Intermittent feeding alters sensitivity to changes in reward value

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Introduction

- Palatable food impairs goal-directed behavior, specifically by reducing performance in food-seeking behavior (Furlong et al. 2014).
- Goal-directed behavior considers (a) food expectation and (b) the motivational value of the food

Introduction

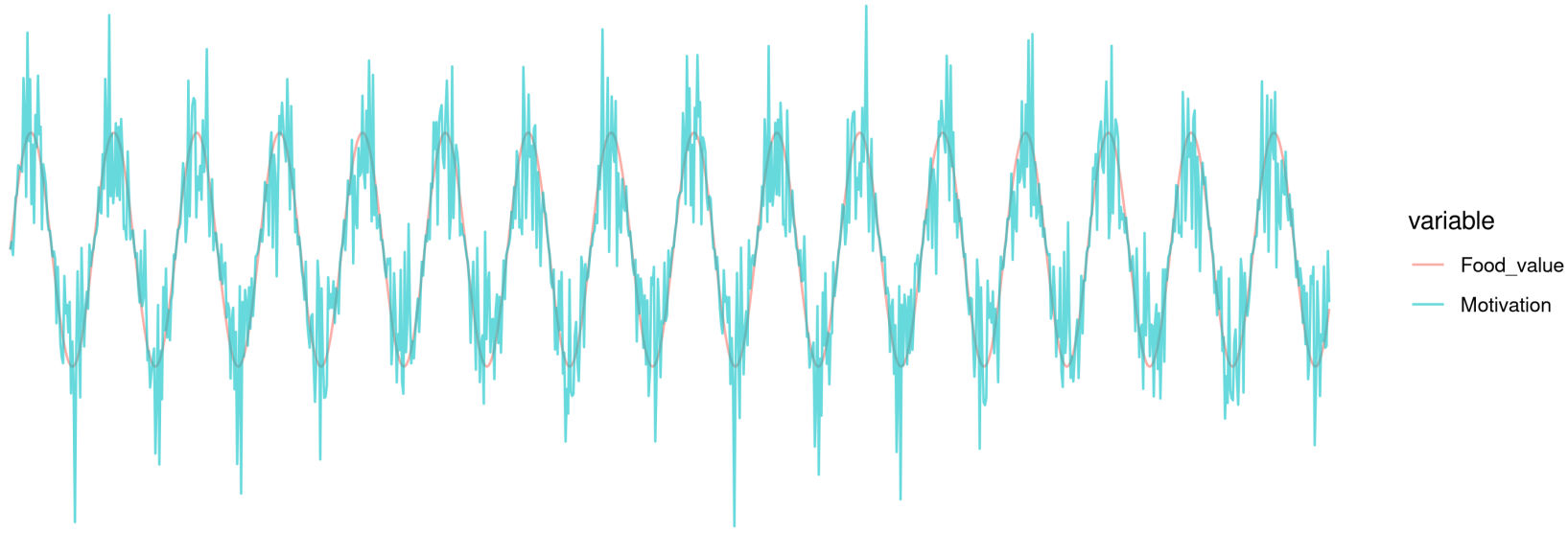

Figure 1: Motivation for food should closely follow its value

- If food is devaluated, motivation should drop
- Devaluation can happen due to sensory-specific satiety

Introduction

- Sensory-specific devaluation is too selective devalue a specific type of food
- Devaluation is measured in subsequent intake reduction or actions required for its acquisition
- Devaluation is specific for the type of food

Research question

- Palatable food impairs goal-directed behavior
- Goal-directed behavior impairment is not responding to sensory-specific devaluation
- Do similar effects happen when altering eating patterns?

Research question: background

- Intermittent diet -> restriction followed by refeeding
- With chow -> promotes persistent binge-like eating (Hagan and Moss 1997)
- 'Sensory-specific satiety is also disrupted following binge-like feeding in rats'
- Intermittent feeding can alter consummatory behavior

Research question: more precisely

- Does restriction + refeeding promotes habitual food-seeking behavior?
  - Goal-directed: behavior is modified by outcome value
  - Habitual: behavior **not** modified by outcome value

Testing the question: material and methods

- 46 male long evans rats (2-3 per box)
- Food-restricted to 85-90% of weight
- Test chamber
  - Pellet A = grain food pellet (more protein)
  - Pellet B = purified pellet (more fat)

Testing the question: procedures

Training

- 5 days of food restriction
- 2 sessions of magazine training
- Operant chamber pellets delivered on a random time (60s)
- 40 outcomes per session; 20 pellet A; 20 pellet B

Testing the question: procedures

Training

- 8 days of instrumental learning
- Left/Right lever; A/B pellet
- Maximum outcome was 40/40
- days 1-2: FR1
- days 3-5: RR5 -> $P(x = 1) = 1/5$
- days 6-8: RR10 -> $P(x = 1) = 1/10$

Testing the question: restriction + refeeding cycles

- Done post instrumental learning
- Intermittent = 23; Control = 23 rats
- Intermittent:
  - 4 days of restricted access (10gr)
  - 2 days of unrestricted access
  - 5 cycles of that
- Control:
  - 20 days of restricted access
  - 10 days of unrestricted access
- 3 days of restriction prior to testing

Testing the question: instrumental outcome devaluation test

- 1 hour access to one of the 2 pellets
- 3 min instrumental choice extinction test (no outcome)
  - Lever presses were measured
- 48 hours after, rats were tested with the other pellet
- 24 hours after, sensory-specific satiety test

Testing the question: sensory-specific satiety test

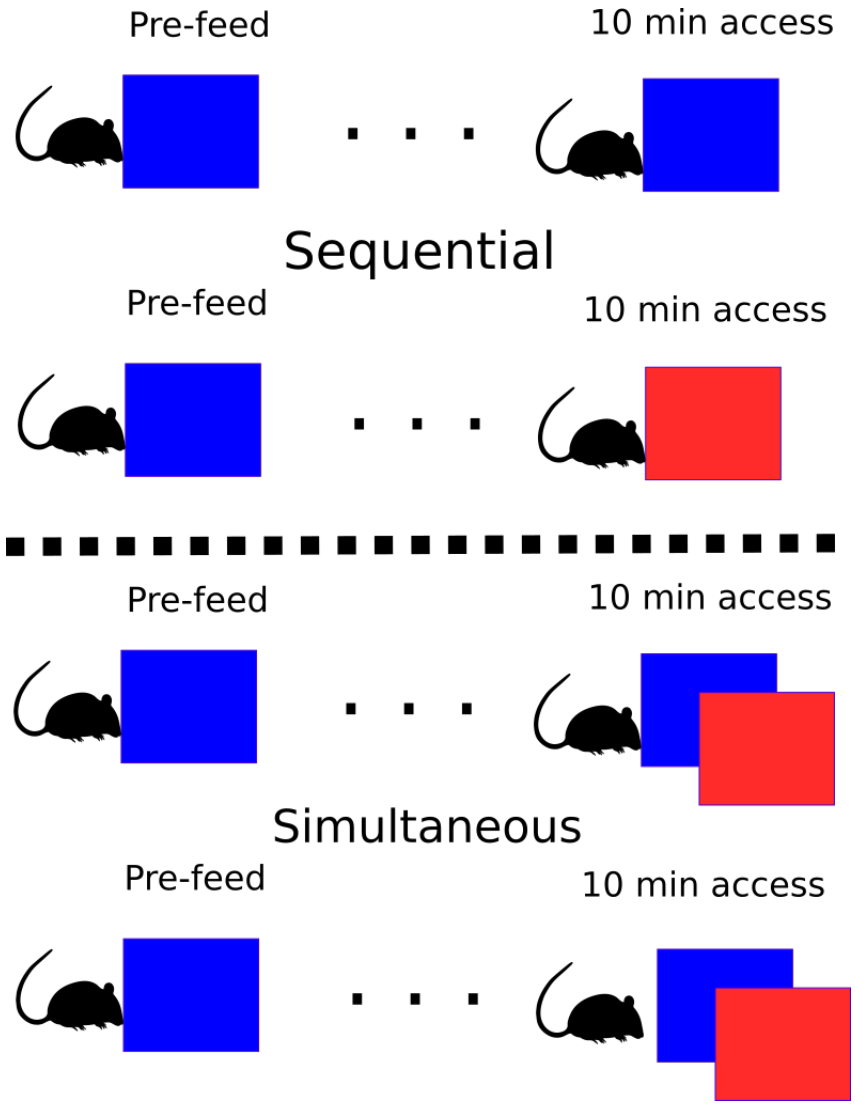

Figure 2: 28 rats for sequential; 18 rats for binary

Results: preliminaries

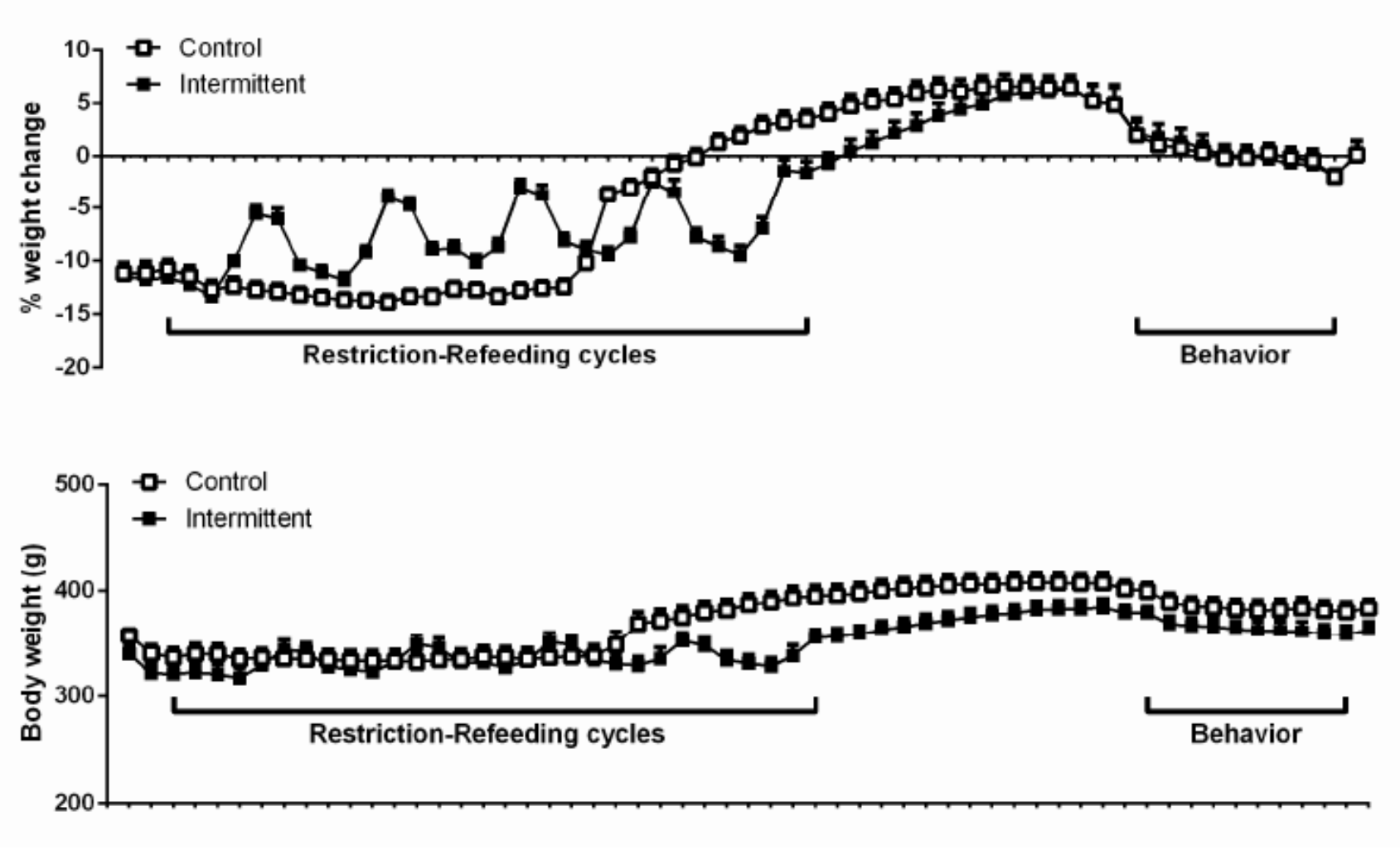

Figure 3: Body weight stays similar despite of restriction and refeeding

Results: preliminaries

- Number of lever presses during training
  - Significant effect of session (they learned)
  - No effect of group
  - No group x session effect
- Weight
  - Percent weight lost was similar prior to testing

Results: instrumental test

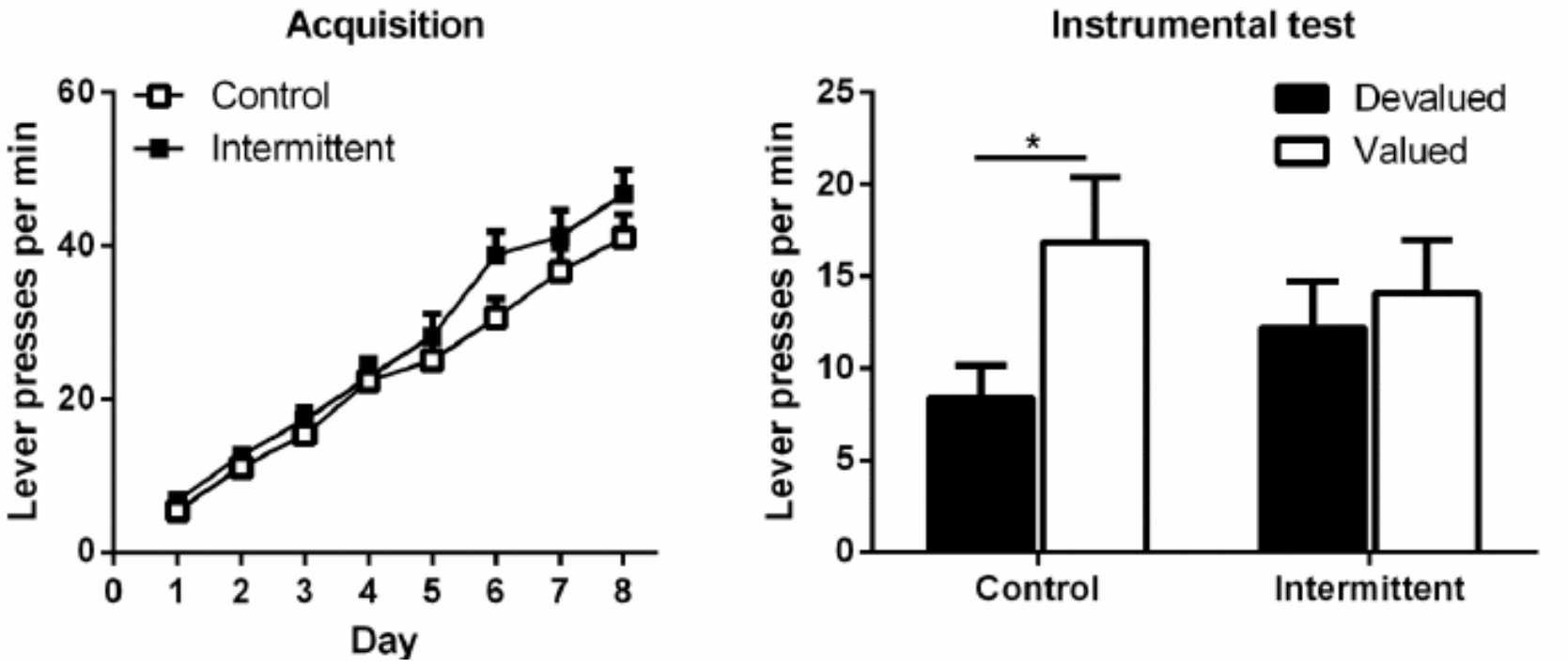

Figure 4: Note that lever pressess were measured in an extinction procedure

Results: sensory-specific satiety

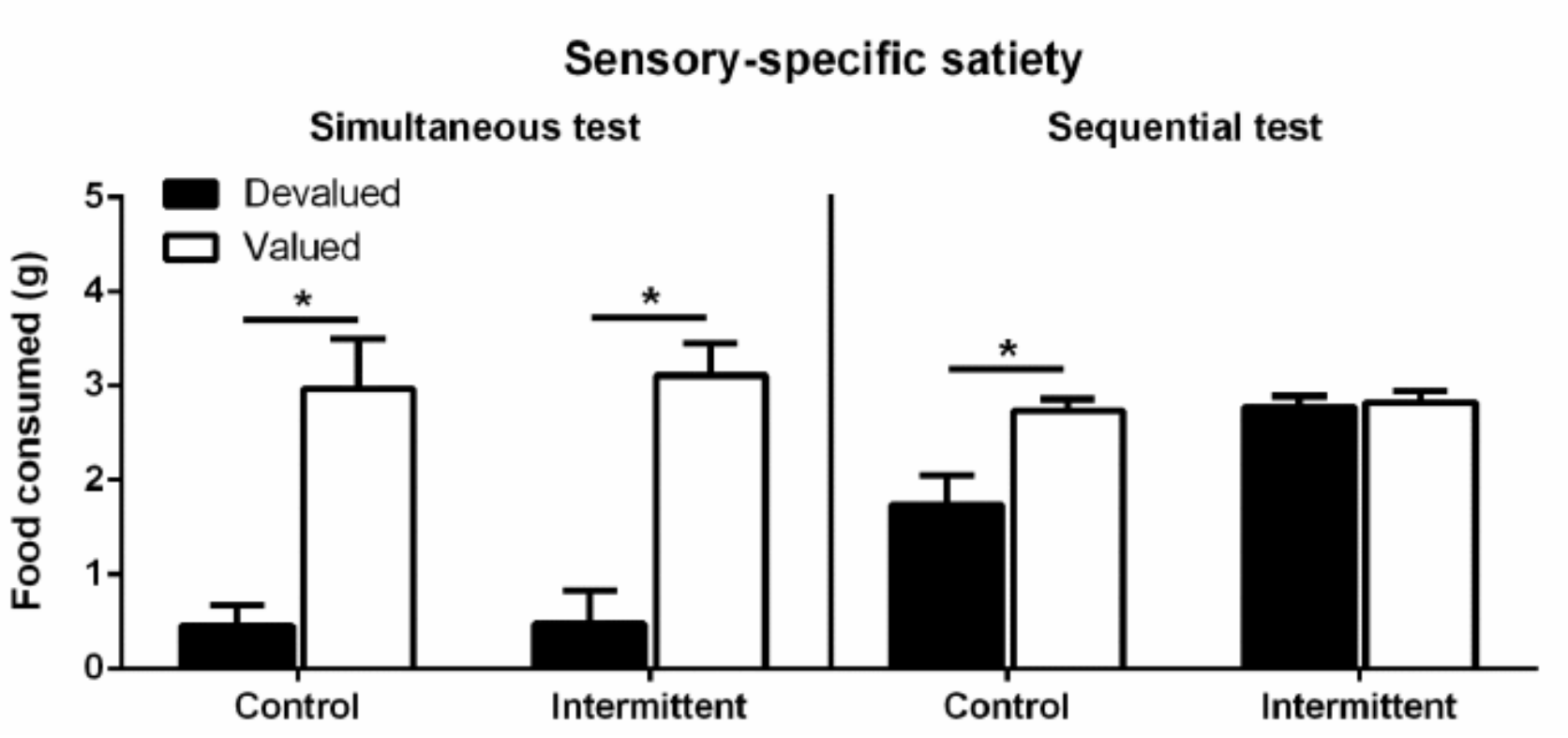

Figure 5: Here, actual food intake was measured

Results: others

- Devaluation test:
  - No differences in consumption
  - Overall purified pellet was more consumed over grain
  - Pellet x group interaction was not significant

Discussion

- Intermittent feeding, similar to palatable food, impair goal-directed behavior
- Impairment was not due to outcome devaluation insensitivity
  - Devaluation effect were present on simultaneous test
  - Not present in sequential test
- Sequential test requires a representation of absent food (pre-feed)
  - Incentive memory impairment (?)
- Perhaps pellets were not different enough (?)
- Intermittent feeding = stress -> change to habitual control

Discussion: my take

- Food intake is related to reward variability (Neuser et al. 2020)
  - Having varied experiences related to food (intermittent), increases reward variability
  - Increased reward variability -> increased intake
- Ancient mechanism to prevent starvation due to uncertainty
- Food shortages increase intake (Forkman 1993)
- Not that good of alternative hypothesis because consumption was similar between groups
- Perhaps intake is not increased, but food value computation is not prioritized

References I

Forkman, B.A. 1993. "The Effect of Uncertainty On the Food Intake of the Mongolian Gerbil." *Behaviour* 124 (3-4): 197–206. https://doi.org/10.1163/156853993X00579.

Furlong, Teri M., Hirosha K. Jayaweera, Bernard W. Balleine, and Laura H. Corbit. 2014. "Binge-like consumption of a palatable food accelerates habitual control of behavior and is dependent on activation of the dorsolateral striatum." *The Journal of Neuroscience: The Official Journal of the Society for Neuroscience* 34 (14): 5012–22. https://doi.org/10.1523/JNEUROSCI.3707-13.2014.

Hagan, M. M., and D. E. Moss. 1997. "Persistence of binge-eating patterns after a history of restriction with intermittent bouts of refeeding on palatable food in rats: implications for bulimia nervosa." *The International Journal of Eating Disorders* 22 (4): 411–20. https://doi.org/10.1002/(sici)1098-108x(199712)22:4%3C411::aid-eat6%3E3.0.co;2-p.

References II

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