The Role of Pre-Feeding on Temporal Discrimination: An Analysis With Signal Detection

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2004
New Orleans 2018
59TH ANNUAL MEETING PSYCHONOMIC SOCIETY®
PSYCHONOMIC SOCIETY®

Introduction

Timing involves that organisms conduct their behavior through discrimination of temporal intervals. Empirical research suggests a relationship between timing and motivational variables (Akdoğan & Balcı, 2016; Galtress & Kirkpatrick, 2010; Roberts, 1981; Ward & Odum, 2006).

This research used a temporal bisection task to identify whether pre-feeding alters interval timing processes. Besides, we assessed a new pair of duration (0.5” – 2.0”) in nonhuman organisms to investigate the boundaries of interval timing in a temporal bisection task.

Objective

The aim of this research was to investigate whether there are changes in the discrimination of interval timing after manipulating pre-feeding in four different types of discrimination (four pairs of durations) in a temporal bisection task.

Method

Subjects: Twelve male Wistar rats were maintained at 80% of their individual free-feeding weights. They were on an inverted 12:12 h light: dark cycle. Rats were randomly assigned to four groups.

Apparatus: Eight operant conditioning chambers (Med PC Associates). Experimental events were controlled and responses were recorded using a personal computer Pentium II operating with Med-PC software (Med Associates, St. Albans, VT).

Procedure:

Training or discrimination phase. Rats were trained in a temporal bisection task. There were four pairs of durations (0.5"-2.0", 1.0"- 4.0", 2.0"- 8.0“, and 3.0"- 12.0") for discrimination phase. Rats should have performed equally or above of 80% of correct responses during three days, or equally or above of 75% of correct responses during five days to pass to generalization phase.

Generalization phase. There were five intermediate durations among short and long durations, none of these intermediate durations were reinforced. There were eighty trials per session.

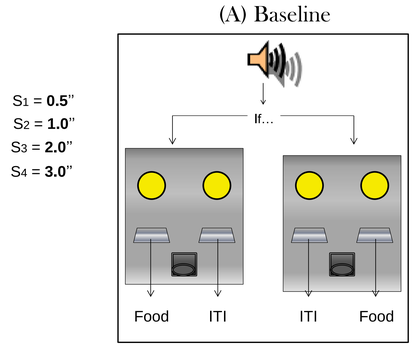
Baseline phase. Each rat performed ten sessions (two blocks of five sessions) in generalization phase, where rats got a pellet for each correct response in discrimination trials, either short or long duration.

Pre-feeding phase. The procedure was the same as in baseline with the only difference that rats received 12 grams of food before each experimental session, around 30 minutes before the experiment started.

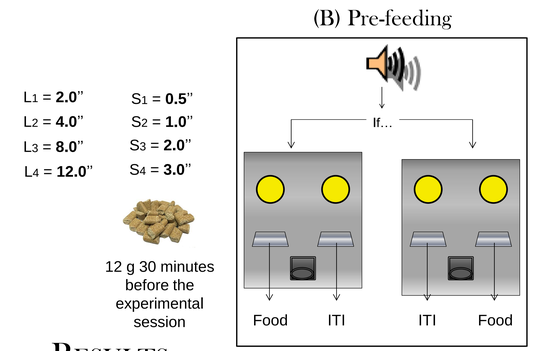
Table 1: training and generalization durations.

		Short duration		Long duration
	N	Intermediate signal duration		
Group 1	3	0.5”	0.63”, 0.80”, **1.01**”, 1.28”, 1.60”	2.0”
Group 2	3	1.0”	1.25”, 1.58”, **2.00**”, 2.54”, 3.20”	4.0”
Group 3	3	2.0”	2.52”, 3.17”, **4.00**”, 5.04”, 6.35”	8.0”
Group 4	3	3.0”	3.78”, 4.76”, **6.00**”, 7.56”, 9.52”	12.0”

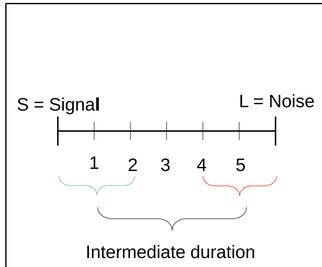
(A) Baseline



(B) Pre-feeding



(C) Signal Detection Theory Design



	Signal (Short duration)	Noise (Long duration)
Response in lever associated with short duration	Hit: Short response in short trials	False alarm: Short response in long trials
Response in lever associated with long duration	Miss: Long response in short trials	Correct rejection: Long response in long trials

Results

Table 2: training sessions

Group	Condition	Subject	Sessions	Group	Condition	Subject	Sessions	Group	Condition	Subject	Sessions	Group	Condition	Subject	Sessions
1	**0.5”-2.0”**	01	15	**2**	**1.0”-4.0”**	77	21	**3**	**2.0”-8.0”**	04	64	**4**	**3.0”-12.0”**	06	77
1	**0.5”-2.0”**	02	20	**2**	**1.0”-4.0”**	13	62	**3**	**2.0”-8.0”**	05	61	**4**	**3.0”-12.0”**	07	85
1	**0.5”-2.0”**	03	22	**2**	**1.0”-4.0”**	14	48	**3**	**2.0”-8.0”**	88	34	**4**	**3.0”-12.0”**	08	113

Psychophysical Functions

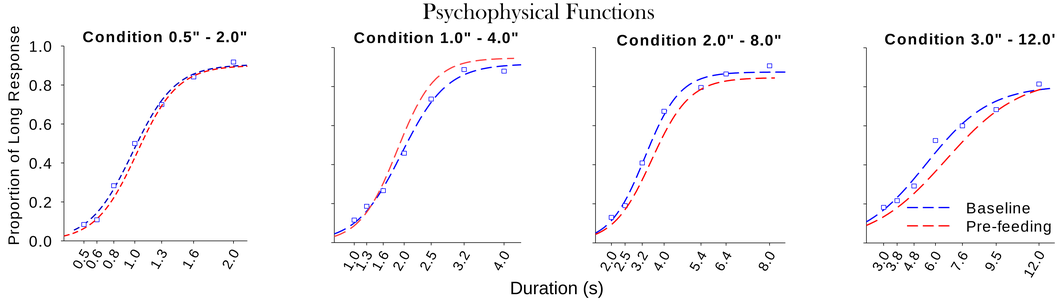


Figure 1. **Psychophysical functions.** The figure depicts the psychophysical functions for all the conditions: 0.5” - 2.0”, 1.0”-4.0”, 2.0”- 8.0”, and 3.0”- 12.0”, they were ordered from left to right respectively. The ordinates axis describes the proportion of long responses and the abscissas axis shows the short, intermediate and long durations (in seconds) in each condition. Blue lines show baseline, while red lines show pre-feeding.

Psychophysical Parameters

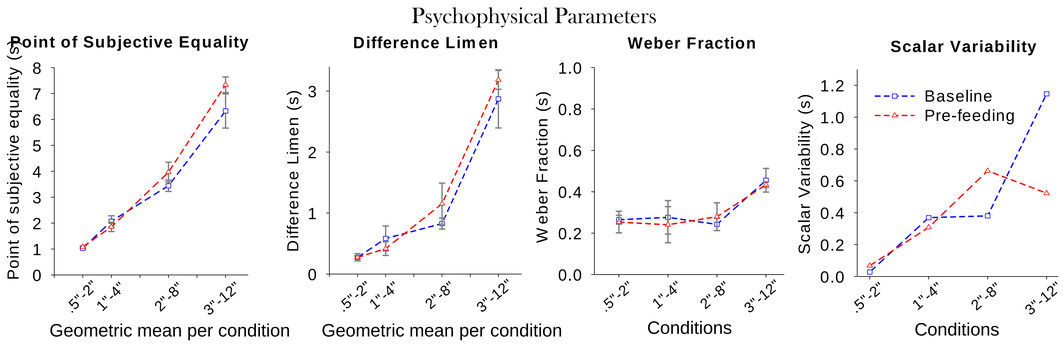


Figure 2. **Psychophysical parameters**. The figure depicts the psychophysical parameters: Point of subjective equality, limen, Weber fraction (WF = Limen/PSE), and scalar variability. Blue squares show baseline, while red triangles show pre-feeding, for all parameters. Vertical bars are standard error of mean.

Signal Detection Theory

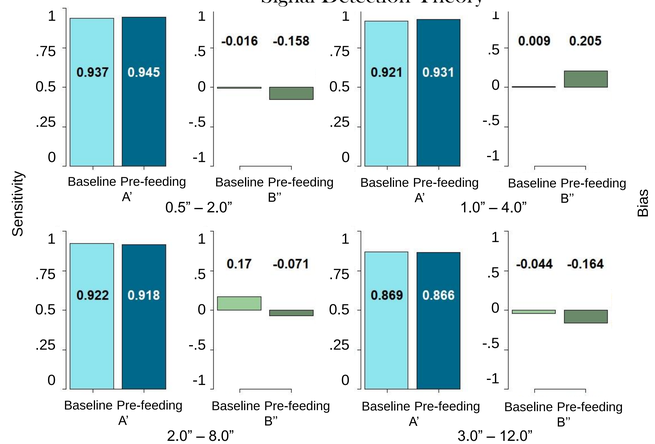


Figure 3. **SDT analysis**. The figure portrays sensitivity (A´) and bias (B´´) parameters per condition when short duration was signal for both phases, baseline and pre-feeding.

Conclusions

Classical psychophysics analysis suggested that interval timing changed as a function of pre-feeding, but the statistical analysis was not significant. We propose that organisms were satisfied because of the pre-feeding, therefore their attentional processes were altered and their psychophysical functions were overlapped or separated. In conditions 0.5”–2.0”, 2.0”–8.0”, and 3.0”-12.0”, durations had been categorized proportionally shorter than in baseline. In contrast, condition 1.0”-4.0”, had been categorized larger than in baseline. In accordance with SDT, organisms discriminated correctly both durations, short and long, thus, pre-feeding did not alter A´ parameter. However, the B´´ parameter indicated that in pre-feeding short durations were judged shorter than they were while in baseline this did not occurred.

References

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Acknowledgements

The authors thank Başak Akdoğan, Fuat Balcı, Arturo Bouzas, Rosana Moreno and Analí de la Cruz for their help and suggestions with signal detection theory analysis.
This research was supported by DGAPA-PAPIIT UNAM - IN307716. Correspondence concerning this research should be addressed to: Oscar Zamora Arévalo, Action and Comparative Cognition Lab. E-mail: ozamoraa@gmail.com.
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