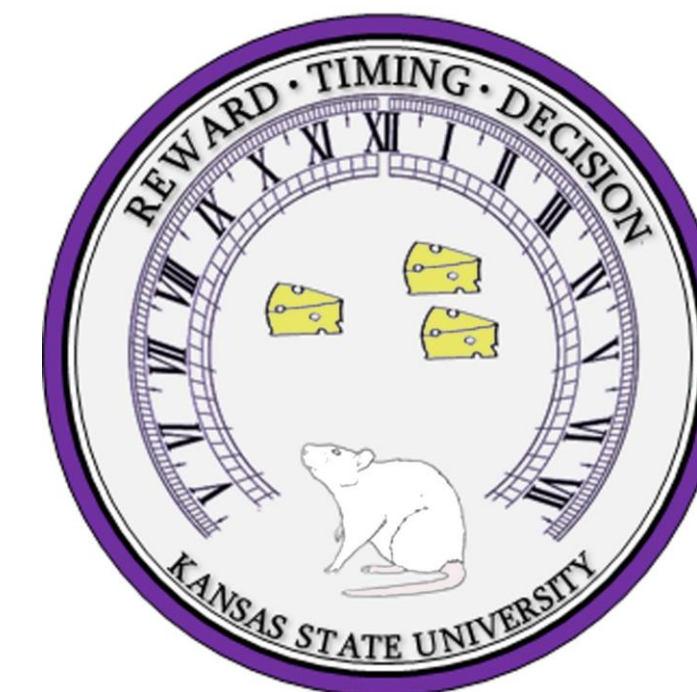




# Diet-induced Impulsivity: An Investigation of Bias and Sensitivity to Delay

Catherine C. Steele\*, Jesseca R. A. Pirkle, Ian R. Davis, & Kimberly Kirkpatrick  
Department of Psychological Sciences, Kansas State University



## Introduction

- Impulsive choice is related to many maladaptive behaviors such as gambling, substance abuse, and obesity<sup>1</sup>
- People who consume diets high in fat and sugar make more impulsive choices<sup>2</sup>
- The effects of diet on impulsive choice can be studied in rodents by measuring a preference for a smaller-sooner (SS) reward over a larger-later (LL) reward
- Time discrimination deficits have been implicated as a mechanism leading to impulsive behavior<sup>4</sup>
- Primary goals: Investigate how high-fat (HF) and high-sugar (HS) diets affect:
  1. bias to the immediate reward and sensitivity to delay on and off diet
  2. time discrimination abilities

## Methods

Subjects: Male Sprague Dawley rats  
8 Week Diet Manipulation

- HF: 60% rat chow and 40% fat
- HS: 60% rat chow and 40% sugar
- C: 100% rat chow

All groups had access to the same number of calories per day

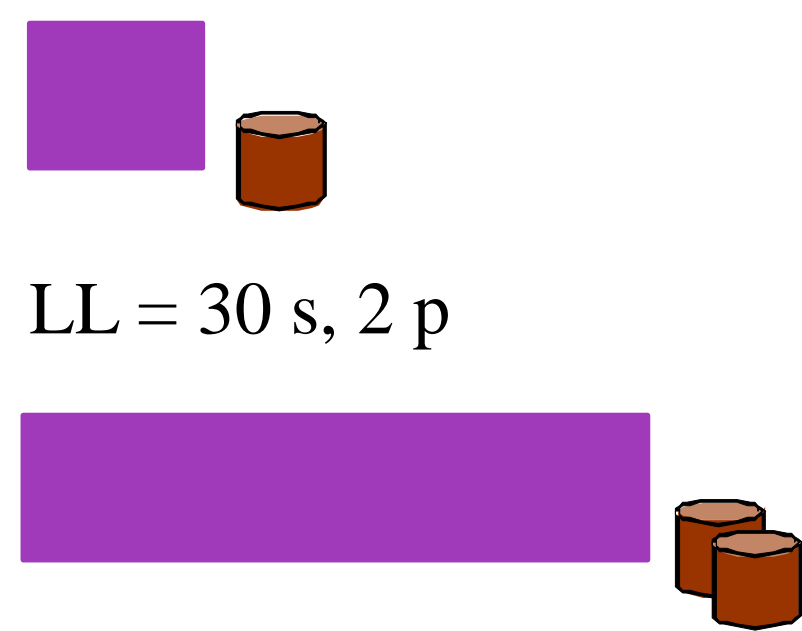
### Experiment 1

Impulsive choice:  
**On Diet**

Impulsive choice:  
**Off Diet**

#### Impulsive Choice

SS = 5→10→20 s, 1 p



### Experiment 2

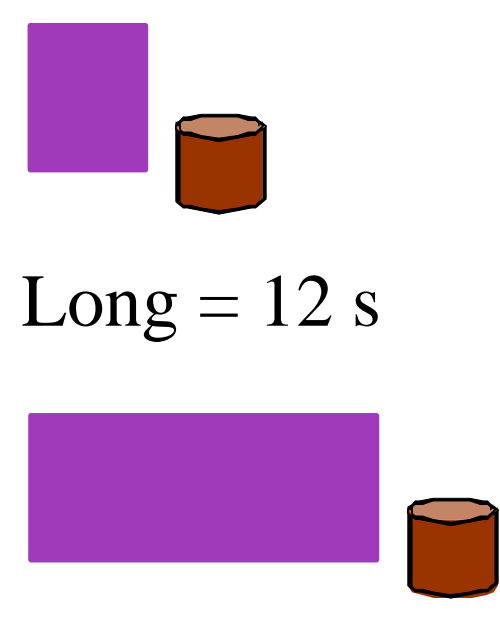
Impulsive choice

Bisection

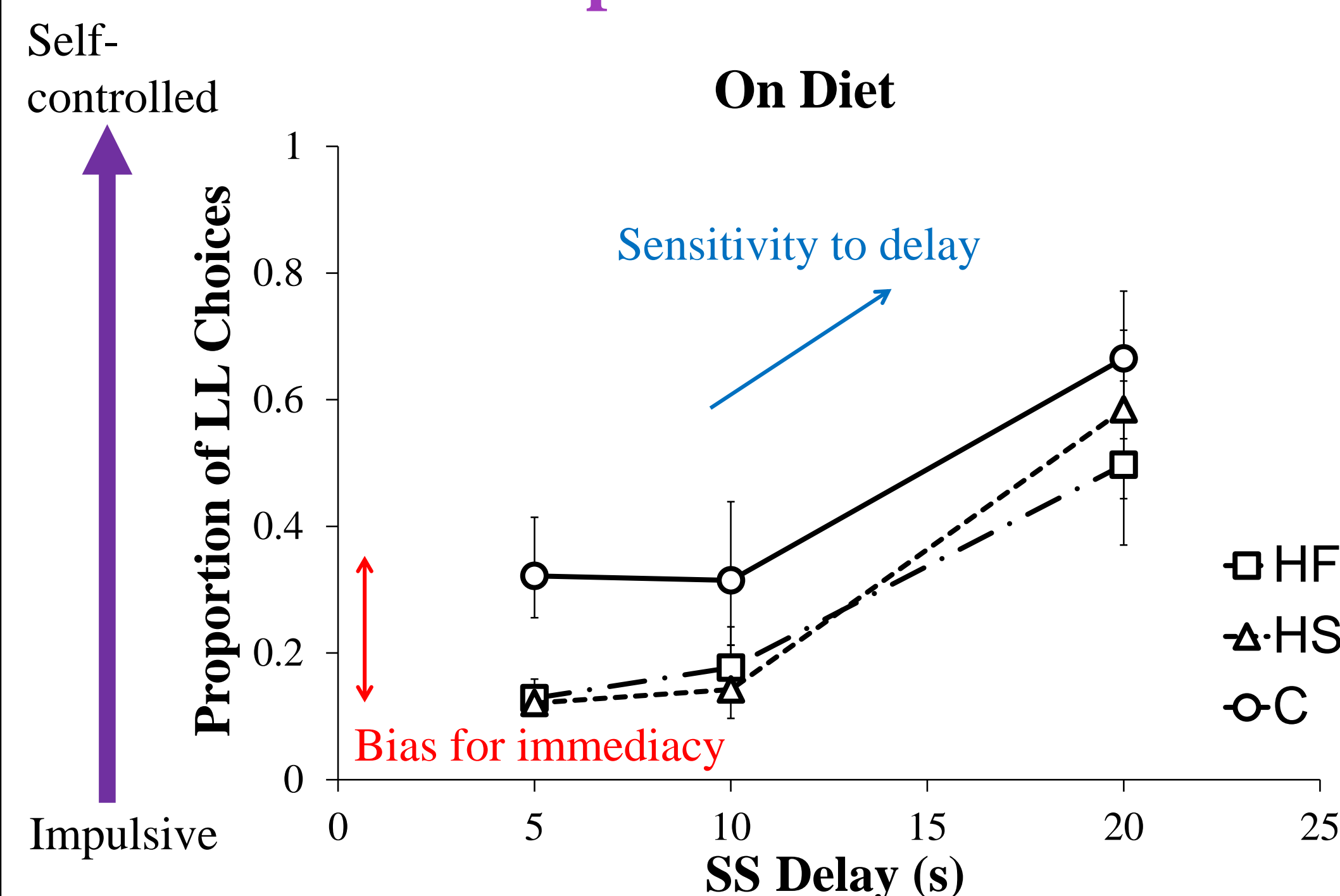
#### Bisection

Short = 4 s

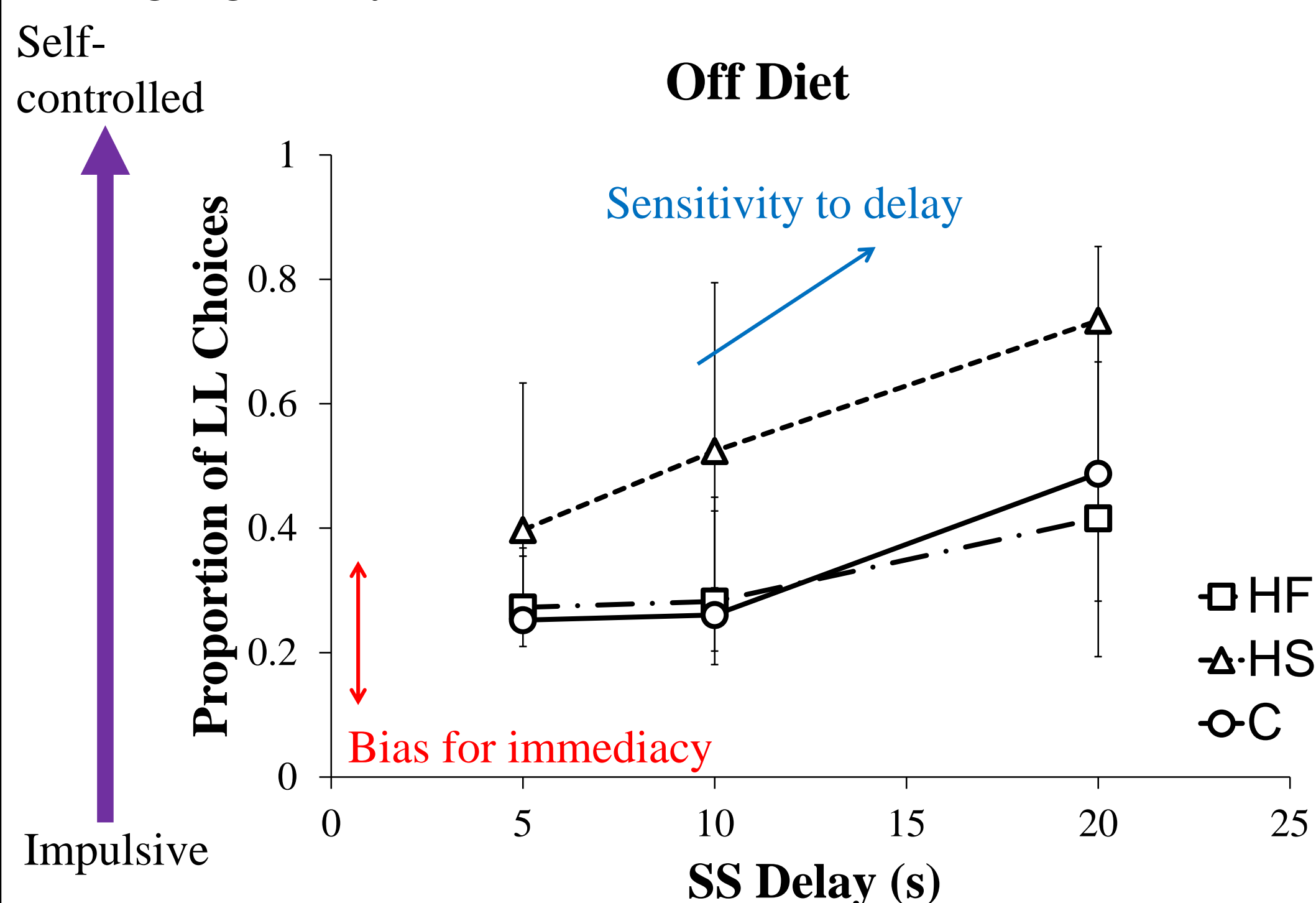
Long = 12 s



## Experiment 1

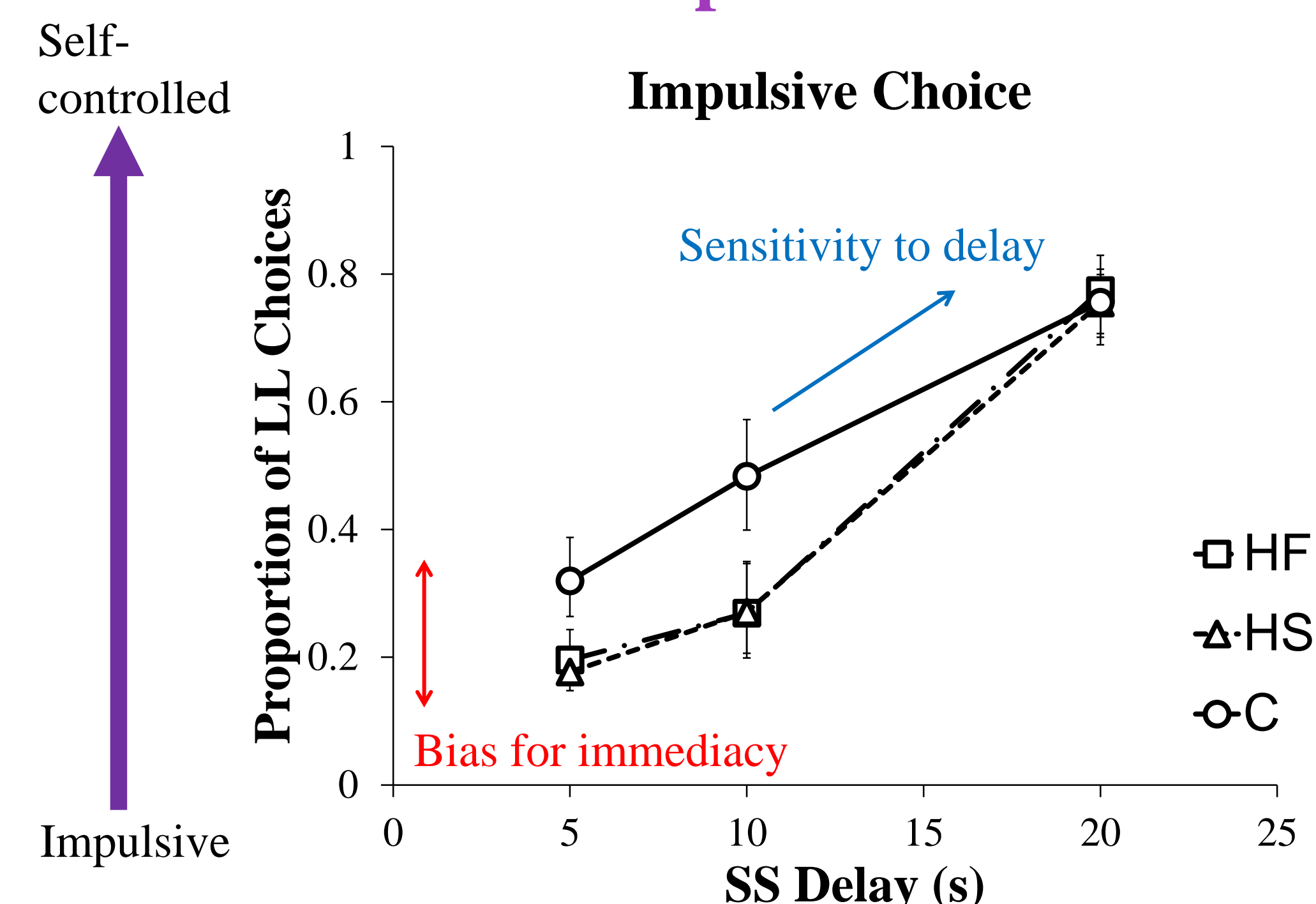


Rats fed a HF or HS diet had a larger bias for the immediate reward and showed greater sensitivity to the changing delays

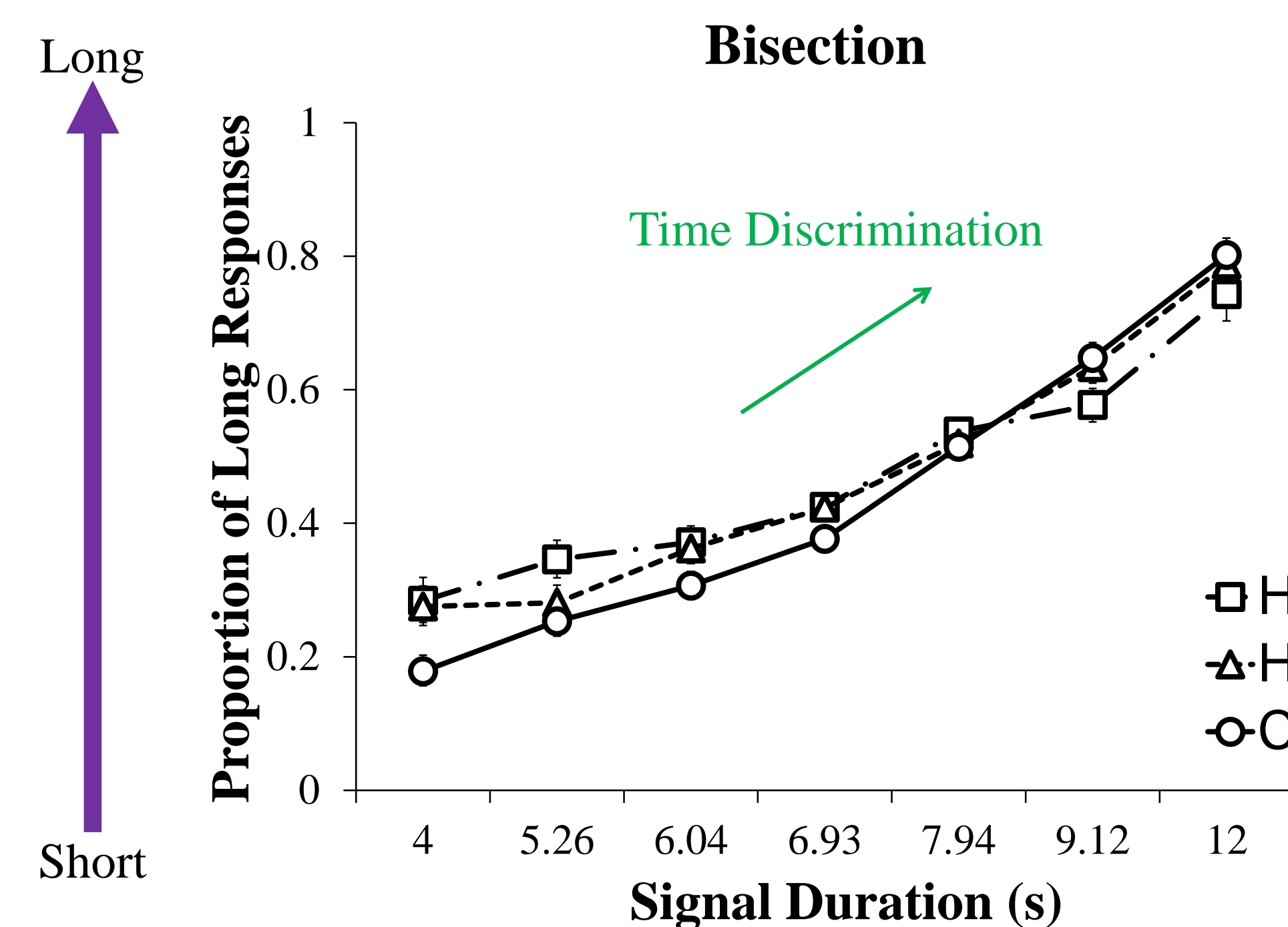


Rats fed a HF or HS diet showed a decrease in their bias for the more immediate reward, yet remained more sensitive to delay

## Experiment 2



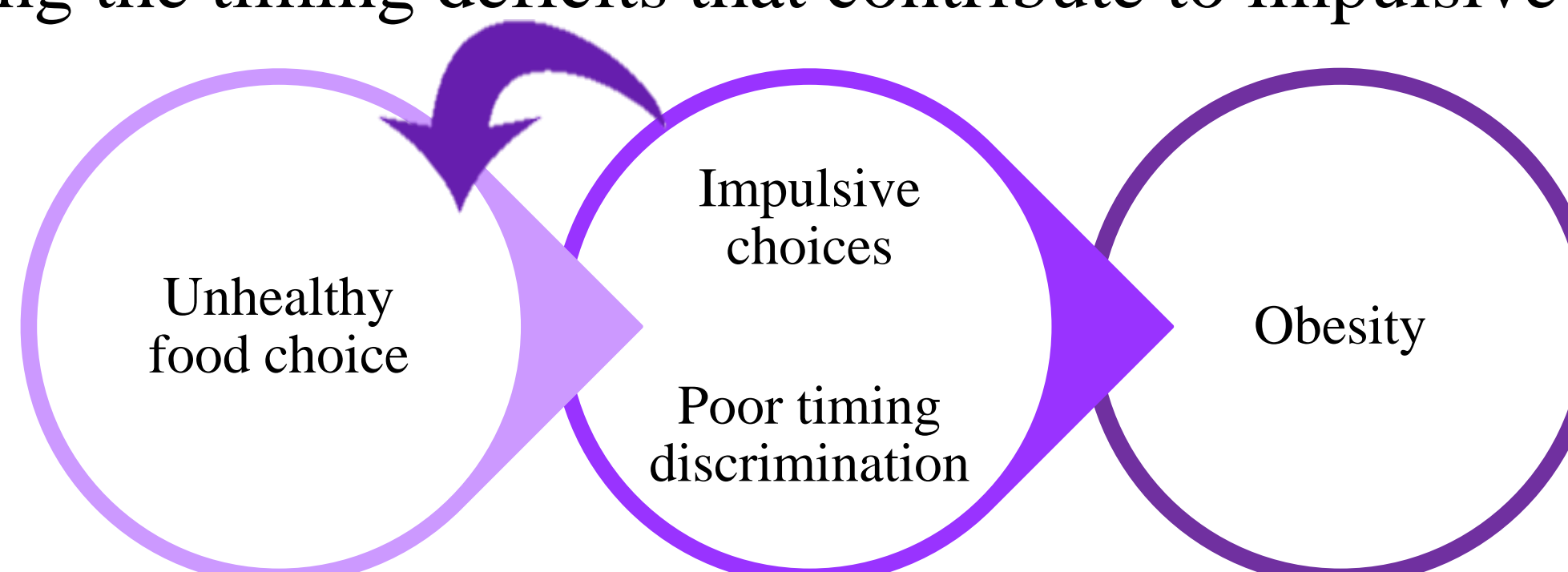
Similar to Experiment 1, rats fed a HF or HS diet were more sensitive to delay, and rats fed a HS diet had a bias for the immediate reward



Rats fed a HF diet were poorer at discriminating signal durations, as indicated by the shallower slope

## Discussion

- HF and HS diets induced a bias for the immediate reward
- HF and HS diets resulted in greater sensitivity to delay that continued once removed from the unhealthy diet
- The increased sensitivity to delay displayed by the high-fat group may result from deficits in timing discrimination
- Behavioral interventions could be used to treat obesity by addressing the timing deficits that contribute to impulsive choice<sup>5</sup>



## References

1. Rasmussen, E. B., Lawyer, S. R., & Reilly, W. (2010). Percent body fat is related to delay and probability discounting for food in humans. *Behavioural Processes*, 83, 23-30.
2. Lumley, J., Stevenson, R. J., Oaten, M. J., Mahmut, M., & Yeomans, M. R. (2016). Individual differences in impulsivity and their relationship to a Western-style diet. *Personality and Individual Differences*, 97, 178-185.
3. Steele, C. C., Pirkle, J. R. A., & Kirkpatrick, K. (under review). Diet-induced impulsivity: The effects of a high-fat and a high-sugar diet on impulsive choice in rats. *PLOS ONE*.
4. Marshall, A. T., Smith, A. P., & Kirkpatrick, K. Mechanisms of impulsive choice: I. Individual differences in interval timing and reward processing. *JAEB*, 102, 86-101
5. Smith, A. P., Marshall, A. T. & Kirkpatrick, K. (2015). Mechanisms of impulsive choice: II. Time-based interventions to improve self-control. *Behavioural Processes*, 112, 29-42.

## Acknowledgements

Thank you to the members of the Kirkpatrick RTD lab, especially Amanda Crawford, Christian Davis, and Jeremy Lott for your help with this project.

\*Email: cchill1@ksu.edu