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Repeatability of the infant food reinforcement paradigm: Implications of individual and developmental differences

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Background

The obesity epidemic is a prominent issue in today's society. The Center for Disease Control and Prevention reports that about 17% of children 2—19 years old are obese. This trend has been shown to continue throughout the individual's life and contribute to health issues. [1] Our laboratory recently developed a paradigm to measure the reinforcing value of food versus an alternative stimulus in infants, namely the food reinforcement ratio (FRR) paradigm. This measure may be important in obesity treatment and prevention. The primary purpose of this study was to examine the short-term repeatability of this measure. The secondary aim was to examine whether temperament dimensions related to novelty responsiveness and if infant age influenced the repeatability of the paradigm.

Objectives

1. Examine the short term repeatability of the FRR task in infants 9-18 months old.
2. Examine the roles of temperament reflecting novelty responsiveness and infant age in influencing the repeatability of influencing the repeatability of the FRR task over time

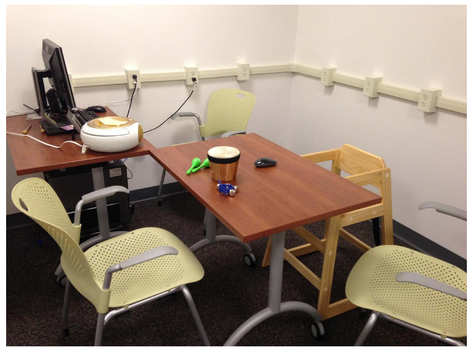

Figure 1: Laboratory set-up for FRR task

Methods

Participants: 37 infants 9-18 months old
Inclusion Criteria: 9-18 month old, > 37 weeks gestation, >2500 grams birth weight, no developmental delays. Mother's age at birth >18 years of age, no alcohol, smoking, or illicit drug use during pregnancy

Laboratory Visits:

- Four appointments— the first two visits were scheduled two days apart, measuring either the food or non food task. This was repeated for the second two visits.
- Food portion of the task was the infants favorite food rated by the parent
- Non food portion of the task was blowing bubbles
- Infants were first given time to play to become comfortable with the environment, then played the computerized task (figure 1).
- The infant and mom's height and weight was taken at the last visit

Figure 2: Infant participant playing with bubble FRR task

Measures:

- The task used a touch sensitive mouse to record the number of responses
- Infants received a short training to learn the task
- Rewards were received after a specific required number of button presses were performed, starting with one press and increased in a progressive fixed ratio (linearly, every 2 trials)
- Infant played until visible signs of wanting to stop along with the parent's agreement
- FRR was calculated by measuring reinforcing value of food (Food P_{max}) compared to total responses
  [e.g., Food P_{max} / (Food P_{max} + Bubble P_{max})].
- Infant temperament was measured using the Infant Behavior Questionnaire-Revised (IBQ-R) in which current analysis focused on high intensity pleasure and approach

Results

	High Intensity Pleasure			Approach		
	β	R^2	*p*	β	R^2	*p*
Food $P_{max}1$	2.044	0.091	0.081	-0.147	0.005	0.879
Food $P_{max}2$	1.566	0.059	0.171	1.008	0.039	0.277
BUB $P_{max}1$	3.212	0.287	**0.001**	0.446	0.037	0.607
BUB $P_{max}2$	1.017	0.048	0.304	0.638	0.036	0.425

$P_{max}1$ = reinforcing value of food (Food) or Bubbles (BUB) measured at time 1;
$P_{max}2$= reinforcing value of food (Food) or Bubbles (BUB) measured at time 2

Figure 3: Comparison of reinforcing value of food and non-food alternative measured at two time points.

- Infant temperamental factor of high intensity pleasure, but not approach, significantly predicted BUB Pmax1 (β = 3.21, p = 0.001), based on linear regression models
- Participants with stronger positive responses to novelty were more likely to work for bubbles at time 1, but not time 2
- Food Pmax1 and Pmax2 were not significantly predicted by either high intensity pleasure or approach

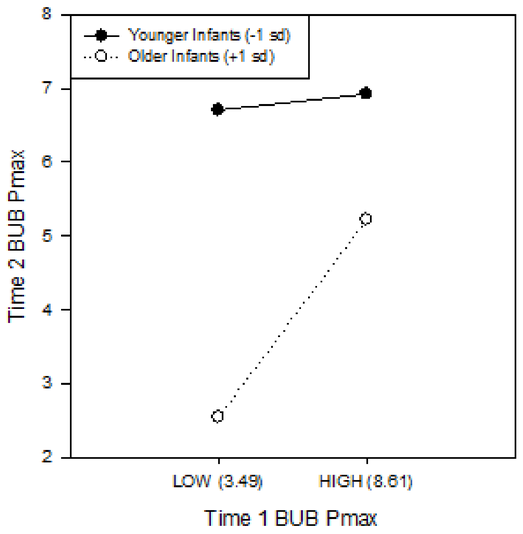

Figure 4: The age moderated the relationship between the reinforcing value of bubbles at time 1 (BUB Pmax1) and time 2 (BUB Pmax2) (p=0.03).

- The slopes reveal an effect of reinforcing value of bubbles at time 1 among older infants (β = 0.52, p = 0.002); this effect is not seen with younger infants (β = 0.04, p = 0.80)
- Among older infants, a low BUB Pmax1 predicts a low BUB Pmax2

Results

- In regards to the reinforcing value of food, bubbles, or the overall FRR between repeat assessments, there were no differences
- No differences in FRR (0.53 ± 0.12 vs. 0.56 ± 0.12) were observed over time

Conclusions

- Novelty responsiveness could play a role in infants' initial behavior in the task, therefore in the future we will integrate an acclimation visit to downplay the affect of novelty on repeatability
- Further information on infants' prior exposure to bubbles would help to analyze the extent that novelty influenced the results
- By establishing procedures to reliably measure FRR among infants, new avenues of research open on the role of early individual differences in appetitive traits in the development of obesity

References

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Infant Lab