



## Nevin Awardees SQAB 2021

All times are Eastern Daylight Time (UTC -4)

11:35 - 12:15 pm     **Poster spotlights/Nevin awards (alphabetized by 1<sup>st</sup> author's last name)**

### **Systematic review on effort discounting in humans: gaps and further research**

**Gisel G. Escobar**<sup>1</sup>, Silvia Morales Chainé<sup>1</sup> Suzanne H. Mitchell<sup>2</sup>

<sup>1</sup>National Autonomous University of Mexico, <sup>2</sup>Oregon Health & Science University

Response effort has a long research history in behavior analysis and is a ubiquitous feature in the decision-making literature. A growing literature examines the effect of effort requirements on choice using the discounting framework, that is, assessing how an outcome's subjective value decreases as the effort required to obtain it increases. We review such research studies that evaluate three types of effort: physical, cognitive, and emotional, as well as the mathematical descriptors used to summarize discounting rate and the functional relationship between various manipulations and effort discounting. We identify knowledge gaps due to the use of divergent definitions of effort, and suggest ways to standardize the highly heterogeneous methodologies and the data analyses.

### **Use of a novel non-differential stimulus change patterns of observing in pigeons**

**Peter B. C. Kim**, Douglas Elliffe

*University of Auckland*

Pigeons pecked at a response key to obtain wheat according to a two-component mixed schedule (VI 30 s/EXT). Observing responses produced 30 s presentations of discriminative stimuli that correlated with the current component. In one condition, pre-training forced pigeons to obtain reinforcers under the non-differential stimulus. When a trained non-differential stimulus was used, more observing responses closely followed the offset of an S- and were temporally distant from the offset of an S+. When a novel non-differential stimulus was used, no such pattern occurred. The data are taken to highlight the significance of the discriminated contingency of the non-differential stimulus which are often neglected in the observing literature.

### **Fixed-Interval Intervention Dose-Response Effects on Impulsive Choices**

**Kelsey Panfil**, Cathryn Haas, Kimberly Kirkpatrick

*Kansas State University*

Time-based interventions increase larger-later (LL) choices in rodents, but the minimum effective dose of intervention training is not yet established. Rats were exposed to interventions ranging 6 to 45 sessions. Rats that received the shortest intervention showed the sharpest increases in responding around the target delays. During the post-intervention choice test, all groups made more LL choices and were less sensitive to delay changes. Rats that received the shortest intervention made the most LL choices when delays to rewards were the same, indicating good magnitude discrimination. The results suggest that shorter intervention training doses may be warranted and could benefit mechanistic investigation of time-based interventions, particularly in studies using neuroscientific techniques that are constrained to short timelines.

### **Calculating the VB-SCoRE: Verbal Behavior Stimulus Control Ratio Equation**

**Janet Sanchez Enriquez**<sup>1</sup>, Lee L. Mason<sup>2</sup>, Alonzo A. Andrews<sup>3</sup>

*<sup>1</sup>University of North Carolina Charlotte, <sup>2</sup>Cook Children's Health System, <sup>3</sup>The University of Texas at San Antonio*

The Stimulus Control Ratio Equation (SCoRE) is a metric summarize a behavioral repertoire by comparing the relative frequency of its component parts. The SCoRE compares observed proportions of responding against the null hypothesis to yield a statistic to describe the present level of functional performance. Such information may be useful for measuring change over time and comparing treatment effects within individuals and across groups. Here we demonstrate the SCoRE as a measure of verbal behavior.

### **Control of transitions time by the likely future as signalled from the past in children with ASD.**

**Aleksandra Wood**<sup>1</sup>, Carsta Simon<sup>1</sup>, William Baum<sup>2</sup>, Silje Haugland<sup>1</sup>

*<sup>1</sup>University of Agder, <sup>2</sup>University of California, Davis*

I will investigate stimulus vs. reinforcer control during transitions from different reinforcement contexts. Are transition times controlled by the very recent past (local pattern), or the likely future based on more extended past experience (overall pattern)? This translational experiment has the potential to both illuminate the strengthening vs signalling debate and to help children with ASD to transition effectively between activities. My research will address the central question: "Control of transition time by the likely future as signalled from the past in children with ASD".

12:15 - 1:30 pm      **First Poster Session (alphabetized by 1<sup>st</sup> author's last name)**

**Resistance to change and transfer of function**

**Beatriz Elena Arroyo Antúnez**, Carlos Javier Flores Aguirre

*Centro de Estudios e Investigaciones en Comportamiento, Universidad de Guadalajara*

Five pigeons were exposed to a control and experimental conditions. Control condition consisted of pigeons trained on a multiple schedule, with a rich component (VI 30s), signaled by red, and a lean component (VI 120s), signaled by green. Pigeons were then exposed to the presentation of a pair of neutral stimuli, with no programmed consequences. Extinction and prefeeding probe sessions were done afterwards with the presentation of the neutral and discriminative stimuli. Experimental condition consisted on the same multiple schedule, however, pigeons were then exposed to a second order conditioning procedure, using the neutral stimuli and discriminative stimuli of the multiple schedule. Probe sessions were carried out. Results are interpreted according to Behavioral Momentum Theory, assessing transfer of function.

**Effect of an Olfactory Inducer on Delay Discounting in Smokers**

**Diego Ávila-Rozo**<sup>1</sup>, Arturo Clavijo-Álvarez<sup>2</sup>

*<sup>1</sup>Fundación Universitaria Konrad Lorenz, Bogotá, <sup>2</sup>Colombia Universidad Nacional de Colombia, Bogotá, Colombia*

Environmental factors might affect delay discounting (DD). Some studies have evaluated how images affect smokers' DD curves. Olfactory stimuli, because of its direct relation to smoking, might strongly affect DD. In this study, we evaluated how olfactory stimuli could affect the DD' areas under the curve (AUC) values for daily and intermittent smokers. Environmental factors seem to induce smoking in intermittent smokers but not in daily smokers. Cigarette smoke did not affect daily smokers AUC (areas under the curve), there was much more variability for intermittent smokers' AUC, and AUC's daily smokers were lower than one in comparison to intermittent smokers.

**To What Extent Does the Reinforcer Pathology Model Predict a Self-Reported Measure of Food Addiction?**

**Sierra Baca-Zeff**, Luis R. Rodriguez, Yaeen Lee, Erin B. Rasmussen

*Idaho State University*

The reinforcer pathology model postulates that people with substance use disorders may have preferences for immediate rewards over delayed rewards despite negative consequences and high valuation of a reward despite increases in price. This model was applied to "food addiction", specifically the Yale Food Addiction measure. We conducted a secondary analysis with 65 undergraduates. Participants completed the Yale Food Addiction scale, delay discounting tasks for hypothetical money and food, and a measure of demand for food. Preliminary results show no significant relations between demand elasticity and discounting tasks. In addition, there was no correlation

of these measures with the Yale Food Addiction scale. These data suggest that for “food addiction”, the reinforcer pathology model may not apply. Further research is required.

### **Framing Effects in Discounting of Delayed Losses**

**Humphrey Bamfo**<sup>1</sup>, Jeremy Haynes<sup>2</sup>, Amy Odum<sup>2</sup>

<sup>1</sup>University of Cape Coast, <sup>2</sup>Utah State University

Prior research has shown that individuals discount delayed monetary gains less steeply when delays are framed in terms of dates (e.g., March 13th, 2022) compared to delays framed in terms of calendar units (e.g., 9 months). We sought to extend this finding by examining whether individuals discount delayed monetary losses less steeply when delays are framed in terms of dates compared to calendar units. Overall, we replicated prior research showing that individuals discount monetary gains less steeply when delays are framed as dates and we extended these findings by showing that individuals also discount monetary losses less steeply when delays are framed as dates.

### **Bayesian Updating and Credible Intervals: An Application to Delay Discounting**

**Jason D. Cleveland**, Todd L. McKerchar

*Jacksonville State University*

Interest in the Bayesian statistical framework has increased considerably in recent years. This poster highlights two important features of this approach: Bayesian updating and credible intervals. Bayesian updating is an iterative process in which previously collected (“prior”) data is combined with new findings in an ongoing estimation process. Credible intervals (unlike confidence intervals) directly specify the most probable values of a parameter. We illustrate these two features of Bayesian statistics with an application to  $k$  values obtained from a delay-discounting task with 145 humans across three experiments. The Bayesian approach is philosophically consistent with the cumulative nature of science as well as the trend toward a more open science.

### **Reinforcement Learning (of the Machine Learning Kind) to Predict the Next Response**

**David J. Cox**<sup>1,2</sup>, Bryan Klapes<sup>3</sup>, John Falligant<sup>4,5</sup>

<sup>1</sup>BHCOE; <sup>2</sup>Endicott College, <sup>3</sup>Philadelphia College of Osteopathic Medicine – Georgia, <sup>4</sup>Kennedy Krieger Institute, <sup>5</sup>Johns Hopkins University School of Medicine

Molecular analyses predict and control behavior through discrete responses strengthened by contiguous reinforcers. Molar analyses predict and control behavior through response-reinforcer relationships aggregated across a temporal window. Unified analyses aim to leverage molecular and molar analyses to describe, predict, and control behavior. Here, we sought to take a unified analytic approach wherein quantitative analyses of behavior and machine learning combined to predict the next response a human made. To do this, we obtained data on every pitch thrown by a pitcher during the 2016-2019 Major League Baseball seasons. The dataset contained information about the game context, the pitch type and characteristics, and the consequences that followed every pitch. Molecular information was included through a weighted decay function placing greater weight on more recent reinforcers and by

making response-by-response predictions. Molar information was included through dynamically updating covariance relations between game context, pitch type, and pitch consequence via the generalized matching equation. Machine learning combined raw data, molecular information, and molar information to predict the next pitch. The resulting dynamic unified model of behavior led to higher response-by-response prediction accuracy than the molecular and molar approaches alone.

**Resurgence following voluntary abstinence from alcohol self-administration in rats**

**Kate E. Derrenbacher**, Charlene Agnew, William E. Sullivan, Emily L. Baxter, Henry S. Roane, Andrew R. Craig  
*SUNY Upstate Medical University*

Resurgence as it is typically studied in the laboratory necessitates extinction of the target response. This method is not face valid for modeling resurgence following contingency management treatment, wherein elimination of the target response is produced by delivering alternative reinforcement for voluntary abstinence. Upon removal of alternative reinforcement, however, a return to substance use (i.e. resurgence) often occurs. The present study aimed to develop a procedure to model resurgence of alcohol-seeking following contingencies supporting voluntary abstinence during treatment. A concurrent chains schedule of reinforcement provided initial-link choices between opportunities to respond for alcohol or non-alcohol (sucrose) rewards. When sucrose reinforcement was available we observed voluntary abstinence from alcohol choice. When sucrose was unavailable, however, resurgence to alcohol self-administration was observed.

**Systematic review on effort discounting in humans: gaps and further research**

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**Methods for Selective Breeding of High and Low Delay Discounting Lines**

**Katherine Garland**, Deborah Sevigny-Resetco, Skyler McShane, Suzanne H. Mitchell  
*Oregon Health & Science University*

Delay discounting (DD) is a heritable trait (~ .4 - .5) linked to the development of various psychopathologies, including addiction. Selectively breeding rodent lines



exhibiting extreme DD would provide a valuable resource to investigate DD's genetic basis. Using 255 heterogeneous stock rats, we selectively bred rats based on DD phenotypes determined via an adjusting-amount procedure assessing choice between a small, immediate sucrose reward and a delayed 150 ul reward (0, 2, 4, 8, 16 or 24 second delays). Twenty rats were excluded for non-systematic data or non-completion of 50% of sessions on delays under 24s. Normalized-AUC was used to create pairs of high-discounting and low-discounting rats, 24 each. The resulting offspring will comprise the first of a four-generation short-term selection.

### **Preference Reversals in Delayed Gratification**

**Jeremy Haynes**, Amy Odum

*Utah State University*

Among humans, patterns of preference for smaller-sooner outcomes over larger-later outcomes are associated with numerous maladaptive behaviors (e.g., smoking). One line of research aimed to improve human health has focused on developing interventions to increase choice for long-term outcomes (e.g., better health from quitting smoking). However, after choosing to pursue a long-term outcome, individuals must also maintain their preference for that outcome. The current study used a preclinical rat model to test whether learning the delays to an outcome would increase the likelihood of waiting for the long-term outcome after choosing it. Thus far, our results indicate that learning the specific delays to a long-term outcome may not influence the degree to which a rat can wait for that outcome.

### **Use of a novel non-differential stimulus change patterns of observing in pigeons**

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Pigeons pecked at a response key to obtain wheat according to a two-component mixed schedule (VI 30 s/EXT). Observing responses produced 30 s presentations of discriminative stimuli that correlated with the current component. In one condition, pre-training forced pigeons to obtain reinforcers under the non-differential stimulus. When a trained non-differential stimulus was used, more observing responses closely followed the offset of an S- and were temporally distant from the offset of an S+. When a novel non-differential stimulus was used, no such pattern occurred. The data are taken to highlight the significance of the discriminated contingency of the non-differential stimulus which are often neglected in the observing literature.

### **Temporal function of the reinforcer on the organization of behavior**

**Gabriela E. López-Tolsa**<sup>1,2</sup>, Armin Rezaeian<sup>2</sup>, Sarah Cowie<sup>3</sup>, Ricardo Pellón<sup>2</sup>

<sup>1</sup>Universidad Nacional Autónoma de México, <sup>2</sup>Universidad Nacional de Educación a Distancia,

<sup>3</sup>The University of Auckland

There is a current debate on how reinforcers affect the organization of behavior: either retrospectively ("reinforcing") or prospectively ("induction"). We conducted an experiment with rats to verify the temporal function of reinforcement. Subjects were

exposed to two levers that delivered reinforcement on a VI 5 s or a VI 50 s schedule, depending on where the last reinforcer was delivered. The distribution of behaviors was similar when no additional signal was present, and when the last-reinforcer location was signaled. When the next-reinforcer location was signaled, rats pressed the signaled lever. The reinforcer seemed to have an inductive function, but the organization of behavior seemed to depend as well on where the next reinforcer was more likely to be delivered.

### **The Peanuts Effect Without Gambling**

**Michael Losi**, Timothy Hackenberg, Vasilii Safin

*Reed College*

The “peanuts effect” or the tendency for individuals to be less risk averse when stakes are low has been consistently evoked by experiments investigating gamble preferences of different stakes. When the stakes are high, people are substantially risk averse. However, when playing for inconsequential sums they are much more prone to take risks. One explanation for the “peanuts effect” is that people discount small sums of money, whereas others posit that the effect is fundamentally related to risks or gambles. We investigate these explanations by trying to replicate the effect without gambles. By having participants allocate a set sum of money to one of two differently sized groups we found that people discount low money magnitudes when risk isn’t present.

### **Effects of Delay Exposure (DE) on Impulsive Choice and Alcohol Self Administration**

**Carla Martinez-Perez**, Rachel Loyst, Adam E. Fox

*St. Lawrence University*

This study aimed to investigate the relationship between delay discounting, delay exposure, and alcohol self-administration. Our objective was to assess if acute, forced exposure to delayed rewards increased choice for larger, later rewards (LLR) and decreased alcohol self-administration in 24 male Long Evans rats. Baseline alcohol self-administration was measured followed by a baseline delay discounting task. Rats were then acutely exposed to delayed or immediate rewards daily prior to the delay discounting task. Finally, a posttest alcohol self-administration test. Results indicated an initial increase in LLR choice for the delayed reward group, but no statistically significant difference between the groups after 30 days. Additionally, there was no meaningful relationship between alcohol self-administration, delay exposure, and delay discounting.

### **Effects of a Daily Experiential Delay Discounting Task on self-Control and Retrospective Timing**

**Juan Molano Gallardo**, Cristian Urbano Mejia, Arturo Clavijo-Álvarez

*Department of Psychology, Universidad Nacional de Colombia, Bogotá, Colombia*

Training in delay rewards improves self-control behavior. We measured the relation between self-control acquisition and retrospective timing estimations (RTE). In both experiments, participants solved an experiential delay discounting task during 16

sessions, 4 per week. Candies were the reward in Experiment 1, and video game playing was the reward in Experiment 2. We measured the RTE in the DD task in both experiments. In Experiment 2, we added a subjective valuation task. In Experiments 1 and 2, participants' self-controlled responses increased while the RTE decreased. Reward's value also increased after training in Experiment 2. We argue that timing plays a prominent role in temporal decision processes.

### **Effects of Visual Cues on Conditioned Salivation and Delay Discounting in Overweight and Healthy-Weight Women**

**Morgan Musquez**, Alam Alvarado, Bryan Fregoso, Erin B. Rasmussen  
*Idaho State University*

Food cues (FCs) serve as conditioned and discriminative stimuli for eating and likely play a role in obesity. This study aimed to condition and extinguish FC in healthy-weight and overweight/obese women and determine the extent to which they induce changes in delay discounting. Participants (23 overweight/obese and 26 healthy-weight) underwent Pavlovian conditioning with neutral visual cues paired with a chocolate reward during three conditions: baseline, acquisition, and post-extinction. Results show conditioned swallowing response was significantly higher in both overweight/obese and healthy-weight participants during acquisition. However, there were no group differences. Additionally, FC conditioning increased delay discounting during acquisition for obese/overweight participants, but no group differences were found at baseline and post-extinction.

### **Fixed-Interval Intervention Dose-Response Effects on Impulsive Choices**

**Kelsey Panfil**, Cathryn Haas, Kimberly Kirkpatrick  
*Kansas State University*

Time-based interventions increase larger-later (LL) choices in rodents, but the minimum effective dose of intervention training is not yet established. Rats were exposed to interventions ranging 6 to 45 sessions. Rats that received the shortest intervention showed the sharpest increases in responding around the target delays. During the post-intervention choice test, all groups made more LL choices and were less sensitive to delay changes. Rats that received the shortest intervention made the most LL choices when delays to rewards were the same, indicating good magnitude discrimination. The results suggest that shorter intervention training doses may be warranted and could benefit mechanistic investigation of time-based interventions, particularly in studies using neuroscientific techniques that are constrained to short timelines.

### **Effects of gonadectomy and supraphysiologic testosterone replacement on impulsive action in male rats**

**Henrique Reis**, Fábio Leyser Gonçalves  
*São Paulo State University*

The influence of gonadectomy and supraphysiologic testosterone replacement procedure on impulsive action was analyzed in 24 Wistar rats: 8 gonadectomized



(GND), 8 control (SHAM) and 8 gonadectomized with testosterone cypionate replacement (TEST) (10mg/kg/5days). Impulsive action was evaluated through a differential reinforcement of low rates schedule (DRL- 72s). Subjects were submitted to DRL 18s for 10 sessions, after that, DRL was increased to 72s, for 40 session or stability achievement. Response rate, reinforcement density and inter-response time distribution. Data were analyzed using a non-parametric ANOVA-Type statistic. Analysis indicated a significant difference between all three groups in response rate and GND and TEST in reinforcement density. IRT analysis indicated a main effect and interaction between IRT and TIME and IRT and GROUP.

### **Calculating the VB-SCoRE: Verbal Behavior Stimulus Control Ratio Equation**

**Janet Sanchez Enriquez**<sup>1</sup>, Lee L. Mason<sup>2</sup>, Alonzo A. Andrews<sup>3</sup>

<sup>1</sup>University of North Carolina Charlotte, <sup>2</sup>Cook Children's Health System, <sup>3</sup>The University of Texas at San Antonio

The Stimulus Control Ratio Equation (SCoRE) is a metric summarize a behavioral repertoire by comparing the relative frequency of its component parts. The SCoRE compares observed proportions of responding against the null hypothesis to yield a statistic to describe the present level of functional performance. Such information may be useful for measuring change over time and comparing treatment effects within individuals and across groups. Here we demonstrate the SCoRE as a measure of verbal behavior.

### **Cognitive Effort Discounting in ADHD and Healthy Control Adolescents**

**Deborah Sevigny-Resetco**, Suzanne H. Mitchell

Oregon Health & Science University, Portland, OR

ADHD has been linked to reward processing differences, and heightened delay discounting has been reported compared to healthy controls. However, differences in effort discounting have not been assessed. This study recruited ADHD-diagnosed and control participants aged 16-21 (N=33, female 42%, ADHD 54%). Participants rated six variants of a Sustained Attention Task and a Working Memory Task on the subjective effort required, then completed two Cognitive Effort Discounting Tasks posing choices between larger, monetary rewards requiring effort and smaller rewards requiring no effort, equated for subjective effort between groups. Systematic cognitive effort discounting curves were obtained, but ratings of subjective effort and area-under-the-curve did not differ between groups for either task.

### **Inequality Acceptance in a Three-Player Ultimatum Game**

**Aaron P. Smith**, Sergej Grunevski, & Richard Yi

Cofrin Logan Center for Addiction Research and Treatment, University of Kansas, Lawrence, KS

In two experiments, online participants decided to accept or reject hypothetical money distributions in a three-player ultimatum game. The offers came from either an undisclosed person (the proposer) or a computer while the third player (the bystander) had no say in the decision-making processes. The question of interest was whether participants would reject unfair

offers on behalf of the bystander which forfeited their own money. Inequitable offers were increasingly accepted as the participant's absolute monetary gain increased and when a computer made the offer. Participants stratified by social value orientation showed disparate results. Individualistic participants continually accepted inequitable offers to bystanders. Prosocial individuals decreased acceptance of inequitable offers to bystanders until their own monetary gain was high enough.

#### **The effects of escalated drug intake on decision-making dynamics.**

**McAllister Stephens**, Trinity Shaver, Joshua Beckmann

*University of Kentucky*

Concurrent choice procedures are used commonly to study decision-making in substance use disorder (SUD). Relatedly, it has been suggested that general decision-making deficits induced by chronic drug exposure underlie the development of SUD. To determine the effects of differential drug exposure on decision making, a choice procedure was run alongside a drug intake escalation procedure in rats. Isomorphic food choice was measured each day, followed by self-administered drug (cocaine or fentanyl) for 1 or 6 hours. Despite clear intake escalation (a commonly used indicator of addiction), isomorphic food choice did not differ between drug access groups, suggesting that decision-making remained intact and that general drug-induced deficits in decision-making are not likely an underlying contributor to SUD development.

#### **Caffeine Choice as a Prospective Predictor of Subjective Response to Methylphenidate and Nicotine**

Breanna Labos<sup>1</sup>, Orrin Ware<sup>1</sup>, Lauren Morris<sup>1</sup>, Thomas Dudey<sup>1</sup>, Michelle Hansen<sup>2</sup>, Darian C. Weaver<sup>3</sup>, Roland R. Griffiths<sup>1</sup>, **Mary Sweeney**<sup>1</sup>

*<sup>1</sup>Johns Hopkins University, <sup>2</sup>Fordham University, <sup>3</sup>American University*

Understanding individual differences in the reinforcing effects of drugs will improve substance use prevention. This study examines whether individual differences in caffeine reinforcement predict positive subjective effects of methylphenidate or nicotine. Participants eliminate dietary caffeine and are exposed to two double-blind, oral drug administration phases. Caffeine choosers are distinguished from non-choosers across choices between caffeine (200 mg/70 kg) or placebo. Subsequently, participants are exposed to methylphenidate (10, 20, and 40 mg/70 kg) and nicotine (1, 2, 3 and 4 mg/70 kg). Preliminary results suggest choosers show greater positive subjective effects of nicotine and methylphenidate relative to non-choosers, although choosers' response to nicotine was inconsistent. These data suggest caffeine reinforcement may reflect a broader vulnerability to effects of other drugs.

#### **Modeling IRT Distributions from DRL using a Combined Exponential and Gaussian Formula**

**Cole Vonder Haar**

*Ohio State University, Department of Neuroscience*

The Differential Reinforcement of Low-Rate Behavior schedule provides a relatively simple means of studying impulsivity. However, there is considerable understanding

which can be gained from studying the distribution of interresponse times (IRTs). Specifically, responses early in the time interval may represent disinhibited responding, while later responses may represent an estimate of the reinforced time. Historically these aspects have been analyzed separately, but are ultimately interdependent because any premature response delays reinforcement. In the current project, we fit DRL data using a combined exponential decay and gaussian formula to model the disinhibitory and timing-related responses, respectively. This combination described the data well and accounted for experimental manipulations, but only after the task was learned.

**Control of transitions time by the likely future as signalled from the past in children with ASD.**

**Aleksandra Wood**<sup>1</sup>, Carsta Simon<sup>1</sup>, William Baum<sup>2</sup>, Silje Haugland<sup>1</sup>

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