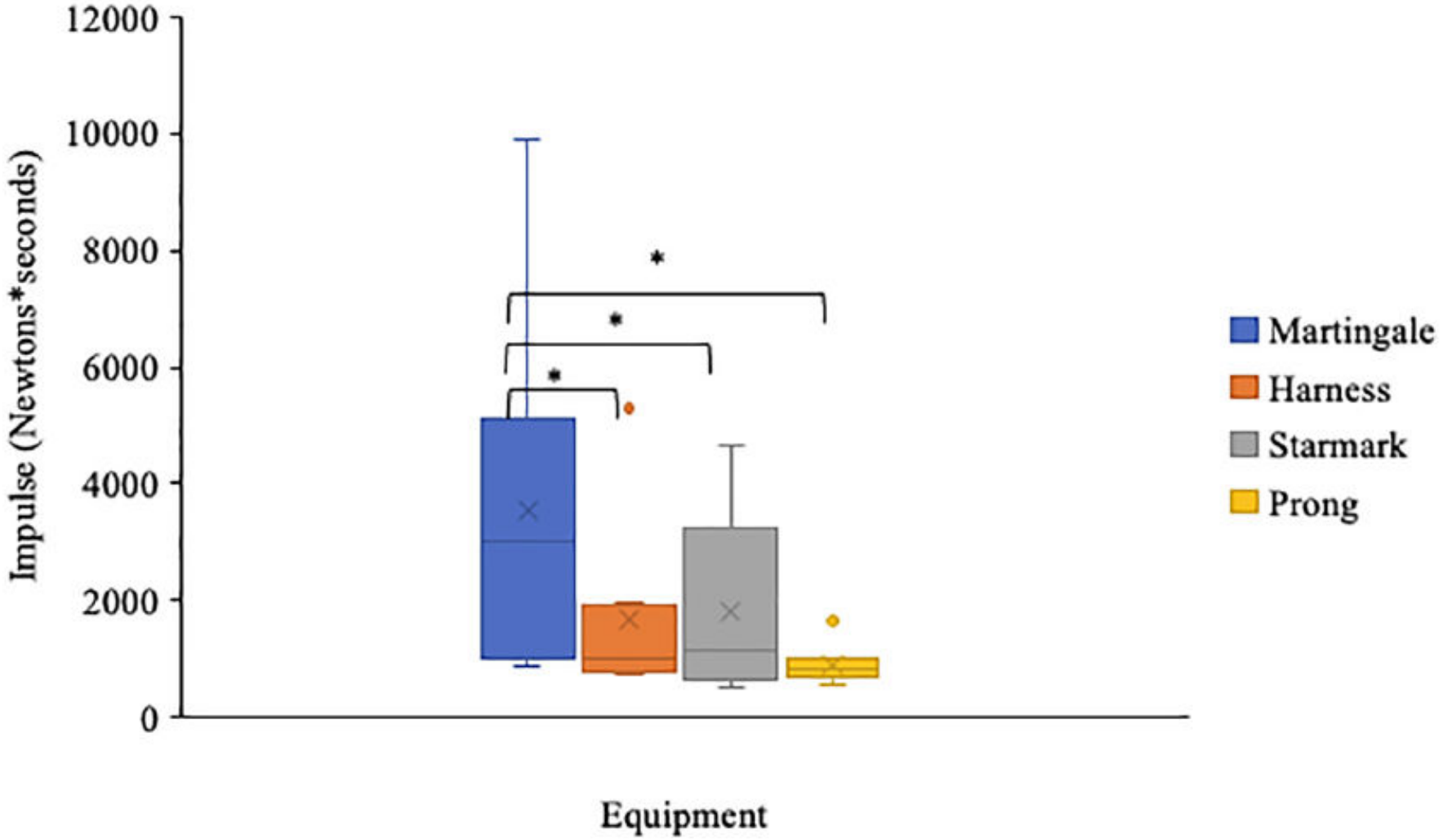
Leash pulling

Table 3 Total frequency of coded behaviors for all dogs for each 5-min walk.

Behavior	Martingale	Harness	Starmark	Prong
Whale eye	0	0	0	0
Look at handler	80	100	69	87
Bark	2	3	0	5
Yelp	0	0	0	0
Whine	2	0	0	6
Howl	2	0	0	0
Growl	1	1	0	0
Lip lick	130	185	158	179
Tucked tail	1	1	0	1
Crouched body	0	0	0	1
Yawn	1	0	0	1
Shake off	1	0	0	0
Quiver	0	0	0	0
Sniff	245	189	197	170
Balk	4	6	8	16

Johnson & Wynne, 2024

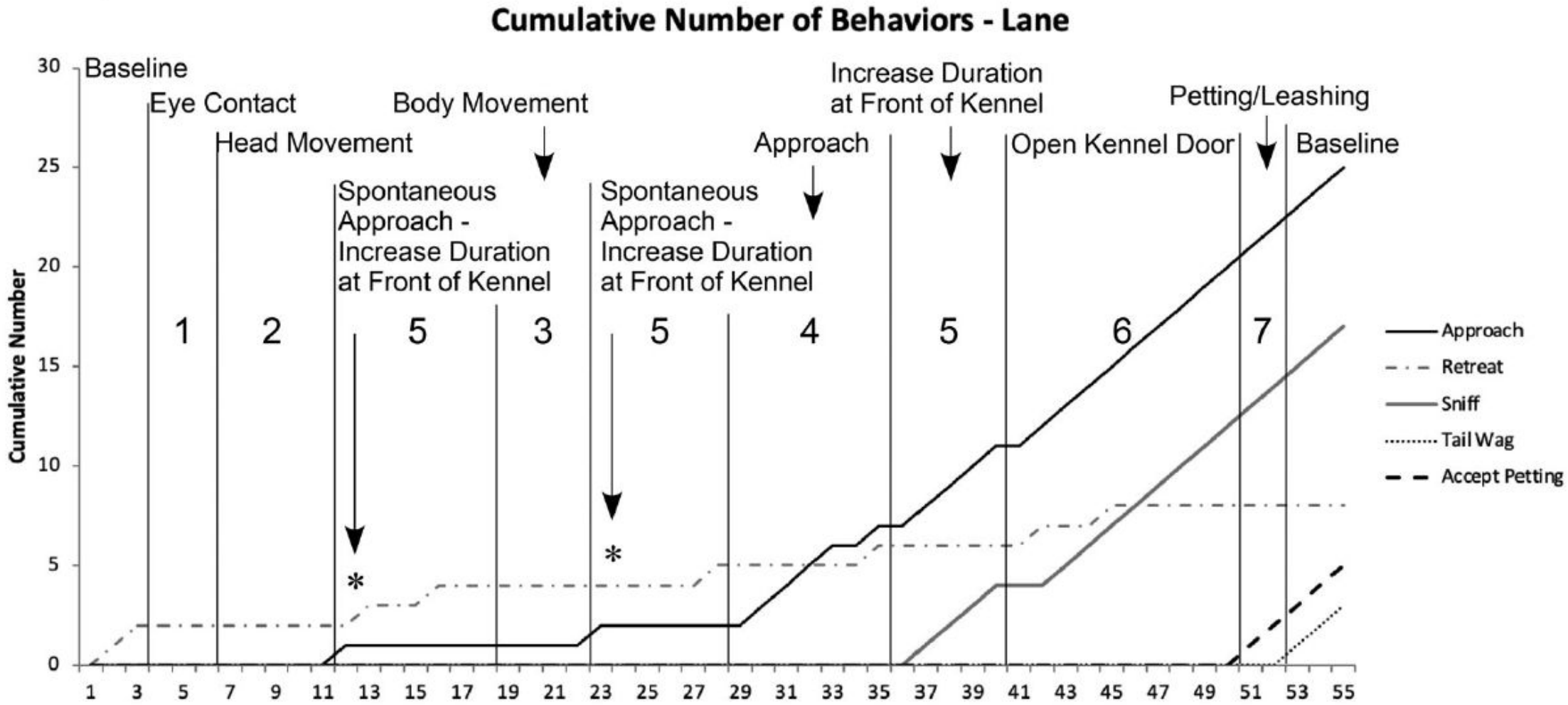
Leash pulling



Johnson & Wynne, 2024

Escape from human

Katz & Rosales-Ruiz, 2022

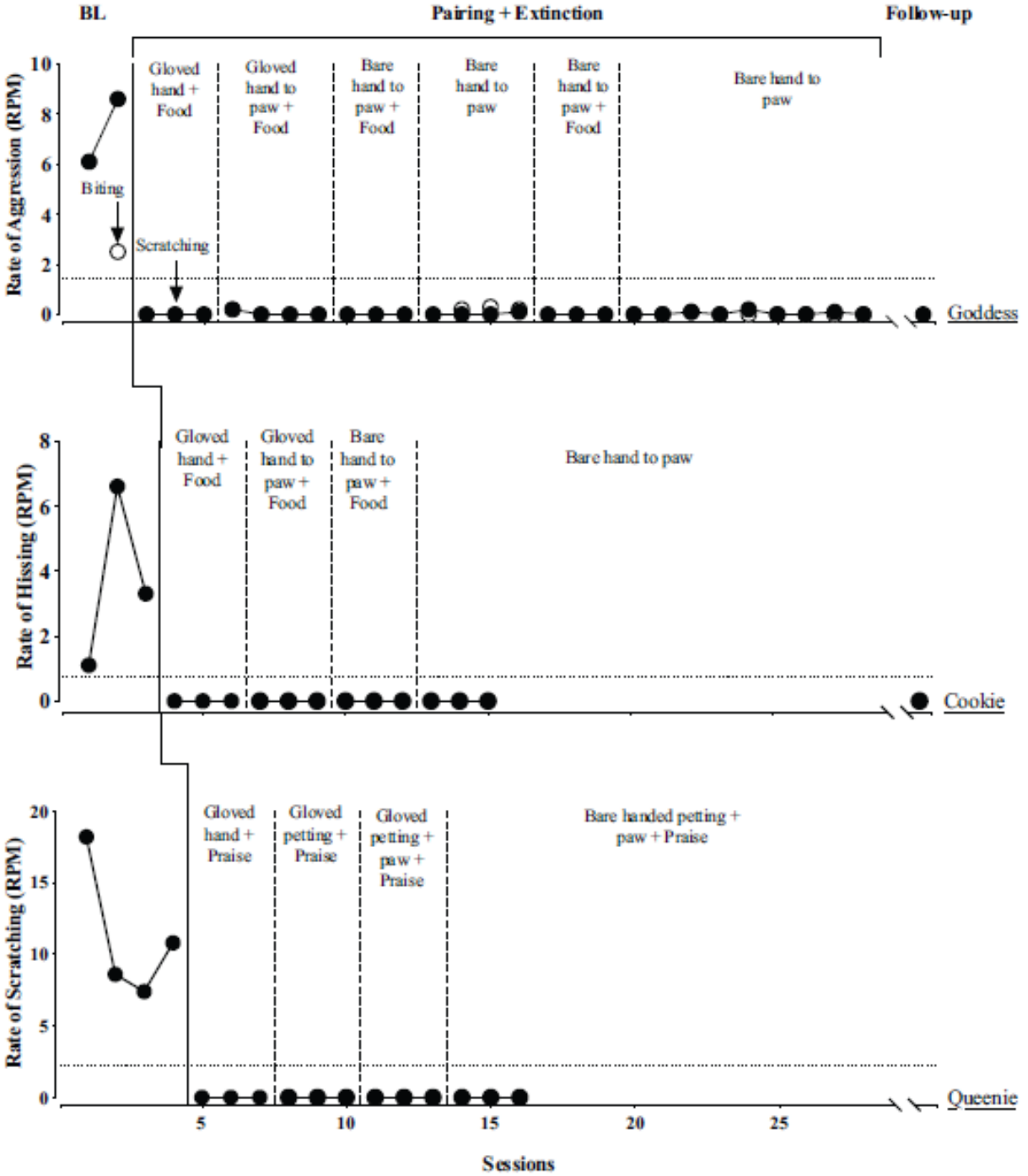


Behavior reduction protocols in cats

Behaviors	Identified/Assumed Function(s)	Intervention Tested	Citation
Aggression N=3	Escape from human physical interaction	**DRO:** 10-s escape from human attention delivered contingent on absence of aggression during petting	Fritz et al. (2022)
Aggression N=3	Escape from human physical interaction	**Respondent counterconditioning + EXT:** Graduated exposure to human physical interaction paired with noncontingent food or praise delivery; aggression put on EXT The protocol for one cat included demand fading.	Guzman (2022)*
Aggression N=3	Escape from human physical interaction	**Respondent counterconditioning + EXT:** Graduated exposure to human physical interaction paired with noncontingent food or praise delivery; aggression put on EXT	Salmeron et al. (2021)
Aggression N=4	Escape from human physical interaction	**Differential DNRA with shaping:** Aversive stimulus removed contingent on acceptable alternative behaviors (e.g., approach, blinking, grooming, stretching); undesirable behaviors put on extinction (e.g., wide eyes, hissing, piloerection, retreat)	Rentfro (2012)*

Aggression

DS/CC + EXT: Graduated exposure to human physical interaction paired with food or praise delivery; aggression put on EXT



Salmeron et al., 2021

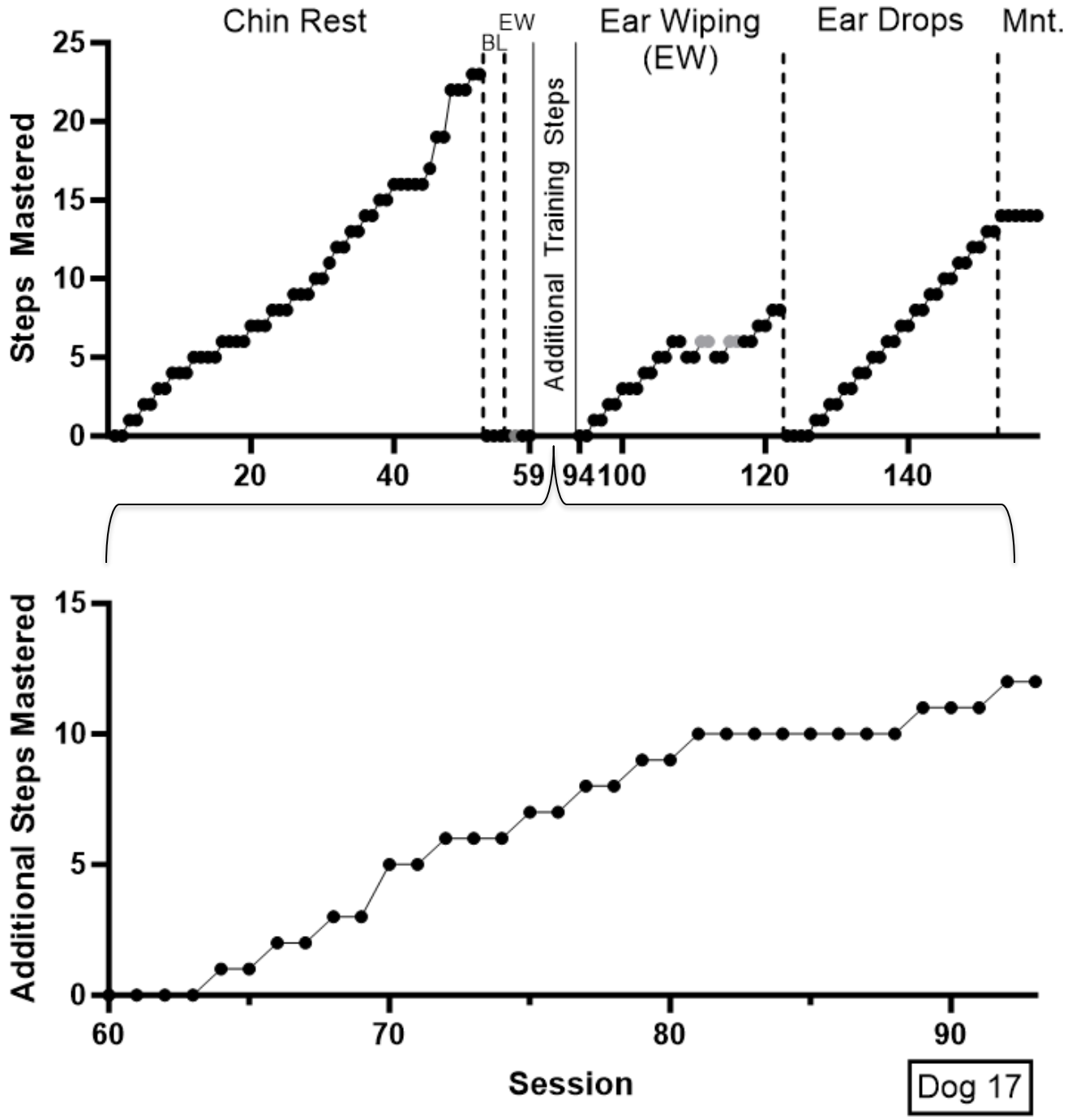
Skill acquisition protocols in dogs

Skills Trained	Skill Use	Reinforcer/Appetitive	Training Procedure	Literature
Resting chin on mat during ear cleaning N=9	Caretakers able to clean dog's ears (wipe or drops)	Edible delivered contingent on successful trial; escape delivered contingent on dissent behavior	Shaping, prompt fading, stimulus fading, desensitization, changing criterion for duration	Waite & Kodak (2025)
Sit or lie down with duration N=3	Replacement behaviors for "hyperactive" behaviors (e.g., barking, jumping, mouthing, mugging)	Attention and putative functional reinforcer (petting, food, or leashing) delivered contingent on behaviors and durations meeting changing criteria	Shaping desired behaviors (sit/down) across topographies and durations and expanding stimulus control	Owens (2017)*
Releasing an object into caretaker's hands N=4	Alternative behavior to aggression	Treats	Backwards chaining	Pfaller-Sadovsky et al. (2017)
Putting harness on and clipping N=1	Replacing escape with holding still	Edible delivered with harness stimulus presentation, non-contingent on behavior	Stimulus fading with respondent counterconditioning and extinction for escape	Salzer (2022)*
Consent/dissent (cooperative care) for body handling and increased acceptance of body handling N=40	During veterinary exam	• Treats contingent on consent responses and desired target behaviors • Escape contingent on dissent behaviors	• Operant conditioning for consent behaviors • Desensitization and operant counterconditioning for body handling acceptance	Wess et al. (2022)

Ear cleaning

Waite, Kodak, & Whang (2025)

Ear cleaning

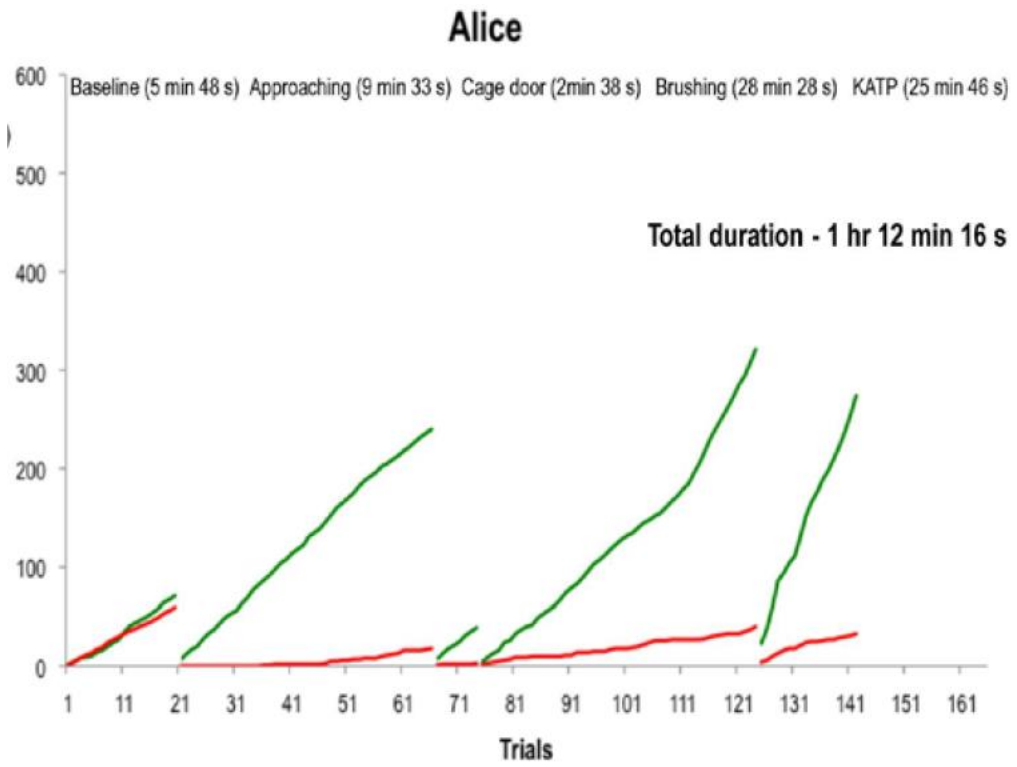


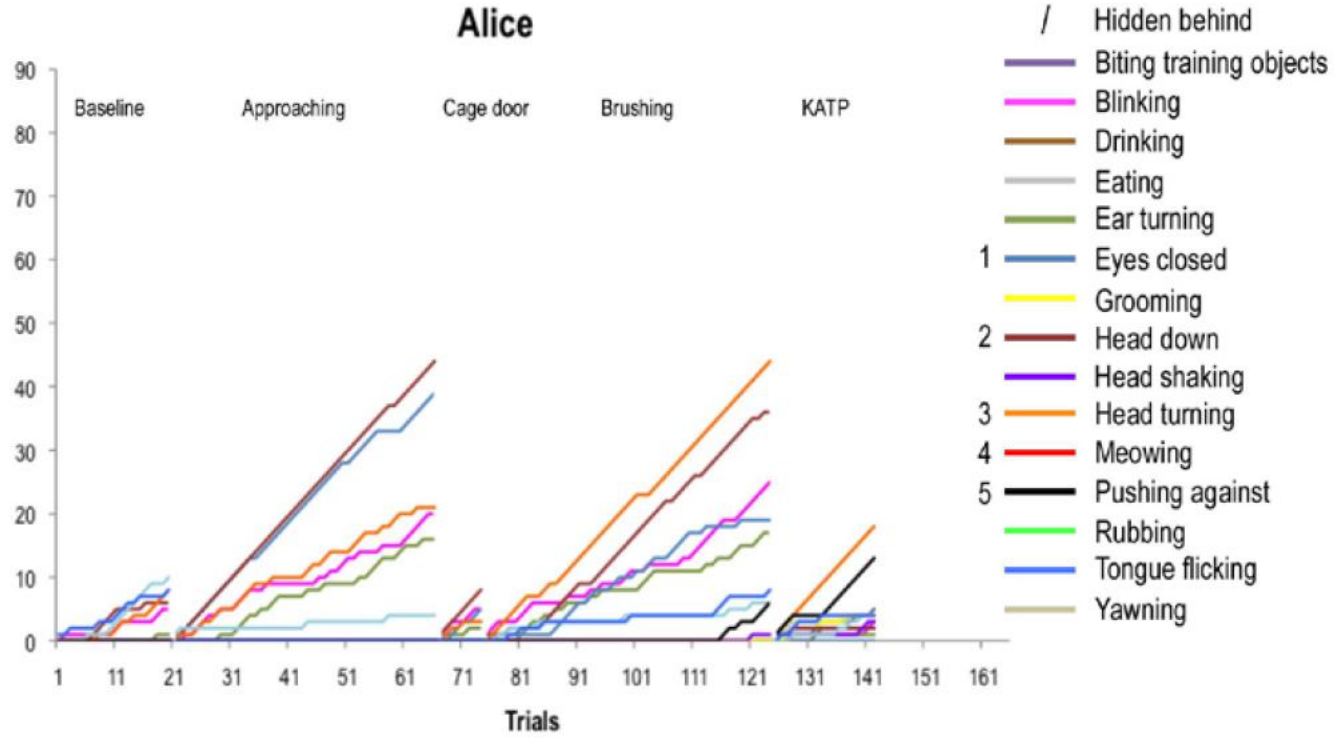
Waite, Kodak, & Whang (2025)

Skill acquisition protocols in cats

Skills Trained	Skill Use	Reinforcer/Appetitive	Training Procedure	Literature
Taking 10 breaths from medical inhaler N=1	For veterinary medical procedures (inhaler use)	Food	• Shaping • Stimulus discrimination training • Counterconditioning (food was paired with medication scent)	Kranak & Kranak (2025)
Increasing behaviors other than aggression N=4	Alternative behaviors to aggression	Escape contingent on alternative behaviors meeting changing criteria	Shaping desired behaviors within and across topographies	Rentfro (2012)*

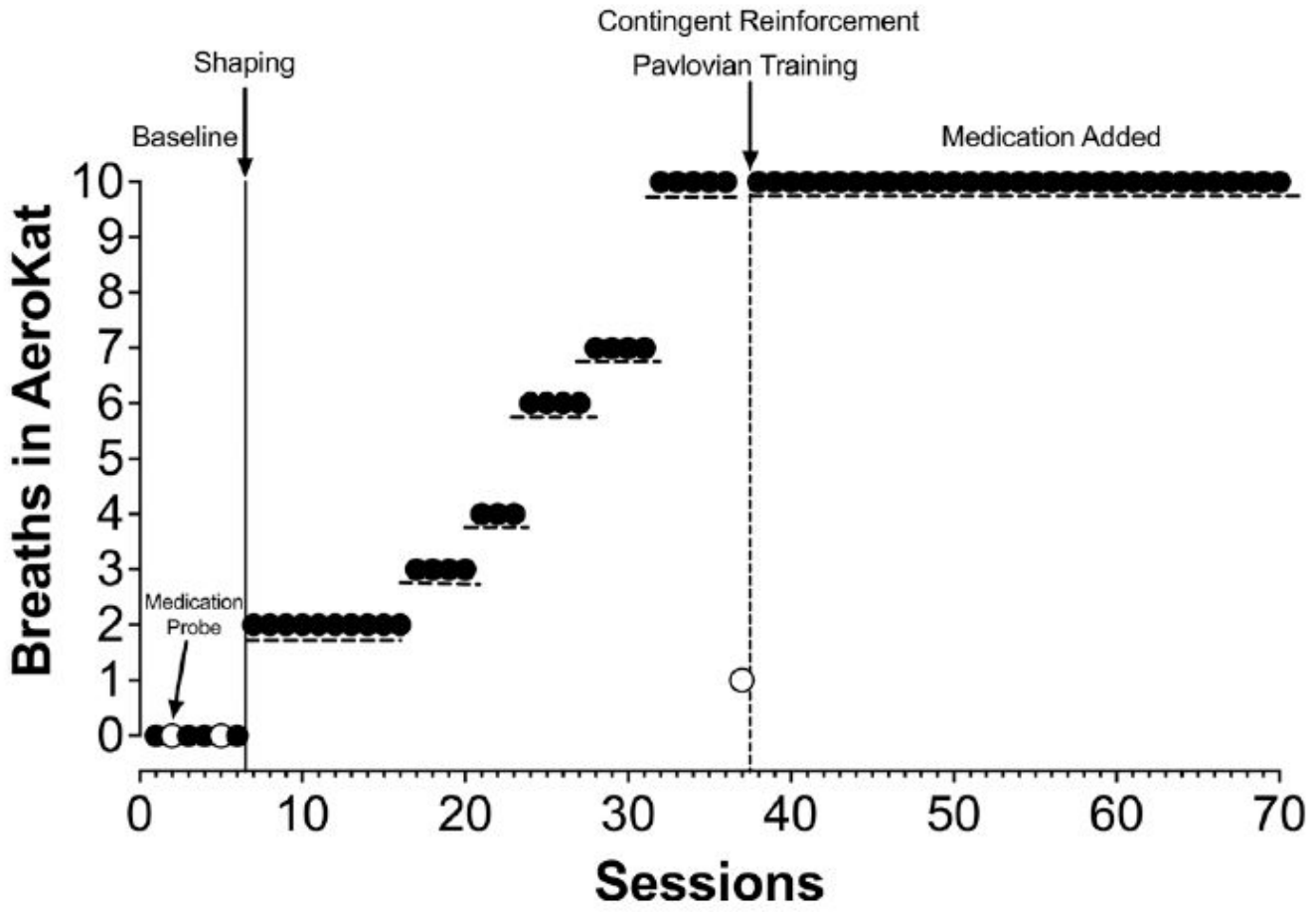
Social behaviors





Rentfro, 2012

Breathing from medical inhaler



Kranak & Kranak, 2025

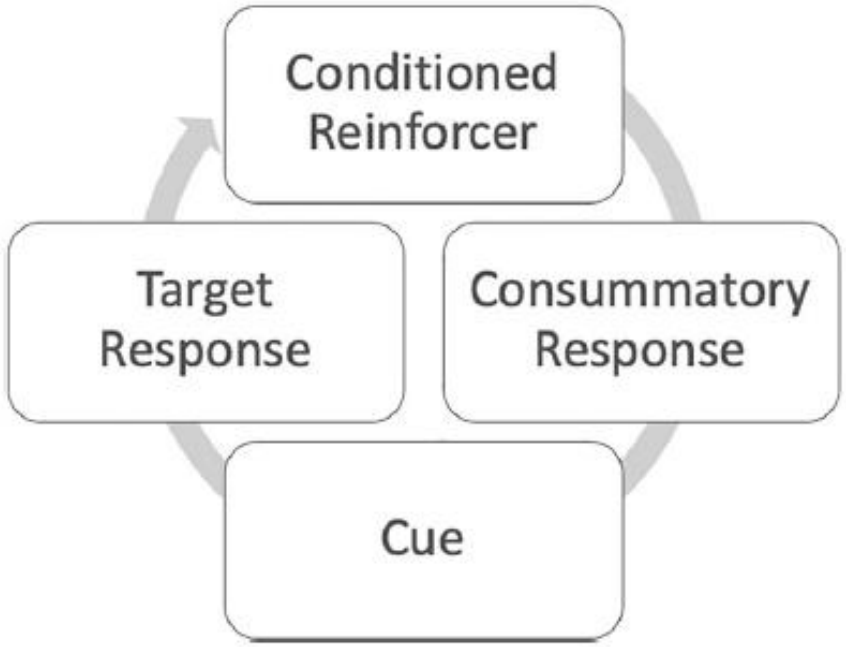
Literature on markers/clickers

- Markers typically function as SD; therefore, click = treat (Kalafut, 2024; Peiris & Rosales-Ruiz, 2022)
- Clickers vs. auditory marker vs. “no marker”

*Although see Lazarowski, 2025

Figure 1

Diagram of Loopy Training



Kurland & St. Peter, 2022

The click is not the trick: the efficacy of clickers and other reinforcement methods in training naïve dogs to perform new tasks

Rachel J. Gilchrist, Lisa M. Gunter, Samantha F. Anderson and Clive D.L. Wynne

Department of Psychology, Arizona State University, Tempe, AZ, USA

Results: You do you.

Sit duration

Distance cone touch

Touch blocks in order

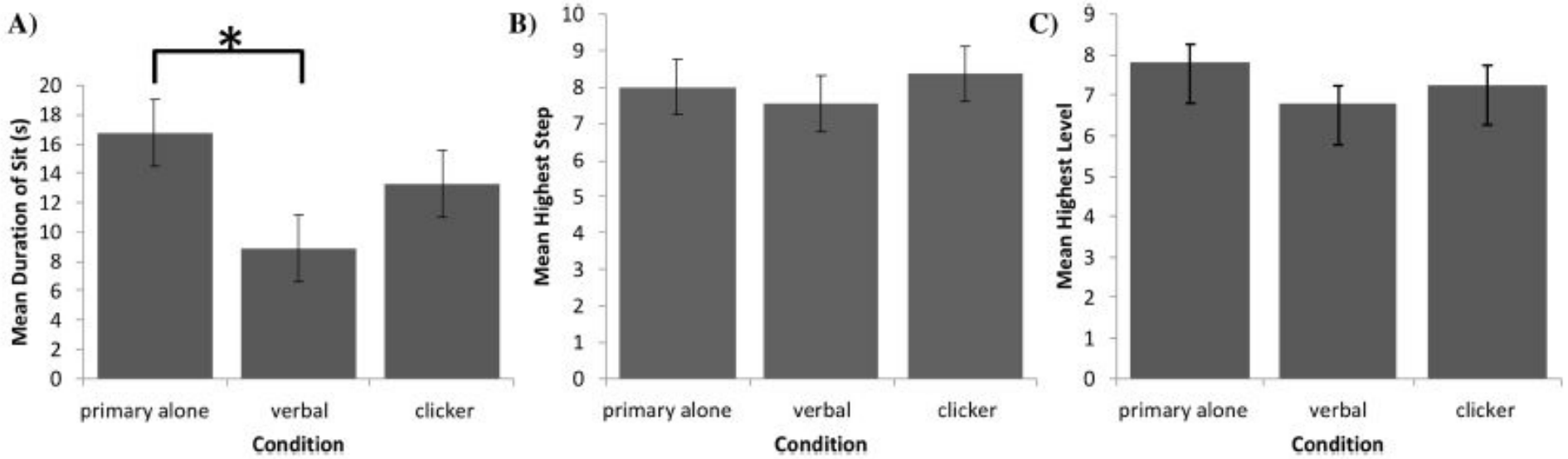


Figure 3 **Task performance in Experiments 1, 2, and 3.** (A) Mean duration of a sit (with error bars depicting standard error of the mean) in seconds for each group of dogs in Experiment 1. Bracket with asterisk between groups indicates a significant difference in means on post-hoc pairwise comparisons ($p < 0.05$). (B) Mean highest completed step (with error bars depicting standard error of the mean) for each group of dogs in Experiment 2. (C) Mean highest completed level (with error bars depicting standard errors of the mean) for each group of dogs in Experiment 3.

Full-size DOI: 10.7717/peerj.10881/fig-3

What if the procedure I want to use isn't validated? How can I be "science-based"?

Problem: Practice is leading the science

Aim: To be able to defend your choices to a jury of your peers with more than just "experience"

Requires knowledge of:

- Intervention efficacy vs. other interventions in any species
- Knowledge of research on ethics or other considerations (e.g., aversive stimulus side effects)

You may need to extrapolate

- Read similar protocol in other species (including humans!), other setting, other behavior
- Determine whether you think the intervention was efficacious
- Determine whether the intervention can be modified into your species/setting/behavior of interest
- Can connect with the author to chat more about re-application or pitfalls
- Apply it. But take data, including baseline data

Protocols I’d like to see studied

- Chirag Patel alternate mat
- Pattern games
  - Crate training
  - Rotating mats
- Karen Overall - Mat relaxation
- Look at That
- Laura Monaco Torelli – reinforce the “no”
- Harder cooperative care protocols

What studies would you like to see?

Thank you

For Questions:

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