



The
Reward,
Timing, &
Decision
Laboratory

A time-based intervention to promote self-control in middle- aged rats

Jennifer R. Peterson & Kimberly Kirkpatrick

Kansas State University

Department of Psychological Sciences



Impulsive Behavior and Aging

- Age-related cognitive and behavioral changes occur in all species, including rats (Dellu-Hagedorn et al., 2004; Kray & Lindenberger, 2000)
- Impulsive choice is involved in maladaptive behaviors across the lifespan (Odum, 2011; Peterson et al., 2015)
- Impulsive choice behavior is a relatively stable, individual trait (Dellu-Hagedorn et al., 2004)
 - Individual differences that were evident in a sample of young rats remained stable at middle age
 - The most impulsive rats remained more impulsive



Impulsive Behavior and Aging

- Conversely, the overall level of impulsive choice declines over time
- Impulsive young rats displayed declines in cognitive performance (i.e., decreased working memory and attention) in middle age (Dellu-Hagedorn et al., 2004)
- Young rats are better at timing, faster to respond, and adapt more quickly to changes in reward than older rats (Lejeune, Ferrara, Soffie, Brochart, & Wearden, 1998)
- Effective time-based interventions increase overall LL choice and timing in young rats (Smith, Marshall, & Kirkpatrick, 2015)



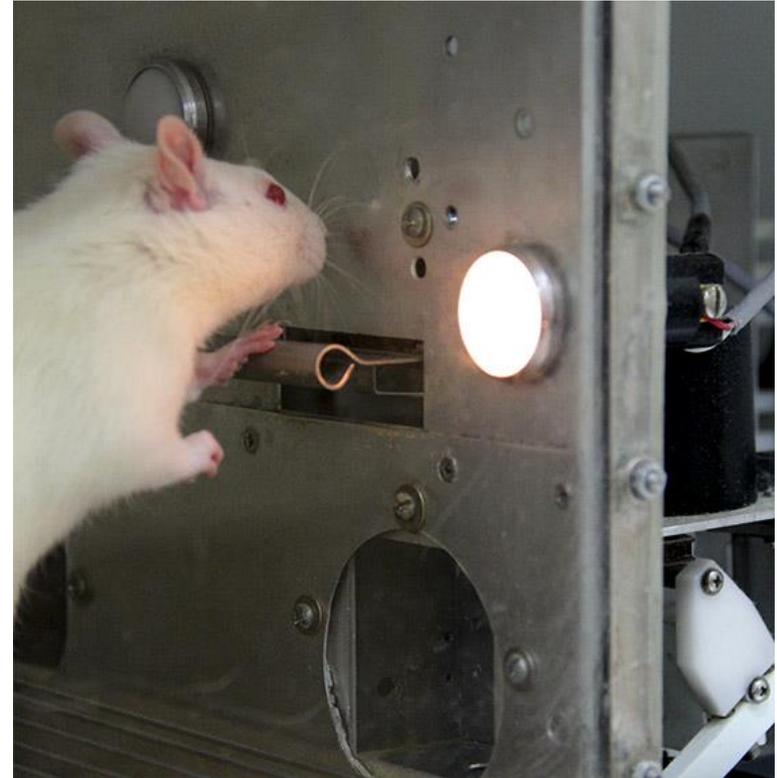
Research Questions

- Will middle-aged rats display less impulsive choice behavior after a time-based intervention?
- Will highly impulsive rats benefit most from the intervention?



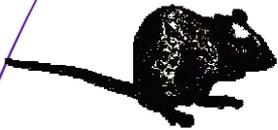
Measuring Impulsive Choice

- Subjects
 - 24 Male Sprague Dawley Rats
 - 15 months old at start of testing
 - Extensive previous experience
- Pretest (modified from Green & Estle, 2003)
 - SS = 1 pellet after 5 s delay
 - LL = 2 pellets after 5 → 15 → 30 → 60 s



Timing Intervention

- Treatment (n = 12)
 - Variable Interval 10 s on small lever 
 - VI 30 s on large lever
- Control (n = 12)
 - No treatment
 - Contextually equal



- Post-test
 - Identical to pre-test impulsive choice task

Pre-test Post-test Results

Random Effects
(Individual
Differences):

LL Delay * Session *
Intercept

Fixed Effects:

Group * Pre/Post * LL
Delay

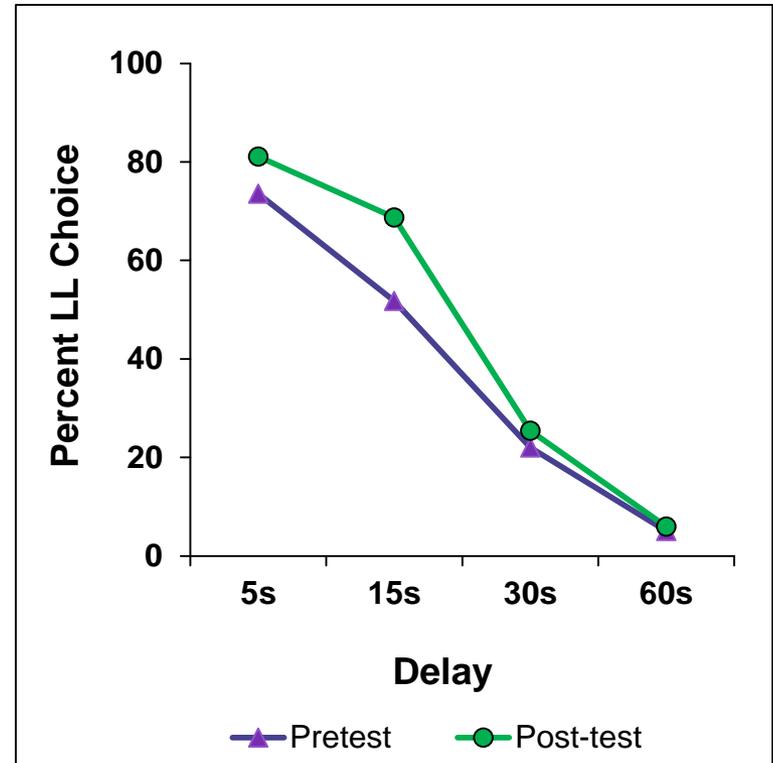


Figure 1: Pre-test versus post-test comparison of impulsive rats. Post-test LL choice increased at 5 and 15s delays.



Individual Differences Results

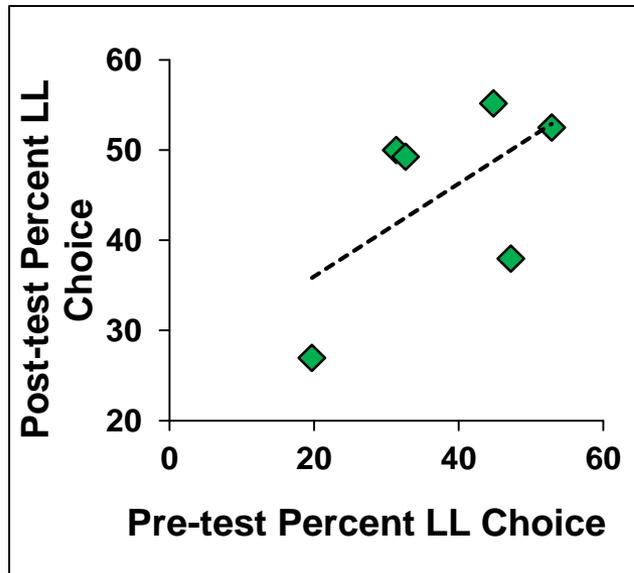


Figure 2: The most impulsive rats displayed the largest increase in LL choices after the VI intervention, $r = .59$.

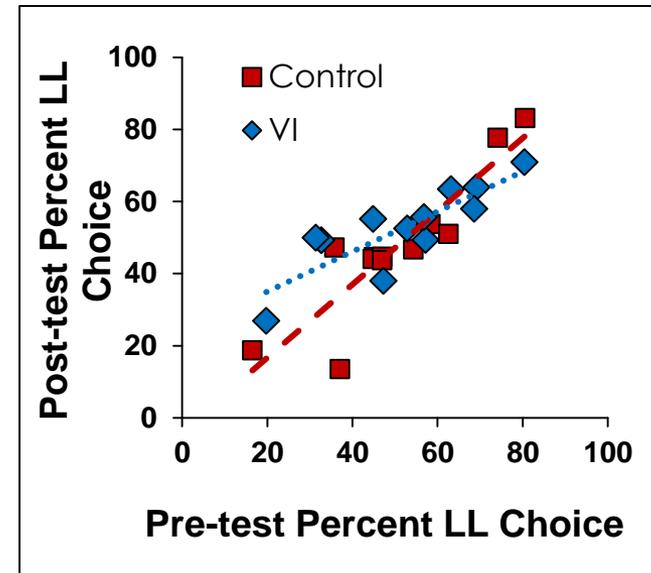


Figure 3: The control and VI rats showed substantial test-retest reliability, and the VI rats that were most impulsive improved the most, $r = .90$, $r = .84$ respectively.



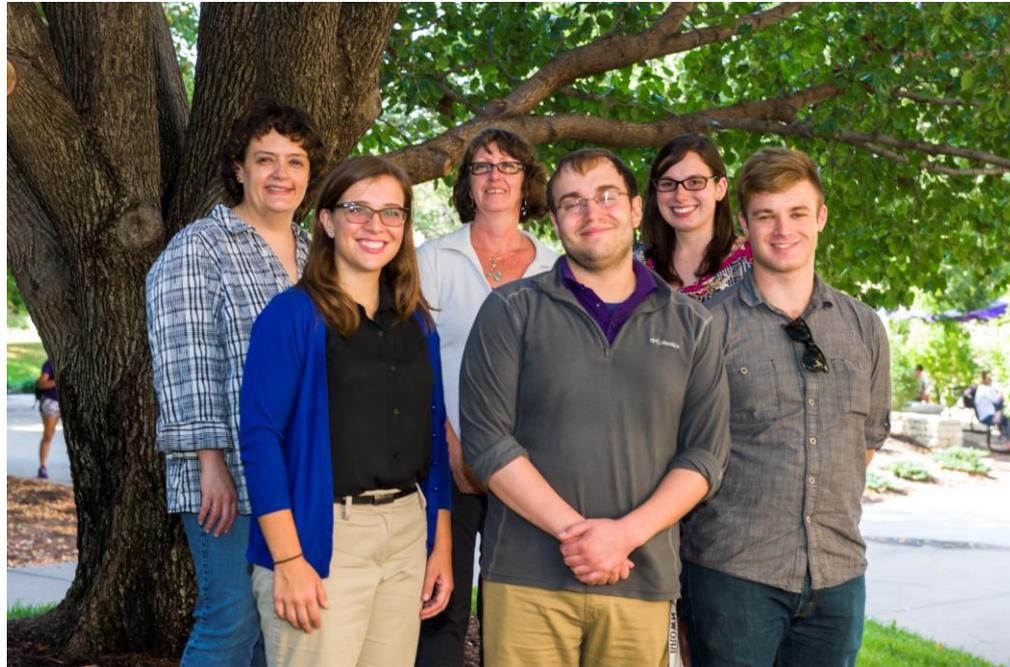
Conclusions & Future Directions

- Old rats CAN learn new tricks
- The time-based intervention was effective in experienced, middle-aged rats
 - Decreased impulsive choice behavior
 - Most impulsive rats in the pre-test showed the largest improvements
- Impulsive behavior remained stable between pre-test and post-test
- Future Questions:
 - How long-lasting are these effects?
 - Would aged rats also benefit from intervention treatment?



Thank You

- RTD lab members past and present



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