Society for the Quantitative Analyses of Behavior

42nd Annual Meeting, May 23 - May 24, 2019

Swissôtel Chicago, Chicago, IL

The Society for the Quantitative Analyses of Behavior (SQAB) was founded in 1978 by M. L. Commons and J. A. Nevin to present symposia and publish material which bring a quantitative analysis to bear on the understanding of behavior. Talks at SQAB focus on the development and use of mathematical formulations to characterize one or more dimensions of an obtained data set, derive predictions to be compared with data, and generate novel data analyses. You can retrieve more information about SQAB at our website, www.sqab.org

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Lewis Bizo
Tim Shahan
Alliston Reid
Randy Grace
Michael Commons
Billy Baum
Armando Machado
Peter Killeen
Tony Nevin
Richard Herrnstein

SQAB holds its annual meeting in conjunction with the Association for Behavior Analysis International (ABAI).

SQAB thanks the Association for Behavior Analysis International (ABAI) for generous support that helps to make this meeting possible, and encourages SQAB participants to take advantage of the ABAI convention that begins immediately following the SQAB program. The ABAI Program includes many presentations on experimental and applied behavior science. A separate registration fee and badge are required to attend the ABAI meeting.

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Florida Institute of Technology
Melbourne, FL, USA
cpodlesnik@fit.edu

Program Chair/President-Elect
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Oregon Health & Science University
Portland, OR, USA
mitchesu@ohsu.edu

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University of Nebraska Medical Center
Omaha, NE, USA
Brian.greer@unmc.edu

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University of Kansas
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asalzer@ku.edu

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St. Lawrence University
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afox@stlawu.edu

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Univ Nacional de Educación a Distancia
Madrid, Spain
gabrielaeugenia.89@gmail.com

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University of Nebraska Medical Center
Omaha, NE, USA
ryan.kimball@unmc.edu

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University of Wisconsin – Eau Claire
Eau Claire, WI, USA
lagorich@uwec.edu

Tutorials/Media Coordinator
Todd McKerchar
Jacksonville State University
Jacksonville, AL, USA
tmckerchar@jsu.edu

Webmaster
Shawn Gilroy
Louisiana State University
Baton Rouge, LA, USA
Sgilroy1@lsu.edu

Jason Bourret
Western New England University
Springfield, MA, USA

Sarah Cowie
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Auckland, New Zealand

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University of Kansas
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Mark Reilly
Central Michigan University
Mount Pleasant, MI, USA

Key locations:

Registration desk is outside Vevey Ballrooms 1-3

General sessions are in Vevet Balrooms 1-3

Poster sessions are in Vevey Ballroom 4.

Thursday, May 23: Registration, 11:30 am -1:00 pm

1:00 **Christopher A. Podlesnik, Florida Institute of Technology**: *President's Introduction*

1:15 **Thomas R. Zentall, University of Kentucky**: *Procrastination in the Pigeon: Can Conditioned Reinforcement Increase the Likelihood of Human Procrastination?*

1:55 **Jerry B. Richards, University at Buffalo**: *Genome Wide-Association Study (GWAS) of Operant Behavior in Rats*

Break and Refreshments: 2:35 – 2:50

2:50 **Todd L. McKerchar, Jacksonville State University**: *Tests of an Indifference Rule in Variable-Delay and Double-Reward Choice Procedures with Humans*

3:30 **Emma Childs, University of Illinois at Chicago**: *Using Conditioned Place Preference to Study Drug Conditioning in Humans*

Break and Refreshments: 4:10 – 4:25

4:25 **Richard Yi, University of Kansas**: *Associations between Cannabis Use Measures and Valuation of Future Cannabis*

5:05 **Randolph C. Grace, University of Canterbury**: *On the Origins of Computationally-Complex Behavior*

– First Poster Session & Cash Bar: 7:00–9:30 pm –

Friday, May 24: Registration, Coffee, & Pastries, 7:45 – 9:00 am

8:00 – 8:50

Student member-focused panel discussion (though all are welcome to attend):

What's Next? A Panel Discussion on Opportunities after Graduate School

Jonathan E. Friedel, National Institute for Occupational Safety and Health

Jillian M Rung, University at Buffalo

Forrest Toegel, The Johns Hopkins University

Chair: Allyson R. Salzer, The University of Kansas

SQAB ~~ PROGRAM OVERVIEW

9:00   **Sally L. Huskinson, University of Mississippi Medical Center**: *Uncertainty as a Major Factor Underlying Substance Use Disorder*

9:40   **Jonathan W. Pinkston, Western New England University**: *The Force Awakens: Clarifying the Role of Response Effort*

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Break and Refreshments: 10:20 – 10:35

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10:35   **Emanuela De Falco, Indiana University-Purdue University Indianapolis**: *Dynamic Patterns of Cortical Neural Activity Predict Performance in a Self-Guided Working Memory Task in Rats*

11:15   **A. David Redish, University of Minnesota**: *The Contrasting Neurophysiology of Foraging and Deliberation in Mice, Rats, and Humans*

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Lunch: 11:55 – 1:30

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1:30   **Daniel M. Bartels, University of Chicago**: *A Preliminary Investigation of How Well (and Maybe Why) Laboratory-Derived Estimates of Temporal Discounting Relate to Self-Reported Behaviors*

2:10   **Meredith S. Berry, University of Florida**: *Visual Exposure to Nature Expands Time and Space Perception and Reduces Delay Discounting*

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Break and Refreshments: 2:50 – 3:10

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3:10   **Warren K. Bickel, Virginia Tech Carilion Research Institute**: *Resolving a Contradiction of Addiction/Obesity Science by Clarifying the Function of Substances and Obesogenic Foods: A Behavioral Economic Approach*

3:50   **The Tony Nevin Invited Student Presentation Series**

Bryan Klapes, Emory University: *Punishment in a Procedure for Rapidly Establishing Steady-State Behavior [Poster# 68]*

Brian Howatt, Kansas State University: *Adaptive Learning in Competitive Games [Poster# 40]*

Julio Camargo, Universidade Federal de São Carlos: *Using Generalized Linear Mixed-Effects Models to Analyze Data from a Common-Pool Resources Task [Poster# 55]*

Robert LeComte, The University of Kansas: *A Comparison of Responding during Three and Four Phase Resurgence Paradigms [Poster# 45]*

Cristina Santos, University of Minho: *The Effect of Reinforcement Probabilities and Reversal Predictability in a Contingency Reversal Rask [Poster# 72]*

4:30   **Awards & Closing Remarks**

4:35   **Business Meeting**

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– Second Poster Session & Cash Bar: 7:00–9:30 pm –

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Saturday, May 25: Swissôtel, Zurich D

10:00 – 10:50 Sarah Cowie, The University of Auckland:
Using the Past to Predict the Future
Chair: Michael Davison, The University of Auckland

11:00 – 11:50 William B. DeHart & Jonathan E. Friedel, Virginia Tech Carillion Research Institute and National Institute for Occupational Safety and Health:
Multilevel Modeling for Single-Subject Designs and Model Fitting
Chair: Michael Young, Kansas State University

12:00 – 12:50 The Potential of Statistical Inference in Behavior Analysis: A Panel with Discussion
Christopher Franck, Virginia Tech
Michael Young, Kansas State University
Amy Odum, Utah State University
Chair: Derek Reed, The University of Kansas

3:00 – 3:50 Paul Soto, Louisiana State University:
Using Genetically Modified Organisms to Probe Neurobiological Bases of Behavior
Chair: Jesse Dallery, University of Florida

4:00 – 4:50 Caio Miguel, California State University, Sacramento:
Stimulus Equivalence 101
Chair: Anna I. Petursdottir, Texas Christian University

5:00 – 5:50 Derived Stimulus Relations: A Panel with Discussion
Erik Arntzen, Oslo and Akershus University College
Karen Lionello-Denolf, Assumption College
Daniel Fienup, Columbia University
Chair: Anna I. Petursdottir, Texas Christian University

SQAB Invited Preeminent Tutorials are recorded and made available on iTunes and YouTube:
youtube.com/c/SocietyfortheQuantitativeAnalysesofBehavior

Welcome to ∫QAB 2019

11:30 am -5:00 pm   Registration, outside Vevey Ballrooms 1-3

1:00 pm   **President's Introduction**
                    Christopher A. Podlesnik
                    Florida Institute of Technology

1:15 - 1:55 pm   **Procrastination in the Pigeon: Can Conditioned Reinforcement Increase the Likelihood of Human Procrastination?**
                    Thomas R. Zentall
                    University of Kentucky (USA)

Procrastination is the tendency to put off initiation or completion of a task. Although people are typically known to procrastinate, recent research suggests that they sometimes "pre-crastinate" by initiating a task sooner than they need to (Rosenbaum et al., 2014). We tested for pre-crastination by giving pigeons a choice between two concurrent chains. Choice of the pre-crastination chain resulted in Color A that 5-s later would change to Color B and 15-s later resulted in reinforcement. Choice of the procrastination chain resulted in Color C that 15-s later would change to Color D and 5-s later resulted in reinforcement. Thus, both chains led to reinforcement after 20 s. Results indicated that the pigeons procrastinated. They preferred the 15-5 chain to the 5-15 chain. The results are consistent with Fantino's (1969) delay reduction theory which posits that stimuli that signal a reduction in the delay to reinforcement, such as the 5-s stimulus that occurred immediately prior to reinforcement, serve as strong conditioned reinforcers and should be preferred. The results raise the possibility that delay reduction, a theory that emphasizes the attraction to stimuli that predict reinforcement with a short delay, also may contribute to human procrastination behavior because when task completion comes just before the deadline it may become a stronger conditioned reinforcer than if task completion comes earlier.

1:55 - 2:35 pm   **Genome Wide-Association Study (GWAS) of Operant Behavior in Rats**
                    Jerry B. Richards
                    University at Buffalo (USA)

We have quantitatively characterized the behavior of 1600 genetically heterogeneous rats on 5 different behavioral tasks. 1)Locomotion in a novel environment, 2)light reinforcement, 3)social reinforcement,

4)reaction time and 5)discounting of delayed reinforcers using a foraging task. A Genome wide association study (GWAS) was performed with the goal of discovering genetic correlations between behavior and genes. Aspects of all 5 tasks were found to significantly correlate with specific genetic loci. The rats used in the GWAS study were pair housed in standard laboratory cages. The performance of the standard pair house rats was compared to the performance of 60 rats housed in a complex enriched environment. It was found that rearing the rats in a complex environment produced a clear effect on the 5 behavioral tasks in comparison to standard housed rats. In this talk we will focus on performance of the reaction time and delay discounting tasks. The results indicate that both the genetic endowment and environment determine behavioral performance and that these effects can be quantitatively characterized.

2:35 - 2:50 pm	Break

2:50 – 3:30 pm	**Tests of an Indifference Rule in Variable-Delay and Double-Reward Choice Procedures with Humans** Todd L. McKerchar *Jacksonville State University (USA)*

Mazur's (1984, 1986) weighted-average hyperbola is a model that predicts a preference for reinforcers with variable over fixed delays as well as multiple over single reinforcers. As a mathematical model, it also predicts the indifference values in each case (i.e., an indifference rule). Results with rats and pigeons support these predictions. In contrast, some research with human participants making hypothetical choices has not supported this indifference rule (McKerchar & Mazur, 2016). Across three experiments, we again test the predictions of Mazur's indifference rule in hypothetical choice procedures with humans. In Experiment 1, participants chose between two monetary alternatives, one consisting of a fixed delay and another consisting of two delays of equal probability (i.e., a variable-delay procedure). In Experiment 2, participants chose between a single, immediate reward and two rewards, one immediate and one delayed (i.e., a double-reward procedure). Experiment 3 also used a double-reward procedure, but with two delayed rewards. Participants in all three experiments also completed a standard delay-discounting task. Finally, three reward amounts were tested in each type of task ($100, $1000, and $5000). In the double-reward conditions (Experiments 2 and 3), the results were in good qualitative and quantitative agreement with Mazur's model. In contrast, when participants made choices involving variable delays (Experiment 1), there was relatively poor qualitative and quantitative agreement with this model. These results, along with our previous findings, suggest the structure of questions in hypothetical tasks with humans can be a strong determinant of the choice pattern.

3:30 - 4:10 pm	**Using Conditioned Place Preference to Study Drug Conditioning in Humans** Emma Childs *University of Illinois at Chicago (USA)*

Drug cues (i.e., the people, places, and paraphernalia surrounding drug taking experiences) are a major barrier to prolonged drug abstinence and render individuals vulnerable to relapse even after long drug-free periods. Cues are a feature of all major addiction theories, yet there is little clinical

evidence of how drug cue associations are formed, how drug cues come to profoundly control behavior, and how they stimulate drug use in humans. Consequently, there are few effective approaches to target the potent influences of drug cues in the treatment of drug abuse and addiction. In recent years, we have translated the preclinical conditioned place preference procedure to humans and are using the model to study drug conditioning processes in recreational drug and alcohol users. The presentation will discuss findings that show laboratory contextual conditioning with stimulants and alcohol produces associations that induce approach responses, control attention, activate regions of the brain involved in reward/motivational processing, stimulate drug consumption, and are related to escalation in real-world drug use. Together, the data indicate that human CPP models the drug conditioning processes occurring during real-world drug taking experiences, and can be used to design and test novel cue-focused treatments for addiction.

4:10 – 4:25 pm	Break

4:25 - 5:05 pm   **Associations between Cannabis Use Measures and Valuation of Future Cannabis**
Richard Yi
University of Kansas (USA)

Cannabis is the most widely used illicit drug among young adults and can have various adverse effects, including psychosocial impairments and cannabis-related problems. The present study examined the associations between cannabis use measures and numerous behavioral economic assessments including single and cross-commodity delay discounting of money and cannabis, relative reinforcing efficacy of cannabis (via cannabis purchase task), and reinforcement from cannabis-associated activities. Ninety-five cannabis-using young adults (20.66 years of age, 15.34 days in past month use) completed session 1 at T1 and session 2 at T2, 3 months later. Noteworthy findings include: (1) predicted associations between cannabis demand measures and single/cross-commodity delay discounting of money and cannabis, (2) an inverse association between T1 predictions for T2 demand of cannabis and observed demand at T2, and (3) an association between reinforcement from cannabis-related activities at T1 and greater cannabis-related problems at T2. These results provide supporting evidence for the utility of behavioral economic constructs as a framework for the study of cannabis use and cannabis use disorder.

5:05 – 5:45 pm   **On the Origins of Computationally-Complex Behavior**
Randolph C. Grace
University of Canterbury (New Zealand)

There is considerable evidence for adaptive behavior that is computationally complex, that is, appears to require the equivalent of mathematical calculation by the organism. Spatial navigation by path integration is perhaps the best example. The most influential account of such behavior has been Gallistel's computational-representational theory, which assumes that organisms represent key environmental variables such as direction and distance travelled as real numbers stored in engrams, and are able to perform arithmetic operations on those

representations. Here we propose that computationally-complex behavior suggests that organisms' perceptual systems represent an algebraic field, a mathematical object consisting of two commutative groups connected by a distributive property, which generalizes the intuitions underlying arithmetic. We review recent research with an 'artificial algebra' task, in which human observers learn arithmetic relations between nonsymbolic stimulus magnitudes by trial and error and without explicit instruction. Results suggest that the perceptual system automatically computes two operations when comparing stimulus magnitudes, corresponding to differences and ratios, and that the commutative and associative properties of an algebraic group are satisfied when observers are trained to add stimulus magnitudes. If these findings can be extended to nonhumans, a field representation suggests that at the neural level we should look for evidence of symmetries corresponding to the additive and multiplicative groups. Finite fields may be more biologically plausible than fields involving real numbers, and allow for both linear and logarithmic representations of magnitude.

7:00 - 9:30 pm   **First Poster Session & Cash Bar, Vevey Ballroom 4**

For abstracts of all posters see https://www.sqab.org/Conference.html

All posters have been assigned a number.
For <u>even-numbered posters</u> – presenters will be standing by the poster from 7:30 pm – 8:15 pm.
For <u>odd-numbered posters</u> - presenters will be standing by the poster from 8:15 pm – 9:30 pm.

1. **Effects of Increased Serotonin on Aβ Production in BACE-1 KO Alzheimer's Disease Model Mice**
   Tessa R. Lutterman[1], Rodney D. Clark[1], E. Lee Coates[1]
   [1] Allegheny College

2. **Delay Discounting of Token Rewards with Pigeons**
   Ricardo Campos Rivera[1], Cristiano Valerio dos Santos[1]
   [1] University of Guadalajara

3. **Effects of High Effort Training on Effort-Based Impulsive Choice**
   Sara Peck[1], Gregory J. Madden[1]
   [1] Utah State University

4. **Be(e) Positive! Probing Melipona Quadrifasciata for Select and Reject Controlling Relations after Simple Discrimination Learning**
   Livia Scienza[1] Marilia P. de Carvalho[2], Armando Machado[3], Antonio Mauricio Moreno[4], Natalia Biscassi[5], Deisy de Souza[1]
   [1] Universidade Federal de São Carlos, Brazil, [2]Universidade Federal do Pará, Brazil
   [3] Universidade de Aveiro, Portugal, [4] Universidade Estadual do Sudoeste da Bahia , Brazil
   [5] Universidade de São Paulo, Brazil

5. **Interrelations Between Co-substance Use and Temporal Discounting in Undergraduate Students: Implications for the Reinforcer Pathologies Model of Addiction**
   Tyler Thornton[1], Gideon Naudé[1] Derek Reed[1]
   [1] Kansas University

6. **Evaluation of Local Behavior Dependence in Continuous and Discontinuous Environments**
   Amanda Miles [1], William Palya [1]
   [1] Jacksonville State University

7. **Do Pigeons Book Ahead for Lunch?**
   Michael Davison[1], Sarah Cowie[1]
   [1] Auckland University

8. **Examining the Intersection Between Resurgence and Variability Following Discontinuation of Reinforcement for Previously Reinforced Responding**
   Carolyn Ritchey[1], Yaara Shaham[1], Ronald Joseph Clark[1], Victoria Ryan[1], Yuto Mizutani[2], Weizhi Wu[1], Toshikazu Kuroda[3], Christopher A. Podlesnik[1]
   [1] Florida Institute of Technology, [2] Aichi Gakuin University, [3] Aichi Bunkyo University

9. **Withdrawn**

10. **The Effects of the Ratio of Smaller-Sooner and Larger-Later Delays in an Impulsive Choice Task**
    Travis Smith[1], Anderson Fitch[1], Kourtney Rumbach[1], Kimberly Kirkpatrick[1]
    [1] Kansas State University

11. **Coordinated Social Behavior Under Fixed- and Variable-Interval Schedules**
    Lucas Couto de Carvalho[1], Deisy das Graças de Souza[1]
    [1] Universidade Federal de São Carlos

12. **Effects of Opportunity Costs on Delay Discounting for Hypothetical Money and Food**
    Yaeeun (Joy) Lee[1], Luis R. Rodriguez[1], Paul Steen[1], Erin Rasmussen[1], Kelsie Hendrickson[2]
    [1] Idaho State University, [2] St. Luke's Clinic Behavioral Health Services

13. **Delay Discounting and Obesity-Related Demographic Information Differ Between Food Insecure and Food Secure Women**
    Ethan Hemmelman[1]
    [1] Idaho State University

14. **Measuring Transfer of Stimulus Control: Pigeons Acquiring Behavioral Skills**
    Alliston K. Reid[1], Elizabeth G. E. Kyonka [2], Sarah Cowie[3]
    [1] Wofford College, [2] University of New England, [3] The University of Auckland

15. **Abstinence from Cocaine Impairs Behavioral Inhibition and Alters Neural Activity in the Prelimbic Cortex**

Travis M. Moschak[1], Regina M. Carelli[1]

[1] Department of Psychology and Neuroscience, University of North Carolina, Chapel Hill, NC

16. **When a Stay is a Switch: Discriminative Control of Response Chunks Determines Preference During Concurrent VI VI Schedules**

J. Mark Cleaveland[1], Kelsie Milburn[1], Anna Roselle[1]

[1] Vassar College)

17. **An Excel Add-in to Teach and Learn Statistical Models**

Armando Machado[1]

[1] University of Aveiro, Portugal

18. **Resurgence Controlled by Different Stimulus: a Within-Session Assessment**

Cinthia M. Hernãndez [1], Kenneth Madrigal[1], Carlos Flores[1]

[1] Universidad de Guadalajara

19. **Monkey See Computer Do: Simulation of Dynamic Behavior via the Evolutionary Theory of Behavior Dynamics**

Cyrus Chi[1], Jack McDowell[1]

[1] Emory University

20. **Human Preferences for Sequences of Hypothetical Monetary Outcomes: Effects of Amount and Time**

Blayne B. Hyatt[1],Todd L. McKerchar, Ph. D. [1]

[1] Jacksonville State University

21. **Effects of Acute and Chronic Stress on Prospective Interval Timing in Rats**

David Renteria[1], Tanya Gupta[1], Federico Sanabria[1]

[1] Arizona State University

22. **Timing and Impulsive Choice in the CNTNAP2 Knockout Rat Model**

Cole Poulin[1], Makayla Rogers[1], Hannah Mungenast[1], Rachel Loyst[1], Paige M. Currie[1], Cheyenne McQuain[1], Adam E. Fox[1]

[1] St. Lawrence University

23. **Choices in Situations of Time-Based Diminishing Returns: Effects of Methylphenidate on "Impulsive" Behavior**

Matthew E. Conzola[1], Christine E. Hughes[1], Raymond C. Pitts[1]

[1]University of North Carolina Wilmington

24. Real Contingencies in Effort Discounting by Overweight Adolescents: Using a Video Game

Gisel G. Escobar [1], Silvia Morales Chainé [1], Laura Jaqueline De la Rosa Vidal [1]
[1]National Autonomous University of Mexico, UNAM

25. Effects of Non-Contingent Shocks on Self-Control Behavior and Preference Reversal in Wistar Rats

Camilo Hurtado-Parrado[1,2], Alejandro Segura [3], Julián Cifuentes [1], Angélica Gómez [1], Juan Carlos Forigua [1], Julian Camilo Velázquez [1], Milena Amortegui [1], Daniela Tovar [1], Sarai Quintana
[1] Konrad Lorenz University, [2] Troy University, [3] Universidad de Guadalajara

26. Interoceptive Drug Conditioning: Sex Matters in the Extent of the Discrimination Between Nicotine and Bupropion

Andrea E. Moran [1], Y. Wendy Huynh[1], Andrew P. Finkner[1], Carly Selleck[1], Scott T. Barrett[1], Rick A. Bevins[1]
[1] Unviersity of Nebraska

27. Defecting During the Delay: Delay Maintenance in Rats

Jeremy M. Haynes [1],Charles C. J. Frye [1], Annie Galizio [1], Ryan J. Becker [1], D. M. Perez [1], Amy L. Odum [1]
[1] Utah State University

28. Numerosity Discrimination: Can Pigeons Report Uncertainty?

Catarina Soares [1], Armando Machado [2], Marco Vasconcelos [2]
[1] University of Minho, Portugal, [2] University of Aveiro, Portugal

29. A Proposal of a Little but Significant Adjustment of the Rate Maximization Model

Laurent Avila-Chauvet[1], Óscar Garcia -Leal[1], Alejandro Segura[1]
[1] University of Guadalajara

30. The Role of Prior Delay Exposure on Intertemporal Choice Preference in Rats

Eric J. French[1], Mark P. Reilly[1]
[1] Central Michigan University

31. Behavioral Economic Demand Elasticity Significantly Predicts Blood Nicotine Across Reduced-Nicotine Cigarettes: A Preliminary Analysis

Brent Kaplan[1], Elisa Crill [1], Haley McBee [2], Warren Bickel [1], Mikhail Koffarnus [1]
[1] Fralin Biomedical Research Institute at VTC, Virginia Tech, [2] Virginia Commonwealth University

32. Mitigating Renewal of Pediatric Feeding Problems

Ronald J. Clark [1, 2], Ryan Walz[1, 2], Marissa Kamlowsky[1, 2], Corina Jimenez-Gomez[1], Christopher A. Podlesnik[1]
[1] Florida Institute of Technology, [2] The Scott Center for Autism Treatment

33. Concurrent and Single-Alternative Progressive Ratio Schedules in Rats
Matthew Locey [1], Courtney Smith [1]
[1] University of Nevada

34. Molar Analysis of Active Patterns in Human Relational-Behaviour: Beyond Contemplative Responses in a Transposition-Based Task
Alejandro León [1], Emilio Ribes [1], Diana Estefania Andrade [1], Varsovia Hernández Eslava [1]
[1] Universidad Veracruzana

35. Quantitative Analysis of Discriminability and Bias during Conditional Discriminations with Changes in Sample and Comparison Disparity
Tiara Putri[1], Courtney Hannula[2], Weizhi Wu[1], Carolyn Ritchey[1], Adam Brewer[3], Blake Hutsell[4] Corina Jimenez-Gomez[1,5], Christopher A. Podlesnik[1]
[1] Florida Institute of Technology, [2] Coastal Behavior Analysis, [3] Western Connecticut State University
[4] East Carolina University, [5] The Scott Center for Autism Treatment

36. Poor Stimulus Control in Multiple Frequency-Dependent Schedules of Reinforcement in Pigeons
Haylee Downey[1], Ryan J. Becker[1], & Amy L. Odum[1]
[1]Utah State University

37. Temporal Discounting of Aversive Stimulation in Spontaneously Hypertensive Rats
Fernanda González-Barriga[1], Valamir Orduña[1]
[1] **Universidad Nacional Autónoma de México**

38. Effects of Within-Session Progressive-Interval Schedules of Alternative Reinforcement on Resurgence
Anthony Nist[1], Timothy Shahan[1]
[1]Utah State University

8:00 am - 5:00 pm   Registration, outside Vevey Ballrooms 1-3

8:00 – 8:50 am   Student member-focused panel discussion (though all are welcome to attend):

What's Next? A Panel Discussion on Opportunities after Graduate School

Jonathan E. Friedel, National Institute for Occupational Safety and Health

Jillian M Rung, University at Buffalo

Forrest Toegel, The Johns Hopkins University

Chair: Allyson R. Salzer, The University of Kansas

9:00 - 9:40 am   **Uncertainty as a Major Factor Underlying Substance Use Disorder**
Sally L. Huskinson
University of Mississippi Medical Center (USA)

Illicit drugs are relatively unpredictable in their quality, cost, time and effort to obtain, and associated risks relative to nondrug alternatives. We know that behavior maintained by variable-ratio (VR) schedules is more persistent than behavior maintained by fixed-ratio (FR) schedules, and reinforcers available under VR conditions are chosen over the same reinforcers under FR conditions. In this talk, I will discuss our methods and preliminary results evaluating variable cost as a determinant of cocaine self-administration in rhesus monkeys. In choice experiments, we use drug vs. nondrug choice to evaluate the prediction that cocaine's potency as a reinforcer will be increased when it is delivered under a VR and food under an FR and will be decreased when food is delivered under a VR and cocaine under an FR. In behavioral history experiments, we hypothesize that long-term exposure to a VR schedule of cocaine will increase the potency and effectiveness of cocaine relative to FR exposure. Confirmation of our hypotheses may indicate that uncertainty in terms of cost is a contributing factor to the excessive allocation and perseverative nature of behavior toward procuring drugs at the expense of nondrug alternatives. Additional implications and future directions of this work will be discussed.

9:40 – 10:20 am   **The Force Awakens: Clarifying the Role of Response Effort**
Jonathan W. Pinkston
Western New England University (USA)

Response effort remains a poorly understood concept, despite its ubiquity in behavior. Prevailing operant paradigms deemphasize behavior's continuous dimensions, and this poses the major impediment to understanding effort and its meaning for behavior. This presentation will develop an alternative paradigm for studying one aspect of effort, response force. We present recent studies

from our lab that challenge some of the conventional wisdom surrounding force and effort, namely that they are aversive and reduce responding. In fact, force and effort's effects are nuanced and may reduce or enhance response output. We further suggest that many studies supporting the contention that force and effort are aversive may instead reflect a measurement artifact. Our findings suggest effort may be better understood as an expenditure in relation to its gains, and it's meaning is found in the economic concepts of price and demand. These data underscore an essential role for response dimensions in the pursuit of behavioral principles.

10:20 – 10:35 am	Break

10:35 – 11:15 am **Dynamic Patterns of Cortical Neural Activity Predict Performance in a Self-Guided Working Memory Task in Rats**
Emanuela De Falco
Indiana University-Purdue University Indianapolis (USA)

Integration of behavioral analysis and neural activity recordings can help us to understand how the brain generates complex behaviors. In this presentation, I will describe a recent work carried out towards this goal. Here, we obtained neural recordings from the medial prefrontal cortex of awake, behaving rats performing an odor span task of working memory capacity. We investigated how distinct aspects of the task are encoded by behavioral variables and by neural population activity. Performance across recording sessions was found to be bimodal, but analyses of the rats' choices and latencies during trials did not show differences related to ultimate performance. However, when looking at neural recordings, the activity of a sub-population of putative pyramidal neurons was, in fact, predictive of performance. Finally, several dynamic activity patterns were found to encode distinct aspect of the task (e.g. task epoch, novelty, error), suggesting that computation in mPFC may facilitate a broad array of behaviors in this task.

11:15 – 11:55 am **The Contrasting Neurophysiology of Foraging and Deliberation in Mice, Rats, and Humans**
A. David Redish
University of Minnesota (USA)

Decisions are fundamentally questions of information processing. Any decision entails a complex process of combining information about the past, present, and potential future, and selecting appropriate actions. Using behavior and neurophysiology in mice, rats, and humans, we will show that the fundamental information processing processes differ under foraging (choose to stay or go) and deliberative (choose between options) decisions. This turns out to have important implications for economic decision making, including a susceptibility to sunk costs under some conditions and not others.

11:55 - 1:30 pm	Lunch – SQAB Executive Committee Meeting

1:30 – 2:10 pm   **A Preliminary Investigation of How Well (and Maybe Why) Laboratory-Derived Estimates of Temporal Discounting Relate to Self-Reported Behaviors**
Daniel M. Bartels
University of Chicago (USA)

We examine when and why laboratory-derived estimates of time preference relate to field behaviors with delayed consequences, ranging from retirement savings to leaving dirty dishes out overnight, from investing in one's educations to flossing. These behaviors can vary in how well they are predicted by measures of time preference, for statistical reasons (e.g., measurement reliability) and for theoretical reasons. We surveyed 1308 participants in two waves of data collection, separated by four months. Our analyses focus on two issues: How well do time preferences predict each of 36 field behaviors, relative to other factors (e.g., demographic variables, personality traits, other behaviors), and we find that for many behaviors, estimates of time preference yield unique explanatory variance and place the predictive validity of these measures in a broader context (e.g., evaluated against the predictive validity of other factors under several model specifications). Second, to understand how time preference enters into decision making across a variety of behaviors, we examine how differences across these behaviors in both domain (e.g., money vs. health vs. social obligations) and in psychological factors that differentiate the behaviors (e.g., some are habitual, others represent self-control dilemmas, for some others, the only rationale for the behavior is the intertemporal tradeoff) moderate how well the behaviors are predicted by estimates of time preference.

2:10 – 2:50 pm   **Visual Exposure to Nature Expands Time and Space Perception and Reduces Delay Discounting**
Meredith S. Berry
University of Florida (USA)

Visual exposure to natural environments has well-documented benefits for human well-being in areas of stress reduction, mood improvement, and attention restoration, but the effects of natural environments on impulsive decision-making within a delay discounting task remain preliminary. The delay discounting paradigm offers generality, predictive validity, and insight into decision-making related to unhealthy behaviors. The present series of experiments evaluated differences in delay discounting in humans experiencing visual exposure to either natural (e.g., mountains, forests) or built (e.g., roads, buildings) environments. Participants viewed the images before and during the delay discounting tasks in which they were required to choose between immediate and delayed hypothetical monetary or other outcomes. Across several experiments, participants discounted less in the condition providing visual exposure to natural scenes compared to built scenes. These results may be related to the expansion of time and space perception with visual exposure to nature.

2:50 – 3:05 pm   Break

3:05 – 3:45 pm   **Addiction/Obesity Science by Clarifying the Function of Substances and Obesogenic Foods: A Behavioral Economic Approach**
Warren K. Bickel
Virginia Tech Carilion Research Institute (USA)

Substances are clearly powerful reinforcers such that individuals in the pursuit of addictive substances will forfeit relationships, their employment, their health and even their lives as evidenced in the recent opioid overdose epidemic. Similarly, the power of obesogenic foods can result in negative health outcomes. However, other observations contradict the seeming power of addictive substances and obesogenic foods among the afflicted. For example, contingency management can readily achieve abstinence or weight loss in substance-dependent and obese individuals, respectively. This contradiction in addiction and obesity science can be summarized by this question: Are drugs and obesogenic foods so strong as to give up employment, health, relationships, and life or are they so weak that abstinence can be achieved by making a few dollars contingent on drug-free biological samples? In this presentation, I will reconcile this contradiction by analyzing existing data in the light of novel applications of economic and behavioral economic principles.

3:45 pm   **The Tony Nevin Invited Student Presentation Series**

3:45 - 3:55 pm   *Punishment in a Procedure for Rapidly Establishing Steady-State Behavior [Poster# 68]*
Bryan Klapes[1], J. J McDowell [1]
[1] Emory University

The Procedure for Rapidly Establishing Steady-State Behavior [PressB; Klapes, Calvin, & McDowell, manuscript submitted for publication, (2019)] is a discriminated rapid-acquisition laboratory procedure for human continuous choice. Here, we display PressB's ability to assess human continuous choice behavior when both gains and losses are associated with operant performance. We replicated an experiment by Critchfield, Paletz, MacAleese, and Newland [Journal of the Experimental Analysis of Behavior, 80, 1-27 (2003)] during which variable-interval (VI) punishment schedules were superimposed on equivalent concurrent VI VI reinforcement schedules. Nineteen undergraduate students were run on three sets of concurrent random-interval random-interval (RI RI) reinforcement schedules of decreasing richness using PressB. In each set, the participants were exposed to a baseline (i.e., no punishment) condition, and then two punishment conditions during which an RI punishment schedule was superimposed on one of the alternatives. One punishment condition superimposed an RI punishment schedule that was 50% as dense as the reinforcement schedule upon which it was superimposed (P50), while the other punishment condition superimposed an RI punishment schedule that was 80% as dense as the reinforcement schedule upon which it was superimposed (P80). Compared to the baseline condition, participants responded less on the punished alternative and more on the unpunished alternative in all punishment conditions, as seen with Critchfield et al.'s (2003) participants. This successful replication indicates that PressB can effectively generate continuous choice behavior under both reinforcing and punishing contingencies.

3:55 - 4:05 pm   *Adaptive Learning in Competitive Games [Poster# 40]*
Brian C. Howatt[1], Michael E. Young[1]
[1]Kansas State University

Human decision-making strategies are shaped by complex interactions within a dynamic environment. While various models of dynamic choice exist, reinforcement learning theorizes the value of an action is adjusted strictly through experience. However, this updating scheme tends to bias individuals towards repeating reinforced actions and avoiding unrewarded or punished actions. In environments that include other people with conflicting goals, an observant adversary will likely be able to exploit these simple learning rules. For such situations, frequently selecting historically less valuable, but unexpected choices may help maximize long-term rewards. Across two studies we investigated the nature of competitive decision-making by having participants play 'Rock Paper Scissors' against computerized opponents programmed using a Q-learning reinforcement algorithm. To simulate different opponent strategies, algorithms were assigned unique pairs of learning rate and decisiveness parameters. In Study 1, model parameters were sampled only at extreme values, while model parameters in Study 2 were sampled across a continuum using a Halton sequence. Bayesian multilevel logistic regressions revealed participants' responding in both studies was highly sensitive to their opponent's strategy, specifically when the algorithm's learning rate and decisiveness were large (which produces a predictable pattern of choices). For example, participants showed a substantial increase in their probability of winning as the session progressed. Furthermore, after losing a trial, participants' probability of repeating that choice was considerably lower than chance. Interestingly, participants in the first study did not exhibit a bias to repeat reinforced actions, whereas participants in the second study did show a marked bias to repeat reinforced actions; this discrepancy possibly emerging from the different parameter distributions. These results provide evidence that individuals can reliably exploit salient choice patterns in their adversaries, and may be able to inhibit similar biases in their own strategies. Thus, a pure reinforcement learning model may not entirely describe competitive decision-making.

4:05 - 4:15 pm   *Using Generalized Linear Mixed-Effects Models to Analyze Data from a Common-Pool Resources Task [Poster# 55]*
Julio Camargo[1], Michael E. Young[2], Julio C. de Rose[1]
[1] Universidade Federal de São Carlos, [2] Kansas State University

We consider the advantages of using generalized linear models and their mixed-effects variants to analyze and draw conclusions from a data-intensive, dynamic common-pool resources task. The task consists of a virtual fishing video game in which participants dealt with the conflict between short- and long-term consequences (i.e., catch fish to stay alive versus maintaining resources necessary to complete the game); this tradeoff was best managed by producing intermediate fishing rates. Computer bots represented competitors for resources. Participants were 77 college students assigned to three conditions that differed in the presence or type of feedback that signaled optimal versus non-optimal consumption. Participants in the Bonuses condition received extra-points following optimal interresponse times (IRTs; i.e., between 3 and 5 seconds), while participants in the Penalties condition lost points due to overconsumption (i.e., IRTs shorter than 2 seconds). Participants in the Control condition did not receive additional feedback. Data analysis included a

Poisson regression to estimate the number of attempts needed to complete the game and its mixed-effects variant to predict the number of fish caught across each attempt at the game. A mixed-effects gamma regression was used to track the changes in IRTs over time, and a mixed-effects logistic regression was used to estimate the probability of sequential optimal responses during the game. We discovered that participants receiving feedback (Bonuses or Penalties) needed fewer attempts to complete the game when compared to the Control. Furthermore, participants moved more quickly toward an optimal and stable pattern of consumption during the game, which allowed them to maximize their earnings. When there was only a more distal consequence (i.e., lose the game) to guide their behavior, participants in the Control condition had more difficulty tracking the game contingencies, resulting in suboptimal consumption and an increase in the number of attempts needed to complete the task.

4:15 - 4:25 pm   *A Comparison of Responding during Three and Four Phase Resurgence Paradigms*
[Poster# 45]
Robert S. LeComte[1], David P. Jarmolowicz, Ph.D. [1]
[1] University of Kansas

Resurgence, or the reemergence of a previously reinforced response following extinction, is a well-documented phenomenon in Behavior Analysis. Basic research studies specifically examining patterns of resurgence often employ a three-phase framework wherein (1) a particular response is reinforced; (2) that response is extinguished while another response is concurrently reinforced; and (3) both responses are placed on extinction and the reemergence of the first reinforced response is observed. This approach, however, may have some limitations given that extinction may not occur for the initially reinforced response. Rather, responding may simply be reallocated in the second phase. The current study compared resurgence in this three-phase framework to that obtained in a four-phase framework wherein responding is extinguished before establishing the alternative response with 12 male Long Evans rats. In dual lever chambers, (1) responses on the right lever are reinforced while left responses are not; (2) both responses are extinguished; (3) responses on the left lever are reinforced while right responses are extinguished; and (4) both responses are placed on extinction and patterns of resurgence are observed. To underscore the difference between the three-phase and four-phase paradigm, one group of rats experiences extinction of both responses in phase 2 while another group is yoked by session time, but only experiences a blackout with no opportunity to respond (i.e., the levers remain retracted). Preliminary results show marked differences in patterns of resurgence for animals that experienced extinction in phase two versus their yoked counterparts. This suggests the utility of a four-phase paradigm when studying resurgence.

4:25 - 4:35 pm   *The Effect of Reinforcement Probabilities and Reversal Predictability in a Contingency*
Reversal Rask [Poster# 72]
Cristina Santos[1], Marco Vasconcelos[2], Armando Machado[2]
[1] University of Minho, [2] University of Aveiro

The goal of this study was to assess how time and consequences acquire behavioral control when (1) they are both good predictors of reinforcement, (2) one of them is a better predictor than the other, or (3) they are both poor predictors of reinforcement. We used a contingency reversal task to set up a situation in which at least two sources could gain control of behavior: the outcome of the previous response, and the time into the session at which contingencies reversed. In every trial, subjects had a choice between two stimuli, responses to one of them (S1) were reinforced during the first part of the session, and responses to the other one (S2) were reinforced during the second part. For one group of pigeons the contingency reversal was fixed half way through the session, and for another group the trial at which contingencies reversed was randomly selected on every session. All subjects experienced four different conditions in which the probability of reinforcement of S1 and S2 varied determining the reliability of the consequences. Birds' performance resembled a win-stay/lose-shift strategy, when reinforcement was higher for S1 and lower for S2, independently of the variability of the reversal. In the remaining three conditions both groups showed a characteristic performance pattern of anticipatory and perseverative errors that suggested strong temporal control of behavior.

4:35 - 4:40 pm	**Joseph V. Brady Impactful Research Award** Presented by Amy Odum, *JEAB* Editor *Utah State University (USA)*
	Closing Remarks Christopher A. Podlesnik *Florid Institute of Technology (USA)*
4:45 – 5:15 pm	**Business Meeting** All SQAB members welcome – Vevey Bsllrooms 1-3

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7 - 9:30 pm	**Second Poster Session & Cash Bar, Vevey Ballroom 4**

For abstracts of all posters see https://www.sqab.org/Conference.html

All posters have been assigned a number.
For <u>even-numbered posters</u> – presenters will be standing by the poster from 7:30 pm – 8:15 pm.
For <u>odd-numbered posters</u> - presenters will be standing by the poster from 8:15 pm – 9:30 pm.

39. Revisiting Locations in Interval Time-Place Learning: Effects of a 16 Periods/4 Locations Task
Daniel García-Gallardo, Francisco Aguilar Guevara[1], Sergio Moreno[1], Isabel Hernández[1], Mitzi Hernández[1], Wendy Concha[1], Fabian Yañez[1], Claudio Carpio[1]
[1] Universidad Nacional Autónoma de México

40. Adaptive Learning In Competitive Games
Brian C. Howatt[1], Michael E. Young[1]
[1]Kansas State University

41. The Extinction of an Alternative Response Does not Always Generate Resurgence
Edileth G. Yocupicio Campa[1], Cinthia M. Hernández Escalante[1], Carlos J. Flores Aguirre[1]
[1]Universidad de Guadalajara-CEIC

42. Asymmetries in Delay Discounting of Gains and Losses: Stability and Heritability
Yu-Hua Yeh[1], Andrey Anokhin[1], Joel Myerson[1], Leonard Green[1]
[1]Washington University in St. Louis

43. Shifting and Discounting Functions in Adolescents Drug Users
Diana Mejía [1]
[1] Instituto Tecnológico de Sonora

44. Differences in Cognitive Effort Discounting and Delay Discounting Processes
Jacob Walter[1], Yoonseo Song[2], Maverick Grey[3], Suzanne H. Mitchell[4]
[1] University of Chicago, [2] Camas High School, [3]Portland State University, [4]Oregon Health & Science University

45. A Comparison of Responding During Three and Four Phase Resurgence Paradigms
Robert S. LeComte[1], David P. Jarmolowicz, Ph.D. [1]
[1] University of Kansas)

46. How to Attach Value to Various Degrees of Matches Between Individuals and Jobs
Michael Lamport Commons[1], Shutong Wei[2]
[1] Harvard Medical School, [2]DARE Institute

47. Repeated Consumption of Saccharin Did not Affect Operant Responding for Sugar Pellets in Rats
Kenjiro Aoyama[1]
[1] Doshisha University

48. Genistein as a Preventative Treatment for Alzheimer's Disease in the Female Rat
Susannah M Chilton[1], Rodney D Clark[1]
[1] Allegheny College

49. Investigations of Operant ABA Renewal During Differential Alternative Reinforcement
Ryan T. Kimball[1], Brian D. Greer[1], Kayla R. Randall[1], Adam M. Briggs[1]
[1] University of Nebraska Medical Center's Munroe-Meyer Institute

50. Comparing Analysis Methodologies: R Tutorial for Nonlinear Repeated Measures Analyses
Kelsey Panfil[1], Kimberly Kirkpatrick[1]
[1] Kansas State University

51. Cue-Induced Craving Increases Demand for Junk-Food
Brady DeHart[1], Warren K. Bickel[1]
[1] Fralin Biomedical Research Institute at VTC

52. Perception of Causality and Risky Choice in Humans
César A. Corona[1], Raul Avila[1]
[1] National Autonomous University of Mexico

53. Time-Based Interventions to Promote Self-Control: Effects of the Hazard Function of Variable Interval Schedules
Carrie Bailey[1], Elassia Cunningham-Younger[1], Torrey Lonker[1], Kimberly Kirkpatrick[1]
[1] Kansas State University

54. Structural Equation Modeling with Co-Twin Control: A Behavioral Genetic Analysis on the Relationship between Stress and Sleep
Yueqin Hu[1], Marieke Visser[2], Sierra Kaiser[1]
[1] Texas State University, [2] University of California, Merced

55. Using Generalized Linear Mixed-Effects Models to Analyze Data from a Common-Pool Resources Task
Julio Camargo[1] , Michael E. Young[2], Julio C. de Rose[1]
[1] Universidade Federal de São Carlos, [2] Kansas State University

56. Conditional Discrimination in Rats: The Role of Response Topography
Mario Serrano[1], Kenneth Madrigal[2], Marisol Hernández[2], Rebeca Mateos[2], Carlos Flores[2]
[1] Universidad Veracruzana, [2] Universidad de Guadalajara

57. The Impact of Caloric Densities on Demand for Food
Rachel N.S. Foster[1] ,Derek D. Reed[1]
[1] The University of Kansas; Cofrin Logan Center for Addiction

58. Effects of Skewed Probe Distributions in Temporal Bisection in Rats: Evidence for Within-session Shifts in Responding
Tanya A. Gupta[1], Federico Sanabria[1],
[1] Arizona State University

59. Elemental and Configural Odor Discrimination in the APP/PS1 Mouse, an Animal Model of Alzheimer's Disease

Amara Miller[1], Tanya A. Gupta[1], Federico Sanabria[1]
[1] Arizona State University

60. Comparison of probability discounting between overweight and normal weight adolescents through a video game

Alma L. Lopez-Fuentes[1], Silvia Morales Chainé [1], María Fernanda de la Cruz Miranda [1]
[1] National Autonomous University of Mexico, UNAM

61. A Ratio Scale for Social Distance

Vasiliy Safin[1], Howard Rachlin[1]
[1] Stony Brook University

62. Cross-Price Elasticity and Unsafe Choice Allocation in Decision for Late Night Transportation

Brett W. Gelino[1], Allyson R. Salzer[1], Hannah W. Glatter[1], Derek D. Reed[1], Steven R. Hursh[2]
[1] University of Kansas, [2] Institutes for Behavior Resources; Johns Hopkins University School of Medicine

63. Food Probability, but not ITI, Affects Latency and Preference in a Discrete-Trials Discrimination Task

Lillian L. Skiba-Thayer[1], Eric J. French[1], Mark P. Reilly[1]
[1] Central Michigan University

64. Delay Exposure Training: Procedures, Effects, & Potential Mechanisms

Emma Preston[1], Kailey Morrissey[1], Nya Harper[1], Sara Peck[1], Gregory J. Madden[1]
[1] Utah State University

65. The Effect of Multiple-Context Training on Resurgence in Children with Autism Spectrum Disorder

Weizhi Wu[1,2], Stephanie N. Brand[1,2], Ronald J. Clark [1,2], Carolyn M. Ritchey[1],Yaara Shaham[1,2], Basak Topcuoglu[1,2], Christopher A. Podlesnik[1]
[1] Florida Institute of Technology, [2] The Scott Center for Autism Treatment

66. Delay Discounting in Adolescents with Overweight Through a Video Game

Sandra Ivonne Ferrer Reyes[1], Silvia Morales Chainé [1], Sandra Moreno García [1]
[1]National Autonomous University of Mexico, UNAM

67. Person Who?: Investigating the effects of an instructional prompt on social discounting

Natalie R. Buddiga[1], Samantha Hemphill[1], Matthew L. Locey, Ph.D. [1]
[1]University of Nevada, Reno

68. Punishment in a Procedure for Rapidly Establishing Steady-State Behavior
Bryan Klapes[1], J. J McDowell [1]
[1]Emory University

69. Further Evaluation of a Non-sequential Approach to Studying Operant Renewal
Andrew R. Craig[1], William E. Sullivan[1], Henry S. Roane[1],
[1]SUNY Upstate Medical University

70. Conditioned Inhibition in Overexpectation: Adding Negative Values?
Felipe Parrado[1, 2], Gonzalo Miguez[3], Mario Laborda[3], Oscar García-Leal [1]
[1] Universidad de Guadalajara, [2] Universidad Surcolombiana, [3]Universidad de Chile

71. A Quantitative Analysis of Cumulative Records Depicting Google Trends: Novel Insights into Health Promotion Campaigns
Alix R. Fisk[1], Brett W. Gelino[1], Derek D. Reed[1]
[1] University of Kansas

72. The Effect of Reinforcement Probabilities and Reversal Predictability in a Contingency Reversal Task
Cristina Santos[1], Marco Vasconcelos[2], Armando Machado[2]
[1] University of Minho, [2] University of Aveiro

73. Can a Single Model Describe Discounting Across Amounts, Signs, and Commodities? A Quantitative and Machine Learning Attempt
David J. Cox[1], Matthew W. Johnson[1]
[1]Johns Hopkins University School of Medicine

74. Evaluation of a Novel Procedure to Describe Group Foraging in Canines
Allyson R. Salzer[1], Laura E. Holt[1], Hannah W. Glatter[1], Derek D. Reed[1], Jerri Johnson[2]
[1]University of Kansas, [2]Wagmore Canine Enrichment

75. Behavioral Economics of the "Bottomless Cup:" Alcohol Demand at Off-Campus Parties
Mikayla N. Morrell[1], Derek D. Reed[2], Rachel L. Edwards[2], Margaret P. Martinetti[1]
[1]The College of New Jersey, [2] University of Kansas

∫QAB Invited Preeminent Tutorials: From Basics to Contemporary Paradigms

SQAB Preeminent Tutorials will be held in the **Swissôtel, Zurich D** as part of the annual meeting of the Association for Behavior Analysis International

10:00 – 10:50 Sarah Cowie, The University of Auckland:
Using the Past to Predict the Future
Chair: Michael Davison, The University of Auckland

Behavior analysis is on the cusp of a major change in the way we think about our most fundamental process: Reinforcement. Whereas the law of effect stipulates that reinforcers control behavior because of their special function in increasing a behavior's strength, an alternative approach casts reinforcers as stimuli with current value to the organism, but no unique function in changing behavior. Under this approach, behavior is controlled by relations between stimuli, depending on the affordances and dispositions of the organism. This tutorial explores some of the data that has led us to change the way we understand control by current environmental conditions. First, the tutorial examines some of the evidence for prospective control, when reinforcers are absent, or temporally distant, or when reinforcer effects are inconsistent with strengthening. Next, I explore how quantitative models can provide a testable explanation of control by the likely future, as extrapolated from the past. Finally, the tutorial considers the implications of a shift from understanding control in terms of retrospective response-reinforcer pairings to prospection on the basis of the perceived structure of the environment, and argues that in conjunction with quantitative models, prospective control need not invoke an inner organism.

11:00 – 11:50 William B. DeHart & Jonathan E. Friedel, Virginia Tech Carillion Research Institute
and National Institute for Occupational Safety and Health:
Multilevel Modeling for Single-Subject Designs and Model Fitting
Chair: Michael Young, Kansas State University

Application of basic statistical measures (e.g., t-tests, ANOVA) to single-subject designs have been a source of conflict in Behavior Analysis because, in part, these tests aggregate behavioral variability across subjects and time, eliminating much of the data that behavior analysts find important. Multilevel modeling (MLM) is a statistical technique that addresses these concerns and is commonly used when data are naturally clustered (e.g., student clusters in classrooms, which are also clustered in various schools across a district). With MLM, the value of a statistical parameter for a specific case depends on the levels of the each cluster for that case. A single subject can serve as a cluster of data and, therefore, MLM can provide subject-by-subject predictions. In a single-subject or small-n design, statistical comparisons based on the IVs of interest are enhanced when the models have already accounted for intrasubject variability. In theoretical modeling of behavior, subject-by-subject model parameters can be obtained while simultaneously accounting for group-level patterns in the data. This tutorial will demonstrate using MLM to analyze experimental data from a single subject design and also to conduct subject level model fitting. The analyses will be conducted in R, a popular, free software package for statistical analyses.

12:00 – 12:50 The Potential of Statistical Inference in Behavior Analysis: A Panel with Discussion
Christopher Franck, Virginia Tech
Michael Young, Kansas State University
Amy Odum, Utah State University
Chair: Derek Reed, The University of Kansas

3:00 – 3:50 Paul Soto, Louisiana State University:
Using Genetically Modified Organisms to Probe Neurobiological Bases of Behavior
Chair: Jesse Dallery, University of Florida

This tutorial will provide a general introduction to some technologies available for manipulating gene expression in mice. Technologies for manipulating gene expression can be used to investigate the neurobiological contributors to behavior. Results obtained from studies in dopamine receptor knockout mice on the role of dopamine receptors in food's reinforcing efficacy will be used as an example of use of a global knockout approach. Results obtained from studies in Alzheimer's transgenic APPswe/PS1dE9 mice on the role of beta amyloid in cognitive decline will be used as an example of a transgene approach. Additionally, the tutorial will discuss emerging technologies that allow precise control over the timing and location of modification of genetic expression. These emerging technologies allow behavioral researchers to investigate the role of neurobiological variables on behavior from a developmental perspective and to address questions regarding the role of particular brain regions in behavior. Genetically modified organisms provide a promising avenue for fruitful collaborations between behavior analysts and geneticists, neuroscientists, and scientists in other complementary areas.

4:00 – 4:50 Caio Miguel, California State University, Sacramento:
Stimulus Equivalence 101
Chair: Anna I. Petursdottir, Texas Christian University

Researchers and clinicians rely heavily on the matching-to-sample procedure (MTS) to establish conditional discriminations. In an MTS trial, a visual or auditory sample is presented, followed by several comparisons (pictures or objects). The selection of the correct comparison leads to reinforcement while selection of the incorrect one leads to some form of correction. Clinically, MTS is used for teaching a variety of skills, including listener behavior, categorization, math, and reading. An important characteristic of MTS is that samples and comparisons become substitutable for each other (i.e., equivalent). Understanding the variables responsible for the development of equivalence classes has been the topic of investigation in the field of behavior analysis for almost 50 years, generating an enormous (and complicated) body of research. This research has led to the development of at least three theoretical accounts to explain meaning and symbolic behavior, as well as has informed clinicians on how to take advantage of the MTS procedure to produce a multitude of generative/novel performances. This talk will serve as a first introduction to the concept of stimulus equivalence and its ramifications for both research and practice.

5:00 – 5:50　　**Derived Stimulus Relations: A Panel with Discussion**
　　　　　　　Erik Arntzen, Oslo and Akershus University College
　　　　　　　Karen Lionello-Denolf, Assumption College
　　　　　　　Daniel Fienup, Columbia University
　　　　　　　Chair: Anna I. Petursdottir, Texas Christian University

SQAB Invited Preeminent Tutorials are recorded and made available on iTunes and YouTube: youtube.com/c/SocietyfortheQuantitativeAnalysesofBehavior