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

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Impulsive Behavior and Aging

- Age-related cognitive and behavioral changes occur in all species, including rats (Dellu-Hagendorn 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.
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

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