Cue duration affects response rate in a human associative learning task

Jeffrey Lamoureux[1], Andrew Fabiano[1], and J. Byron Nelson[2]

Boston College[1]; University of the Basque Country[2]

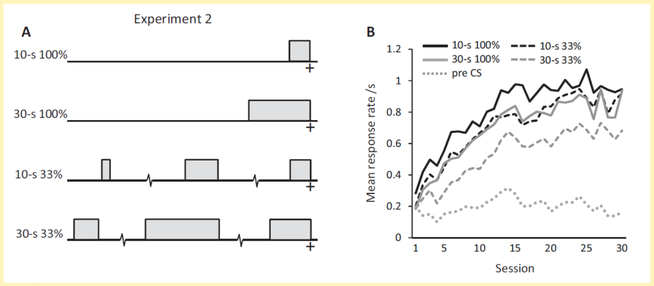
eman ta zabal zazu

Universidad del País Vasco

Euskal Herriko Unibertsitatea

Introduction

- Theories of conditioning make different predictions about what variables have the greatest effects on the rate of learning.
  - Many classic *associative theories* (e.g., the Rescorla-Wagner model) predict that the ***number of CS-US pairings*** correlates best with responding.
  - In contrast, *rate estimation models* (e.g., Gallistel & Gibbon, 2000) suggest that learning is driven by the ***cumulative time during the CS per reinforcement***.
- Bouton & Sunsay (2003) found that US probability – as determined by training trials - better predicted response rates in rats.
- Conversely, Harris, et al. (2015) recently found that conditioned responding correlated much better with cumulative CS time than number of training trials using a within-subjects procedure.



Experimental Aim

- Explore whether CS duration affects response rate in humans playing a videogame task designed to mimic nonhuman appetitive conditioning paradigms.
  - CS duration is manipulated within-subjects, as in Harris, et al. (2015).

Experimental Methods & Design

Participants: 64 students from Boston College, ages ranging from 18 to 22 years.

Method:

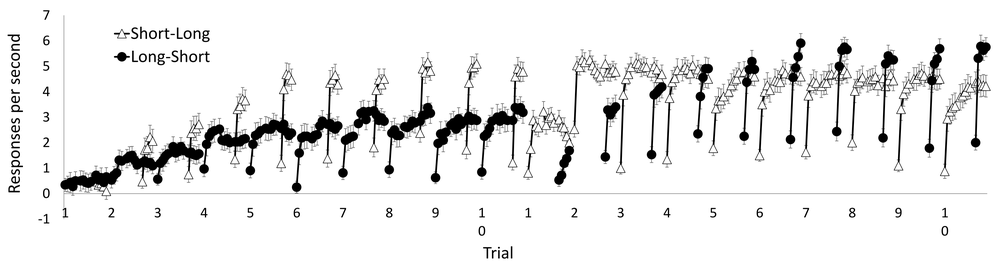
- science fiction-themed video game employing a simulated fight against an enemy spaceship
- response = conditioned key pressing
- CSs = colored sensors
- USs = invading enemy ships
- contexts = background galaxies

Experimental Design:

- Two, consecutive CS-US training phases with CSs differing in both color and duration

Group	Phase 1 (10 trials)	Phase 2 (10 trials)
Short–Long	5s CS1 | 10s CS1+US1	15s CS2 | 10s CS2+US2
Long–Short	15s CS1 | 10s CS1+US1	5s CS2 | 10s CS2+US2

Results



- No main effect of CS Duration, $F(1,62) = 1.378$, *ns*.
- Significant Duration x Training Order interaction, $F(1,62) = 74.868$, $p < 0.0001$.
- Significant Duration x Order x Trials interaction, $F(9, 558) = 4.880$, $p < 0.0001$.

Summary & Future Directions

- Although responding to the shorter duration CS was numerically greater than to the longer CS – as predicted by rate estimation models – this effect was nonsignificant.
- We believe the significant interactions between Duration and Training Order (and Trials) are best described as a ***learning-to-learn*** effect.
  - The group first trained with the short CS also exhibited high levels of responding to the secondly-trained, longer CS.
  - The group receiving the opposite training order exhibited only modest responding to the long CS in Phase 1, but typically high responding to the short CS in Phase 2.
- Future experiments will examine responding to CSs of different durations intermixed within one training phase, as well as introducing variability in CS duration for both long and short CSs so that participants cannot time the occurrence of the US.

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