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An Experimental Arrangement to Study Spatial Dynamics of Behavior in Domestic Dogs under Pavlovian Contingencies: A Proof of Concept

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Introduction

- In Pavlovian contingencies, the pairing of at least two stimuli presented independently of the organism's activity is programmed: an initially neutral stimulus (NS) and another stimulus (unconditioned stimulus or US) that systematically elicits an unconditioned response (UR). After pairing, the EN (now conditioned stimulus or CS) begins to elicit a response similar to the UR (conditioned response or CR).
- It has been reported that, in dogs with free locomotion exposed to this type of contingencies, CR is conformed by the organization of the animal's spatial behavior -e.g. orientation and displacement towards the source of stimulation- (Jenkins et al., 1978; Kupalov, 1969; 1983).
- Most studies using dogs as experimental subjects (Jenkins et al., 1978; Kupalov, 1969; 1983; Stepien, 1974; Wasserman, 1978; Zener, 1937, among others) have not systematically recorded locomotion and the emergence of moment-to-moment orientation patterns.
- The systematic recording of moment-to-moment locomotion and orientation patterns enables the analysis of the spatial dynamics of behavior and emphasizes the continuous character of organism-environment interaction (León et al., 2021). Likewise, it allows the visualization of spatio-temporal variables integrated in the behavioral organization, which remain hidden due to the standard forms of recording.

Objective

Analyze the spatial organization of behavior in a domestic dog with free locomotion in the establishment and extinction of a Pavlovian tone-food contingency.

Method

Design

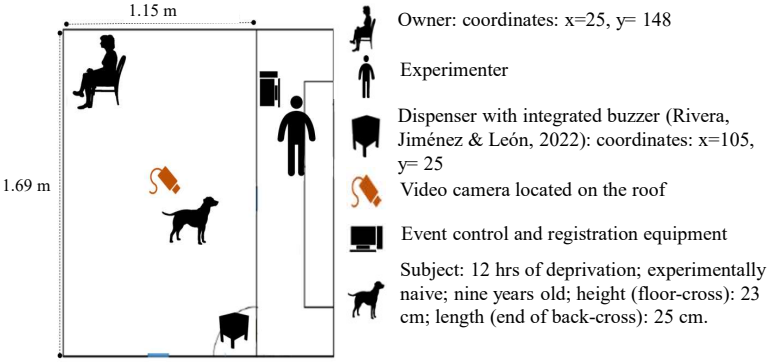
Phases			
B	A	B	A

Note: **B** = Trace pairing (0.5 sec): 10 daily sessions with 16 trials each; **A** = Extinction (CS only): 10 sessions with 16 trials each.

Procedure

- **CS** = Three-second tone (23 kHz; 75 db).
- **UC** = Meal (one kibble per delivery).
- Fixed Time 60 seconds (FT60s).
- Each session lasted 16 minutes and 55 seconds.
- Event programming was made using Visual Basic® language software developed in Visual Studio® 2015 (Díaz et al., 2022).

Apparatus and experimental situation



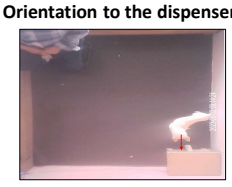
Data recording and analysis

Recording:
Organism x and y coordinates were recorded at each session (center of mass, 10 fps) with Ethovision Software (ver. 14). Orientation patterns were recorded with Behavioral Observation Research Interactive Software [BORIS] (see 8.13).

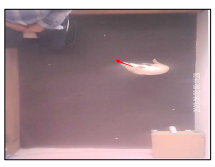
Measures:
- Displacement routes.
- Distance to relevant zones.
- Location entropy.
- Dispenser orientations, owner and non-specific (duration and probability of each type of orientation in the presence of tone).

Analysis and representation: Motus software, Jamovi (open statistical software) and Microsoft Excel.

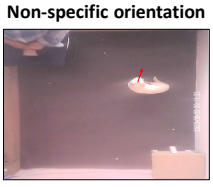
Orientation to the dispenser



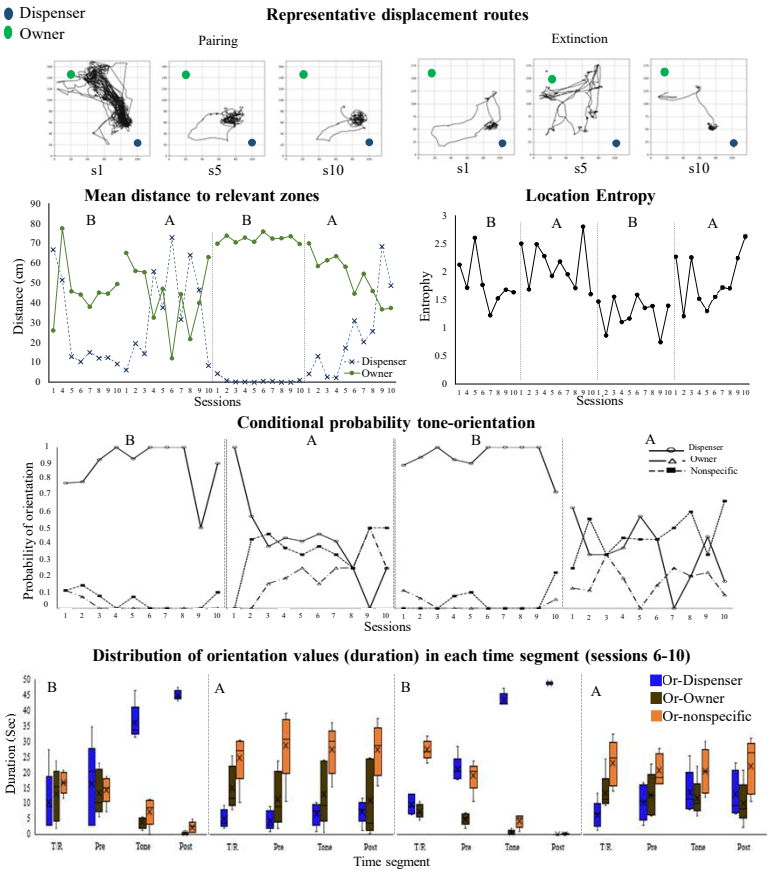
Orientation to the owner



Non-specific orientation



Results



Summary of results and discusion

- The analysis of orientations and locomotion patterns moment by moment allowed us to observe the establishment of different organism-environment organizations.
- In pairing, the displacement routes were more narrow and concentrated in areas close to the dispenser, which is congruent with the mean distance to relevant areas. Also, the tendency of the organism to orient more to the dispenser in the presence of the tone and in the post-tone segment was observed, with a gradual decrease in the other types of orientation as the post-tone segment was approached. The probability of orientation to the dispenser in the presence of the tone was considerably higher in the pairing phases compared to the extinction phases.
- In extinction, the displacement routes were distributed in a less restricted manner, with a higher concentration in areas close to the owner and with lower values of mean distance to the owner. The established orientation pattern was drastically altered with a more homogeneous distribution of orientation patterns as a function of time segment. Finally, location entropy values were higher in extinction compared to pairing phases.
- The results obtained are in agreement with previous findings on dogs regarding the spatial differentiality supported by an CS-US correlation (Kupalov, 1969; 1983; Jenkins et al., 1978), as well as the variation of behavioral patterns in extinction (Zener, 1937). However, they make possible the extension of the conclusions insofar as the establishment of a temporal differentiation of the orientation patterns in each segment (T/R, pre, tone and post) could be observed from the same CS-US correlation.
- The present pilot study shows the relevance of including the continuous recording of behavior in Pavlovian contingencies, since it allows the quantification of variables that were previously only mentioned descriptively, enables the inclusion of robust measures that account for behavioral change (e.g. distance, entropy, among others) and facilitates the identification and systematic representation of aspects of the phenomenon commonly ignored in the field, such as behavioral variability and the temporal organization of orientation patterns. The promising findings of the work make feasible the implementation of a study with a larger number of subjects and the inclusion of other types of variables (e.g., changes in the values of the CS-US correlation).

References:

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