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Parental Discounting of Delayed Outcomes in Treatment-Related Decision-Making

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Open-sourced Methods/Data/Analyses: https://www.github.com/miyamot0/Caregiver-Delay-Discounting (Private while Under Review)

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An "Everyday" Example

- Imagine a parent with a child displaying tantrum behavior in the supermarket
  - Tantrum behavior quickly followed a denied request for a candy bar
  - Behavior becomes very loud, disruptive and others take notice

- Consider some choices available to the caregiver
  1. Honor the request to produce some brief, immediate relief from this episode of problem behavior (SSR)
  2. Maintain limits on the child's behavior, enduring the current episode, and (probably) produce more relief from problem behavior in the future (LLR)

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Discounting in "Everyday" Outcomes

- The discounting framework is increasingly used to evaluate more common, everyday types of decision-making, such as:
  - Preferences in healthcare planning (Chapman, 1996, 2002)
  - Adherence to prescribed medication (Bruce et al., 2015; Jarmolowicz et al., 2016)
  - Pursuit of vaccination (Chapman & Coups, 1999; Chapman, Li, Colby, & Yoon, 2010)
  - Continuation/discontinuation of individual psychotherapy (Swift & Callahan, 2008, 2010)

- Few have evaluated how outcomes from behavioral therapies are affected by delays (Call et al., 2015)
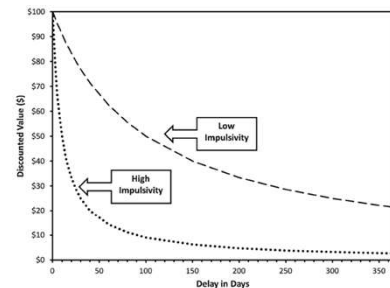
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Caregiver Contingencies in Adherence

- Caregiver adherence to behavioral therapies is likely maintained by some combination of immediate and delayed reinforcers
  - S^{R+}: More enjoyable interactions, improved child compliance, etc.
  - S^{R-}: Relief from problem behavior, decreased child dependence on prompts/redirection, etc.

- However, most benefits from behavioral intervention tend to delayed
  - Observed improvements may take weeks/months
  - Few reinforcers are explicitly programmed for caregivers related to implementation

EXPECT DELAYS

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Earlier Work: Call et al., (2015)

- This study evaluated temporal preferences of caregivers (*n* = 17) across monetary and behavioral outcomes (i.e., improvements from treatment)
  - Children presented with developmental disabilities and severe problem behavior
  - Discounting of monetary and behavior outcomes were not significantly different (null effect)

- Limitations
  1. Not sufficiently powered to find small, potentially relevant differences*
  2. Caregivers managing severe behavior may not be generalizable to less severe behavior

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ORIGINAL PAPER

The Impact of Delays on Parents' Perceptions of Treatments for Problem Behavior

Nathan A. Call · Andrea R. Reavis ·
Courtney E. McCracken · Scott E. Gillespie ·
Mindy C. Scheithauer

*Note: Studies without sufficient power can yield a null effect not because an effect isn't there, but because the test is not powerful enough to detect it

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Remaining Questions: Call et al. (2015)

- Call et al. (2015) found that behavioral outcomes were discounted at rates similar to other items (i.e., monetary)

- However, some questions remain unanswered:
  1. Given insufficient power, would we find an effect if the tests used were sufficiently powered (i.e., larger sample)?
  2. Temporal preferences for behavior outcomes are *potentially* different in across "common" and severe forms of problem behavior

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Expanding on Call et al. (2015)—#1

- A power analysis was conducted to support a fully powered comparison

- The observed effect (AUC; d = .32) from Call et al. (2015) was extracted*

- Power analysis for a matched pairs T-test (alpha = .05, beta = .8) indicated that at least 61 participants were necessary to power the comparison**
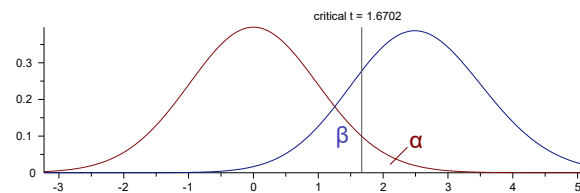
*The AUC effect size was used to avoid the assumption that future studies would be best fit by the original model (i.e., Mazur)
**Computed using G*Power v 3.1.9.3

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Expanding on Call et al. (2015)—#2

- A sample of caregivers with "everyday" behavior issues were collected using Amazon's Mechanical Turk (mTurk)

- A total of 62 participants were screened and met criteria for inclusion in the study
  1. Endorsed having at least 1 or more child
  2. Endorsed some level of difficulty managing child behavior (i.e., caregivers reporting no issues were not eligible)

Participant Demographics (n = 62)			
Age (years)		**Number of Children**	
Mean (SD)	38.8 (10.1)	Median (Q1-Q3)	2 (1-3)
Median (Q1-Q3)	36.5 (32-43)	Mean (SD)	2.1 (1.2)
Sex		**Education**	
Male	25 (40.3%)	High School graduate	2 (3.2%)
Female	32 (51.6%)	Some college but no degree	17 (27.4%)
Would rather not say	5 (8.1%)	Associate degree	12 (19.3%)
Income		Bachelor's degree	21 (33.9%)
Q1	30,000 USD	Master's degree	6 (8.1%)
Median	60,000 USD	Professional degree	1 (1.6%)
Q3	81,000 USD	Would rather not say	4 (6.5%)
Behavior Concern		**Ethnicity**	
A little	31 (50%)	African-American	3 (4.8%)
A moderate amount	9 (14.5%)	Asian	5 (8.1%)
A lot	12 (19.3%)	Hispanic/Latinx	1 (1.6%)
A great deal	10 (16.1%)	White/Caucasian	49 (79%)
Marital Status		Would rather not say	4 (6.4%)
Single	9 (14.5%)		
Married	39 (62.9%)		
Divorced	7 (11.3%)		
Would rather not say	7 (11.3%)		

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Methods: Temporal Preferences

- Participants completed two hypothetical titration tasks*
  - Monetary Outcomes: Reinforcer varied was currency (US Dollars)
  - Behavioral Outcomes: Reinforcer varied was % reduction in behavior
  - Preferences assessed at 1 and 2 weeks, 1, 3, and 9 months, and 1 and 2 years

- Decision-making tasks were delivered using the Qualtrics platform

- Caregiver data were screened for systematic responding using criteria derived from Johnson and Bickel (2008)

*Titration task was modeled from Frye et al. (2016)

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Modeling Caregiver Discounting

- Discounting as modeled using the Hyperbolic (Mazur, 1987), Green-Myerson (2004), Rachlin (2006), and Ebert-Prelec models (Ebert & Prelec, 2007)
  - Fitted using mixed-effects model (Young, 2018)
  - Decision-making clustered at the individual-level

- Model fitness was evaluated using the Akaike Information Criterion (AIC)

| Model	Rank	Log k	s	AIC
Rachlin	1	-4.954	0.842	8282.621
Ebert-Prelec	2	-6.994	0.686	8364.779
Green-Myerson	3	-3.341	0.477	8628.272
Hyperbolic	4	-5.835	---	8828.572

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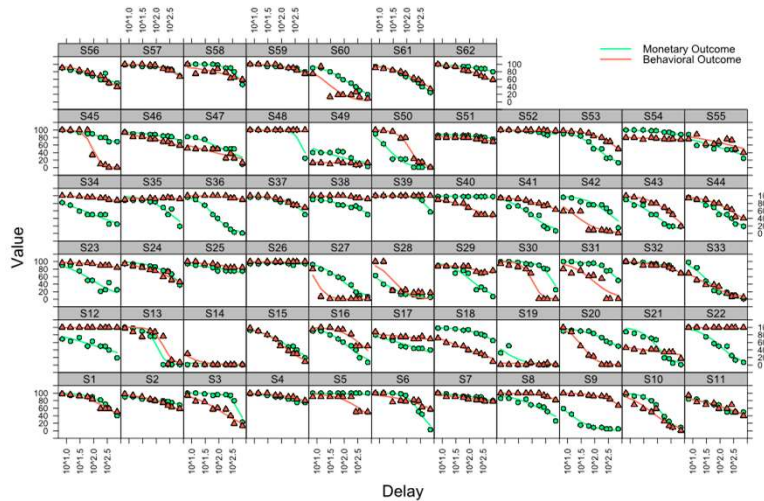
The fits above are modeled using the Rachlin Hyperboloid Model with fixed and random effects, clustered at the individual

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Modeling Caregiver Discounting

- Fitted discounting series were converted into a Model-based form of AUC (Gilroy & Hantula, 2018)
  - Allows for an overall comparison when multiple parameters are fitted
  - Leverages area-based interpretation alongside mixed-effects modeling
  - Computed in both the normal and log$_{10}$ scale (see Borges et al., 2016)

- Logit transform (Young, 2016) of the Log-Scaled MB-AUC met criteria to support parametric assumptions*
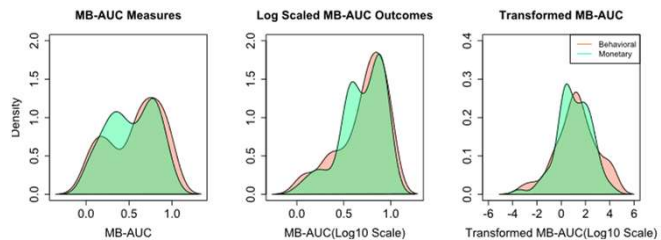
*Kolmogorov-Smirnov: D = 0.1542, p = .531 (emerged from comparable distribution)
*Levene's test for equality: F = 0.8374, p = .362 (equal variance observed across groups)

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Preliminary Findings

- We did not find significant differences between monetary (M = 1.04, SD = 1.40) and behavioral outcomes (M = 1.22, SD = 1.70) at the individual-level
  - A paired-samples T-test (equal variance) was not significant, t = -0.62, df = 122, p = .536
  - These findings are <u>consistent with the null effect observed in Call et al. (2015)</u>

- Caregiver discounting was not correlated with family characteristics*
  - Number of children, r(62) = .021, p = .866
  - Caregiver age, r(57) = -.02, p = .826
  - Behavior intensity, rs(62) = 0.003, p = .980
  - Educational level, rs(62) = -.086, p = .501

*Behavioral intensity and educational-level were converted into ordinal equivalents

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Initial Conclusions

- These results support the finding that delays affect caregiver-reported preferences for behavioral outcomes (i.e., SSR vs. LLR)

- This confirms a common challenge in Behavior Analysts—our procedures rarely produce immediate relief from problem behavior (we probably start by making it *worse*)

- A priori knowledge of how caregivers are to delayed gains could be useful in programming parent-mediated interventions

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Future Research

- Future research could better clarify the factors that contribute to the discounting of behavioral outcomes
  - Preliminary results suggest that family factors were not significantly correlated
  - Existing research has found that biases (DeHart & Odum, 2015) and individual traits (Odum, 2011) are more related to this phenomena

- Interventions designed to reduce individual discounting may be useful
  - Acceptance and Commitment Therapy
  - Episodic Future Thinking

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