



SQAB 2010 at a Glance

Thursday Evening, May 27
Salon A-F, Lonestar Ballroom, Grand Hyatt

5:00-8:00 Registration, *1st Poster Session / Cash Bar*

Friday Morning, May 28
 Salon A-D, Lonestar Ballroom, Grand Hyatt

7:15 Registration, Coffee and Pastries
 8:25 Alliston K. Reid (President's Introduction)
 8:45 Peter Balsam & Ryan Ward
 9:20 Bjoern Brembs
 9:55 Coffee Break (20 min)
 10:15 Laurent Madelain, Céline Paeye, & Jean-Claude Darcheville
 10:50 Alliston K. Reid
 11:25 John P. Berg & Jack J. McDowell

12:00 - 1:45 Lunch Break

Special Section on Choice and Discounting

1:45 Cynthia J. Pietras, J. Adam Bennett, & Gabriel D. Searcy
 2:20 Howard Rachlin & Matthew L. Locey
 2:55 Amy L. Odum
 3:30 Coffee Break (20 min)
 3:50 Suzanne H. Mitchell
 4:25 Matthew L. Locey & Jesse Dallery
 5:00 Leonard Green & Joel Myerson
 5:45 Business Meeting
 6:30 2nd Poster Session / Cash Bar until 9:00 pm

Saturday Morning, May 29
 Salon A-D, Lonestar Ballroom, Grand Hyatt

7:00 Registration, Coffee and Pastries
 8:30 Thomas R. Zentall
 9:05 Gregory J. Madden
 9:40 Coffee Break (15 min)
 9:55 Peter R. Killeen
 10:30 Taiki Takahashi
 11:05 End of SQAB - Beginning of ABAI

Saturday Afternoon, May 29
 (Henry B. Gonzalez Convention Center)

SQAB Invited Preeminent Tutorials
 From Basics to Contemporary Paradigms

1:00 Stephen Fowler - Dynamics of response:
 Uninterrupted measurement of the behavior stream
 2:00 Robert MacPhail - Environment, behavior and pollution: Quantifying risk
 3:00 Michael Davison - What "reinforcers" do to behavior, II: Signposts to the future
 4:00 Gerald Shook - The Behavior Analyst Certification Board and the behavior analyst profession

SQAB



Society for the Quantitative Analyses of Behavior
San Antonio



33rd Annual Conference
 Grand Hyatt, San Antonio, Texas
 May 27-29, 2010

SQAB

The Society for the Quantitative Analyses of Behavior, SQAB, was founded in 1978 by J. A. Nevin and M. L. Commons to present symposia and publish material which bring a quantitative analysis to bear on the understanding of behavior. This can be defined as the development and use of mathematical formulations to characterize one or more dimensions of a data set, derive predictions to be compared with data, and generate novel data analyses. This International Society holds its annual meeting in conjunction with the Association for Behavior Analysis International, ABAL.

You can retrieve more information pertaining to SQAB from our web site <http://sqab.psychology.org>

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Thursday Evening
Reception & Poster Session
5:00-8:00 pm

Abstracts for the Thursday evening
poster session begin on page 14.

Welcome to SQAB 2010



Friday Morning:

7:15-8:25 Registration, Coffee and Pastries

8:25-8:40 Welcome to **SQAB 2010**: President's Introduction

Alliston K. Reid
Wofford College (USA)

8:45-9:20 Neuroscience and Behavior Analysis (NABA): To Know a Mouse

Peter Balsam & Ryan Ward

Barnard College and Columbia University (USA)

The experimental analysis of behavior has created powerful methods for isolating and describing the functional properties of behavioral regulation mechanisms. While great strides have been made in understanding biological and molecular processes, elucidation of neural mechanisms underlying behavior has been hindered by a cursory approach to analyzing behavior. Better understanding of the biological basis of behavior requires a merging of methods from behavior analysis and neurobiology. An example of this sort of synthesis is presented in which the behavior and neurobiology of an animal model of schizophrenia is jointly analyzed. The synergy between basic behavior analysis, neurobiology and Psychiatry has great potential to lead to deeper understanding of behavior and neurobiology as well as lead to improvements in diagnosis and treatment in clinical settings.

9:20-9:55 Spontaneous Decisions and Operant Learning in Fruit Flies

Bjoern Brembs

Freie Universität Berlin (Germany)

Already in the 1930s Skinner and Konorski debated the commonalities, differences and interactions among the processes underlying what was then known as “conditioned reflexes type I and II”, but which is today more well-known as classical (Pavlovian) and operant (instrumental) conditioning. Subsequent decades of research have confirmed that the interactions between the various components during operant conditioning are complex and difficult to disentangle. Today, modern neurobiological tools allow us to dissect the biological processes underlying operant conditioning and study their interactions. These processes include initiating spontaneous behavioral variability, world-learning and self-learning. The data suggest that behavioral variability is generated actively by the brain, rather than as a by-product of a complex, noisy input-output system. The function of this variability, in part, is to detect how the environment responds to such actions. World-learning denotes the biological process by which value is assigned to environmental stimuli. Self-learning is the biological process which assigns value to a specific action or movement. In an operant learning situation using visual stimuli for flies, world-learning inhibits self-learning via a prominent neuropil region, the mushroom-bodies, while the world-learning process itself presumably takes place in the so-called fan-shaped body. Only extended training can overcome this inhibition and lead to habit formation by engaging the self-learning circuit. Self-learning transforms the spontaneous behavioral variability into stereotyped habits.



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JOURNALS IN EXPERIMENTAL PSYCHOLOGY: 2010

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Friday Morning

Paper Session

Lonestar Ballroom A-D

9:55-10:15

Break - Refreshments

10:15-10:50

Operant Control of Eye Movements

Laurent Madelain, Céline Paeye, & Jean-Claude Darcheville
Université Lille Nord de France (France)

Primates use two types of voluntary eye movements to view their visual environment. Saccades are the rapid movements that orient the retinal image of a target toward the high-acuity area of the retina, whereas pursuit is the continuous response that smoothly compensates for the displacement of a visual target. These oculomotor responses have been extensively studied both at the behavioral and neural levels, and are commonly used as models for motor control systems. Most of these models rely on servo-mechanisms based on the computation and comparison of internal signals. We contrast these theoretical approaches with behavioral researches exploring the operant properties of voluntary eye movements in humans. Here we present studies showing that various dimensions of these responses such as velocity, latency and amplitude of movements are controlled by reinforcement contingencies. These findings suggest that experimental analysis of behavior may provide a useful framework for understanding how reinforcement affects both motor control and sensorimotor adaptation but leaves open the question of how a particular behavioral pattern might emerge.

10:50 - 11:25

Resistance to Change Within Response Sequences: It Doesn't Measure What You Think!

Alliston K. Reid
Wofford College (USA)

Three experiments investigated how instrumental and Pavlovian contingencies contribute to resistance to change (RTC) in different ordinal response positions within heterogeneous response sequences in pigeons. RTC in the initial and terminal response positions of a three-response sequence were compared in Experiment 1, which presented three colored key lights in succession in each trial; and in Experiment 2, which severely degraded Pavlovian contingencies by presenting the lights simultaneously at each ordinal position, yet maintained identical response requirements. Experiment 3 eliminated the instrumental contingency completely in a high-order sign-tracking procedure. When the instrumental contingency was in effect, RTC of the initial position was greater than the terminal position (Initial RTC > Terminal RTC) when the Pavlovian contingencies were strong and when they were degraded. When the instrumental contingency was eliminated, RTC patterns reversed, producing a graded pattern of RTC (Initial < Middle < Terminal). Current theoretical approaches (e.g., behavioral momentum theory, conditioned reinforcement, and motivational control of instrumental conditioning) can not account for these results. An alternative approach (a gradient model) shows that obtained measures of RTC in heterogeneous sequences may reflect a combination of three dissociable processes. Although RTC is a powerful tool useful for measuring the combined effects of the three processes described, RTC is not a direct measure of response strength or conditioned value in heterogeneous response sequences.

11:25 - 12:00 Catania's Computational Model of the Operant Reserve Does Not Generate Herrnstein's Hyperbola in the Steady State

John P. Berg & Jack J. McDowell
Emory University (USA)

BF. Skinner (1938) proposed the concept of the reflex or operant reserve. The main construct was simple: a reserve of behavior would be decremented when responses occurred and incremented after contingent reinforcement. When the reserve was depleted, behavior would return to operant levels. However, shortly after its proposal, support for the reflex reserve all but disappeared. Catania (2005) proposed that a computational account of the reflex reserve could provide an environment uniquely suited to the low-level, simple rules of the reflex reserve. This talk will review recent findings replicating and extending the Catania (2005) computational model with emphasis on systematic evaluation of model behavior in the steady state. Results suggest that model behavior was inconsistent with matching theory across various conditions. Implications for modeling behavior in a computational environment will be discussed and new methodology for evaluating computationally simulated behavior will be proposed.

12:00 - 1:45 Lunch Break

The SQAB Executive Committee and Board will meet during lunch

Special Section on Choice and Discounting

1:45 - 2:20 Optimal Risky Choice in Humans: Effects of Amount of Variability

Cynthia J. Pietras, J. Adam Bennett, & Gabriel D. Searcy
Western Michigan University (USA)

Prior decision-making research with humans has shown that a risk-sensitive optimal foraging model, the energy-budget rule, can be used to predict human risky choice for monetary outcomes. Trial-by-trial choices were also well described by a dynamic risk-sensitive optimization model. In prior studies, participants were given repeated choices between an option delivering a constant amount of money and an option delivering a variable amount of money with an equal mean value. Several more recent studies will be presented in which both choice options were characterized by some degree of variability. Choices were again well described by the energy-budget rule, suggesting that the model can also be applied to humans' choices between low- and high-variance outcomes. When both options were variable, however, trial-by-trial choices were less consistent with predictions of the dynamic optimization model. Additional analyses suggest that this may be attributed to the smaller differences in reinforcement between optimal and nonoptimal choices in conditions with greater variability.

Journal of the Experimental Analysis of Behavior

Special Issue (May, 2010) on Translational Research

Selected Contents

Semantic false memories in the form of derived relational intrusions following training P.M. GUNTHER and M.J. DOUGHER

Neurobehavioral evidence for the "near-miss" effect in pathological gamblers
R. HABIB and M.R. DIXON

Differential reinforcement of alternative behavior increases resistance to extinction: Clinical demonstration, animal modeling, and clinical test of one solution F.C. MACE, J.J. McCOMAS, B.C. MAURO, P.R. PROGAR, B. TAYLOR, R. ERVIN, and A.N. ZANGRILLO

Shifts in postdiscrimination gradients within a stimulus dimension based on bilateral facial symmetry A. DERENNE

Bias and undermatching in delinquent boys' verbal behavior as a function of their level of deviance J.J. McDOWELL and M.L. CARON

The effects of constant versus varied reinforcers on preference and resistance to change J.S. MILO, F.C. MACE and J.A. NEVIN

Call for Future Translational Manuscripts

JEAB seeks to continue its longstanding tradition of publishing occasional articles that bridge basic and applied research. Translational manuscripts should communicate equally well to two audiences: those with primary interest in fundamental behavior processes, and those with primary interest in a particular type of socially-relevant behavior. Most suitable are studies that examine the external validity of laboratory-based principles and/or explore fundamental questions about behavior that are brought into focus by applied problems. *JEAB's* emphasis remains on experimental analyses of individual behavior, although it is understood that practical constraints of field settings may sometimes dictate other kinds of methods. Address questions about the suitability of a given manuscript to Editor James E. Mazur (mazurj1@southernct.edu). For general author instructions see <http://seab.envmed.rochester.edu/jeab/>



**Comparative Cognition Society
Annual Fall Meeting**
November 18 – St. Louis, MO
In association with the annual meeting of the
Psychonomic Society (Nov 18-21)



The online journal of the Comparative Cognition Society



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2:20 - 2:55 **Why Cooperate In A One-Shot Prisoner's Dilemma Game? Three Answers**

Howard Rachlin & Matthew L. Locey
Stony Brook University (USA)

A significant number of players cooperate in multi-player, one-shot prisoner's dilemma games where cooperation benefits each of the other players but is costly to the cooperating player. I consider three potential explanations for such cooperation. The first explanation, following a suggestion by the philosopher Derek Parfit, assumes that players devise a strategy to avoid being free-loaders – and that in the present case this strategy dictates cooperation. The second explanation takes social discounting as a given. Cooperation ensues, according to the second explanation, when the sum of the benefits to the individual player, from rewards given to other players, simply outweighs the cost. The third explanation says that cooperators reject the one-shot aspect of the game and behave so as to maximize reward over a series of choices (even though reward is not maximized in the present case). The first two explanations are molecular and assume innate altruistic mechanisms. The third explanation is molar; it assumes that people may learn to extend the boundary of reward-maximization socially, beyond their own skin, as well as temporally, beyond the present moment. I propose a learning mechanism for such behavior analogous to the biological mechanism of group selection.

2:55 - 3:30 **Delay Discounting: Trait and State Contributions**

Amy L. Odum
Utah State University (USA)

The field of psychology has traditionally distinguished between state and trait variables. State variables may be considered environmental factors that affect behavior over relatively short time frames, whereas trait variables are relatively stable preexisting individual characteristics that affect behavior. Delay discounting has been a topic of increasing study across multiple areas of psychology and neuroscience. Delay discounting refers to the decrease in the value of an outcome as the delay to its receipt increases. Is it useful to consider delay discounting within the state/trait dichotomy? If so, is delay discounting a state, trait, or both? I will consider evidence from the literature as well as recent studies from my laboratory in an attempt to answer these questions.

3:30 - 3:50 **Break - Refreshments**

3:50 - 4:25 **Lost in Translation: Exploring Delay Discounting in Humans and Rodents**

Suzanne H. Mitchell
Oregon Health & Science University (USA)

Research examining delay discounting in human and nonhuman subjects has led to the development of very distinct procedures to assess choice between smaller, sooner rewards and larger later rewards. Data have suggested that human drug users devalue delayed rewards to a greater degree than nonusers using a questionnaire-like task. This finding has elicited numerous studies in rats and mice to examine whether differences in discounting predated and predict subsequent drug use, or are a consequence of drug exposure. In addition, other studies have focused on identifying the genetic and neurological substrates of any heightened discounting-drug use associations. However, it is unclear to what degree the experimental procedures used with rodents call on the same processes that are used human subjects performing discounting tasks and are implicated in drug addiction. A series of studies using mice and rats will be presented to enable a critical comparison of the experimental procedures and to illustrate the interpretational complexities of translating rodent research to humans.

4:25 - 5:00 **Nicotine and the Behavioral Mechanisms of Intertemporal Choice**

Matthew L. Locey & Jesse Dallery
Stony Brook University & University of Florida (USA)

Nicotine has been found to produce dose-dependent increases in impulsive choice (preference for smaller, sooner reinforcers relative to larger, later reinforcers) in rats. Such increases could be produced by either of two behavioral mechanisms: (1) an increase in delay discounting (i.e., exacerbating the impact of differences in reinforcer delays) which would increase the value of a sooner reinforcer relative to a later one or (2) a decrease in magnitude sensitivity (i.e., diminishing the impact of differences in reinforcer magnitudes) which would increase the value of a smaller reinforcer relative to a larger one. In a series of studies, we manipulated reinforcer delay and magnitude to isolate which of these two behavioral mechanisms was likely responsible for nicotine's effect on impulsive choice. Across studies we found that nicotine had no effect on preference for short vs. long delays, which suggests that nicotine does not alter delay discounting. However, nicotine did decrease preference for large vs. small magnitude reinforcers. This suggests that nicotine decreases sensitivity to reinforcer magnitude. If nicotine influences impulsive choice without influencing delay discounting, perhaps the same is true of other manipulations. For example, perhaps the commonly found decreases in impulsive choice produced by increases in reinforcer magnitude have nothing to do with changes in delay discounting. With some current quantitative accounts of intertemporal choice, we may be in danger of misinterpreting changes in choice as being "delay discounting" effects. Adding a magnitude sensitivity parameter to such accounts might prove useful.

Society for Quantitative Analyses of Behavior San Antonio, Texas, USA



27 - 29 May, 2010

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(Papers on behaviour
analysis, comparative cognition
and experimental psychology)

5:00 - 5:35 Modeling Magnitude Effects: Implications for Theories
of Delay and Probability Discounting

Leonard Green & Joel Myerson

Washington University in St. Louis (USA)

The hyperboloid function provides a very good description of both delay and probability discounting. In delay discounting, the degree of discounting decreases with the amount of the delayed reward, whereas in probability discounting, the degree of discounting increases with the amount of the probabilistic reward. The discount rate parameter in the delay discounting function varies with the amount of delayed reward, but the exponent remains relatively stable and is an index of the psychophysical scaling of time and amount. In contrast, the discount rate parameter in the probability discounting function shows no systematic change as a function of amount, but the exponent increases with amount of probabilistic reward – a finding inconsistent with the assumption that the exponent is an index of the psychophysical scaling of likelihood. The finding that the corresponding parameters of the delay and probability discounting functions behave differently as amount is varied provides evidence that at least some different decision-making processes must be involved in the two types of discounting, and that one type of discounting is not fundamental. Our results are consistent with the Prospect Theory view that probability discounting involves a probability weighting function that reflects the weight given to reward likelihood relative to reward amount, rather than an estimate of subjective probability. Unlike Prospect Theory, however, the present account proposes a specific mathematical form for an amount-dependent weighting function. So delay and probability discounting are more complicated than some might have hoped – an amount-dependent rate parameter for delay but not for probability discounting, and an amount-dependent exponent for probability but not for delay discounting. We can't wait to see how we deal with this odd symmetry.

5:45-6:30 Business Meeting - All **SQAB** members are welcome

6:30-9:00 2nd Poster Session/Cash Bar

Abstracts for the Friday evening poster session begin on
page 25 of this program booklet.

*The SQAB Student Council will meet for dinner
after the Friday poster session.*

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

The Society would like to express its appreciation to each of the presenters, our advertisers, and to the following journals and societies:

Behavioural Processes

The Psychonomic Society

The Society for the Advancement of Behavior Analysis

Journal of the Experimental Analysis of Behavior

Journal of Applied Behavior Analysis

The Comparative Cognition Society

The Association for Behavior Analysis International

 7:15-8:30 Registration, Coffee, Pastries

 8:30 - 9:05 A Pigeon Model of Addictive Gambling

 Thomas R. Zentall
University of Kentucky (USA)

Humans often buy lottery tickets in spite of the fact that generally they lose more money than they win. The reasons for this maladaptive behavior are complex and may include the inability to calculate or understand the odds, the salience of winning but not losing by others (the availability heuristic), and the possible social reinforcement that may come with winning. But pigeons too show maladaptive gambling behavior. Specifically, pigeons choose an alternative that provides 20% reinforcement (when reinforcement is signaled) over another that provides 50% reinforcement (unsignaled). This suboptimal choice behavior does not depend on the certainty of reinforcement associated with the low frequency (20%) stimulus that provides 100% reinforcement because if the probability of reinforcement associated with that stimulus is reduced to 80%, pigeons still prefer that alternative. Nor does it depend on the uncertainty of reinforcement associated with the 50% reinforcement alternative because if the choice is between (1) a 100% probability of receiving 3 pellets and (2) a 20% probability of receiving 10 pellets on some trials or an 80% probability of receiving no pellets on other trials, the small chance of receiving 10 pellets is still preferred. As with humans, this maladaptive choice behavior overemphasizes the infrequent occurrence of the winning event and underemphasizes the more frequent occurrence of the losing event and it suggests that basic learning processes are involved.

 9:05 - 9:40 Delay Discounting and “Gambling”

 Gregory J. Madden
University of Kansas (USA)

Steep delay discounting is known to robustly correlate with substance use disorders and a host of other problem behaviors. Some evidence suggests that steep delay discounting precedes and predicts drug acquisition and escalation in rodents and success/failure in human drug-treatment trials. What about pathological gambling? The extant literature will be reviewed and a SQABatative account of why steep delay discounting might be predictive of susceptibility to gambling will be outlined. Empirical evidence informing this account will be presented.

 9:40 - 9:55 Break - Refreshments

SQAB Preeminent Tutorials From Basic to Contemporary Paradigms



SQAB is committed to simplifying the transition to quantitative analyses for students as well as advanced researchers. Informal videos of live ABA tutorial presentations from previous years are available for order at the SQAB Website:

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#35) Three-term learning predicts both fluid intelligence and listening comprehension across the adult lifespan.

Elaine Tamez, Joel Myerson, Sandra Hale, & Nathan Rose
Washington University in St. Louis (USA)

The three-term associative learning task (Williams & Pearlberg, 2006) has recently been found to be highly correlated with fluid intelligence in young adults (Tamez et al. 2008; Williams & Pearlberg, 2006). The present study extended these findings to adults 30-80 years of age and also examined the role of learning as a predictor of comprehension of extended spoken passages (lectures, interviews, and spoken narratives). A regression model with vocabulary, speed, working memory, and three-term learning as predictors accounted for more than 50% of the variance in fluid intelligence, although only learning and speed accounted for unique variance. In addition, a regression model with vocabulary, speed, working memory, learning and fluid intelligence as predictors accounted for more than 50% of the variance in listening comprehension, although only learning and vocabulary accounted for unique variance. Importantly, with differences in learning statistically controlled, age was not a significant predictor of either fluid intelligence or listening comprehension. These findings highlight the role of complex associative learning in fluid intelligence and listening comprehension across the adult lifespan.

#36) Essential value for food brands

Ji Yan & Gordon Foxall
Cardiff University (UK)

The essential value, a measure of the strength of reinforcers, is recently developed by behavioural economists. The measure reflecting the rate of change in elasticity of demand has been proved to successfully estimate animal food/drug consumption by latest experiments. In the present paper we modified this model to assess the essential value of different brands of products based upon human buying behaviour. Panel data collected from over 1500 British consumers during 52 weeks were examined. Results find the reliability of the essential value in measuring the strength of commodities and that the increase of brand essential value positively associated with the increases in utilitarian reinforcement and partially correlated with informational reinforcement.

#37) On the relation between resurgence and delays to reinforcement

David P. Jarmolowicz & Kennon A. Lattal
West Virginia University (USA)

Resurgence is the reemergence of a previously extinguished behavior when the currently reinforced behavior faces some sort of challenge. Although resurgence is typically studied within the context of extinction, this phenomenon has also been observed during shifts from dense to lean variable-interval schedules. As such, it is possible that resurgence may be observed when reinforcement is delayed. The current experiment examined this possibility within the context of a four phase resurgence procedure wherein 1) behavior on one key is reinforced according to a VI schedule, 2) that responding is then extinguished, 3) variable-interval responding is then established on a second key, and 3) that responding is subsequently exposed to a procedure wherein the delay to reinforcement is increased each session.

9:55 - 10:30 The Grand Mother of All Discount Functions

Peter R. Killeen
Arizona State University (USA)

Goods remote in temporal, spatial, or social distance, or in likelihood, exert less control over our behavior than those more proximate. This presentation develops discount functions from marginal utilities, yielding a framework that resolves several anomalies of inter-temporal choice. Utilities are inferred to be power functions of monetary value, delay, and probability. Utility, not value, is discounted, with decisions made by adding the utility of a good to the disutility of a delay or contingency. The theory reduces to standard treatments, such as exponential, hyperbolic and hyperboloid, and exponential-power; it naturally predicts magnitude effects and other asymmetries; is consistent with sub-additivity, immediacy and certainty effects; returns conjointly measured determinations of monetary utility and temporal distance functions; and is extensible to other dimensions of distance. When animals experience the delays, as is typical of non-human animal experimentation, a different type of gradient, based on a simple model of conditioned reinforcement, yields a simple hyperbolic gradient.

10:30 - 11:05 Neuro-social Modulation of Discounting

Taiki Takahashi
Hokkaido University (Japan)

Impulsivity (impatience) and time-inconsistency in temporal discounting have been attracting attention in psychology, behavioral economics, psychopharmacology, and neuroeconomics. The relationship between temporal discounting and risk aversion (probability discounting) has also been investigated in behavioral and social sciences. By utilizing hyperbolic discounting models (including q-exponential discounting based on Tsallis' statistics), we have demonstrated (i) addiction and abstinence were associated with impulsivity in temporal discounting in positive and negative manners, respectively, (ii) arousal-related neurochemical substrates (e.g. salivary amylase and cortisol) were associated with patience in temporal discounting, (iii) intertemporal choice for someone else was more time-inconsistent and impulsive than that for oneself, (iv) depression was associated with exacerbated time-inconsistency and impulsivity in temporal discounting behavior, (v) although certainty for delayed rewards decayed hyperbolically, temporal discounting was not attributable to aversion to uncertainty associated with delay, and (vi) time-inconsistency in temporal discounting may be attributable to psychophysics of time-perception. These findings imply the importance of incorporating psychophysical and biophysical theories into discounting theory.

11:05

SQAB 2010 Closing Remarks

Alliston K. Reid
Wofford College (USA)

SQAB Preeminent Tutorials will be held in the
Henry B. Gonzalez Convention Center



1:00-1:50 Dynamics of Response: Uninterrupted Measurement of the
Behavior Stream

Stephen C. Fowler
University of Kansas (USA)

Introduction: Jonathan Pinkston
*University of Texas Health Sciences
Center at San Antonio (USA)*

This tutorial will show 1) how the behavior analytic reach of operant conditioning methods can be increased by examining force, duration, and time integral of force (effort) of individual operant responses and 2) will describe a non-video method (i.e., force-plate actometer as the floor of an operant chamber) for tracking and otherwise quantifying behaviors that occur during interresponse times. Measurement of operant response force, duration and effort introduces new levels of complexity and apparatus considerations that are not present when responses are treated as intermittent, dimensionless events. These issues will be addressed in the context of selected behavioral pharmacology experiments with emphasis on drugs that affect brain dopamine systems. Tracking and measuring drug-induced behaviors with a force-plate as the floor of an operant chamber will be illustrated in two different paradigms: 1) rats self-administering cocaine and 2) rats performing on a 72-s differential reinforcement of low rate schedule of reinforcement under baseline and amphetamine-treatment conditions. Recent pertinent work conducted between the writing of this abstract and the convening of the annual meeting may also be described.

2:00-2:50 Environment, Behavior and Pollution: Quantifying Risk

Robert C. MacPhail
*National Health and Environmental Effects
Research Laboratory (USA)*

Introduction: M. Christopher Newland
Auburn University (USA)

This tutorial will describe past and current studies on behavior in the field of environmental toxicology, an area of inquiry that has a remarkably longer history than generally recognized. Toxicology bears much in common with pharmacology in that both fields investigate the effects of chemicals on living organisms, organs or tissues. Whereas pharmacology most often focuses on therapeutic or abused agents, environmental toxicology deals with a broader array of chemicals including atmospheric pollutants, water contaminants, pesticides, metals and a range of naturally occurring toxins. Numerous poisoning episodes have highlighted the diverse behavioral impacts of exposure to toxic chemicals. Given the limitations of epidemiological research, laboratory studies are needed for linking exposure (i.e., dose) and effect unequivocally. A much more challenging issue is using these data to then estimate the risk of an adverse (toxic) effect. This requires a focus on the variability in response to chemical exposure. Examples will be provided of both traditional approaches for estimating risk, and some newer approaches that specifically incorporate variability in response. The implications for understanding the effects of environmental pollutants on the health of humans (and other animals) will be explored.

#33) Impulsivity predicts amphetamine conditioned place preference in rats

Justin R. Yates & Michael T. Bardo
University of Kentucky (USA)

Impulsivity has been linked to increased drug vulnerability in adolescents and young adults. Individuals who are impulsive are more likely to use and abuse drugs compared to individuals who are self-controlled. The present preclinical study was designed to determine if a correlation exists between impulsivity and amphetamine conditioned place preference (CPP). Eighteen Sprague Dawley rats were first trained in a delay discounting task, in which rats chose between a small, immediate reward and a larger, delayed reward. Animals that demonstrated the strongest preference for the small immediate reward were designated as impulsive. Rats were then tested for amphetamine CPP in which injections of either amphetamine (0.5 mg/kg) or saline were paired with one side of a CPP chamber. Following conditioning, preference scores were determined by allowing the rat free access to both end compartments, and these preference scores were correlated with the scores obtained from the delay discounting task. Rats high in impulsivity spent more time in the compartment paired with amphetamine compared to those low in impulsivity. The results suggest that impulsivity may be related to differential sensitivity to amphetamine reward, thus implicating individual differences in impulsivity on vulnerability to stimulant abuse.

#34) Categorization of dimensionally-separable Gabor stimuli in a single dimension
relevant task.

Mark E. Berg, Eric Fox, & Randolph C. Grace
*The Richard Stockton College of New Jersey & University of Canterbury
(USA & New Zealand)*

Notable contributions to categorization literature that uses Gabor patches as stimuli have investigated single and multiple dimensional tasks (Maddox, 2003). None have specifically investigated the direct effects of manipulating the relevant dimensions of the Rule Based (RB) single dimensional task with nonhuman subjects. The RB task utilizes stimuli that vary in terms of a distribution of frequency and orientation but only attention to one of the dimensions is required for accuracy in the task. Our results showed that pigeons' accuracy was relatively high but not 100% which was possible in both conditions. Average performance was not significantly different between frequency- and orientation-relevant conditions. Model comparison analyses based on the General Linear Classifier (GLC) confirmed that subjects' responding was controlled by the relevant dimension in both conditions. However, systematic deviations of GLC predictions from the data were obtained for two of three pigeons.

#31) Effects of overall absolute reinforcement rate in a computational model of selection by consequences

Andrei Popa & J. J McDowell
Emory University (USA)

McDowell (2004) instantiated the Darwinian principles of selection, reproduction, and mutation in a computational model of selection by consequences. Behavior generated by the model has been shown to be quantitatively indistinguishable from the behavior of living organisms. McDowell and Popa (in press) showed that when running concurrent schedules, experimental settings designed to reasonably sample the reinforcement ratio domain may not adequately sample the absolute reinforcement rate domain. For example, a concurrent RI 10 RI 20 has a reinforcement ratio of 2:1, equal to a concurrent RI 100 RI 200; evidently, the absolute reinforcement rates differ considerably. McDowell and Popa suggested that the overall absolute reinforcement rate in a concurrent schedule might affect behavior generated by the computational model. Systematic and thorough sampling of the absolute reinforcement rate domain in a series of computational experiments confirmed this hypothesis. The results showed that as the overall absolute reinforcement rate increased, behavior generated by the computational model became less sensitive to changes in parameters related to reinforcer value, changeover delay, and impulsivity.

#32) Effects of reinforcer magnitude on resistance to extinction and reinstatement of alcohol self-administration

Adam D. Pyszczynski & Timothy A. Shahan
Utah State University (USA)

Considerable evidence suggests that the persistence of a target behavior is determined by the overall rate of reinforcement delivered in the presence of a discriminative stimulus associated with that behavior. Recent studies suggest that this stimulus-reinforcer relation also modulates propensity to relapse. The present experiment assessed whether variations in alcohol concentration produce corresponding differences in resistance to extinction and relapse of alcohol self-administration. Rats lever pressed in a multiple schedule of reinforcement alternating across days. Multiple-schedule components were associated with equal rates of alcohol deliveries, but different ethanol concentrations - 5% (lean) or 15% (rich). Rats received approximately the same number of dippers in rich and lean, but consumed more ethanol (g/kg) in rich. After stability in baseline, lever pressing was extinguished in both components. After an extinction criterion was met, rats experienced reinstatement sessions in which response-independent deliveries of 10% ethanol were delivered at 2-, 8-, 32-, and 128-s into each session. Relative resistance to extinction and relapse were greater in the rich component than lean, suggesting that these outcomes correspond to ethanol consumed and not the number of dippers delivered. These results extend the generality of Behavioral Momentum Theory to manipulations of reinforcer magnitude and reinstatement in alcohol self-administration.

3:00-3:50 What "Reinforcers" do to Behavior, II: Signposts to the Future

Michael Davison
The University of Auckland (New Zealand)

Introduction: Peter Killeen
Arizona State University (USA)

Over the last few years, it has become increasingly evident that the process of reinforcement may well have been misnamed and misunderstood. Events like contingent food for a hungry animal do not simply increase or maintain the probability of responses that they follow, they don't strengthen behavior. Rather, they may act as signposts to future events, guiding behavior through the learned physical and temporal maze of life. This signposting is not to be seen as additional to these events as reinforcers; Signposting is the reinforcement effect. This realization puts reinforcement right back into the purview of stimulus control. Events that we usually consider "reinforcers", on the other hand, have more or less value to the organism-so, signposting is additional to value. Thus, the next step is to ask whether organismically-valuable stimuli have any special properties when they signal future events. I will briefly discuss some research that starts the process of experimentally investigating what food delivery can, and cannot, signal in the time following such an event. I will try to reorganize some of what we think we know in these terms, and to suggest how this approach may provide a new understanding of behavior-analytic practice.

4:00-4:50 The Behavior Analyst Certification Board and the Behavior Analyst Profession

Gerald L. Shook
Behavior Analyst Certification Board (USA)

Introduction: James M. Johnston
Auburn University (USA)

The tutorial will explore the development of the Behavior Analyst Certification Board (BACB) including the growth of the BACB since its inception a decade ago; the process used by the BACB to develop degree, coursework, and supervised experience requirements to qualify for the examinations; the development of the examination content and construction of the examinations; the spread of certification to countries outside of the United States; and future development of BACB behavior analyst credentialing. The presentation will examine the role BACB certification has within the larger context of the behavior analytic field and the contributions that the BACB has made to the growth and development of the field. The tutorial will focus on how Behavior Analyst Certification Board certifications can help individuals have fulfilling careers as professional behavior analysts and will provide examples of career paths that are available for behavior analysts with Board Certified Behavior Analyst and Board Certified Assistant Behavior Analyst certifications.

#1) Components of time allocation in 2- and 3-alternative choice

Diann E. Gaalema & Michael Davison

Georgia Technical Institute & The University of Auckland. (USA - New Zealand)

Time allocation as conventionally measured includes three components: Time after reinforcers before responding commences, time spent responding, and time spent changing over between alternatives. Traditionally, these are arbitrarily allocated to alternatives according to the last response emitted, but this allocation may be wrong. This research investigated how each of these detailed measures was related to extended relative food frequencies in pigeons in 2- and 3-alternative choice with no changeover delay. Switching times constituted a surprisingly large proportion of session time, often greater than responding time. In 2-alternative choice, both responding time overmatched, post-food time undermatched, and switching times strongly undermatched, log food rates. Biases were inconsistent between the measures. In 3-alternative choice, responding time and post-food time undermatched log food ratios, and switching times again strongly undermatched. In 2-alternative choice, the tempo of responding (responses per time spent responding) were significantly related to log food ratios. Our discussion focuses on which time measure properly characterises choice, and which detailed time measure is isometric with the traditional response-allocation measure.

#2) Timing, reward processing and choice behavior in Wistar and Sprague-Dawley rats

Ana Garcia & Kimberly Kirkpatrick

Kansas State University (USA)

The present experiments evaluated timing, reward processing and impulsive choice behavior in Wistar (WS) and Sprague-Dawley (SD) rats, the two strains that are most commonly used in the temporal discounting literature. The rats were trained with a Progressive Interval/Fixed (PI/FI) procedure with a 15-s PI and a 60-s FI initially. They could choose a lever associated with a PI that began at 0-s and increased with each consecutive PI choice in increments of 15-s and a 60-s FI lever choice which resulted in a delay of 60 s until the delivery of the reinforce and reset the PI to 0 s. Over subsequent phases, the FI reward was increased to 4 pellets and the FI duration was increased to 120 s in separate phases. The results showed no difference among the strains in timing or choice behavior in any of the phases. Then, half of rats were exposed to a discrete trial delay discounting task with a Smaller sooner reward of 1 pellet delivered after 10 s and a Larger-later reward of 2 pellets delivered after 30 s. The results again showed no difference among the strains. Finally, to assess the effects of methylphenidate on choice and timing behavior in the two choice procedures, rats were injected subcutaneously with 0, 4, 8 mg/kg, and 12 mg/kg to obtain a dose-response curve. Methylphenidate increased preference for the PI lever in the PI/FI procedure indicative of increased impulsive choice. However, the effects of methylphenidate on the discrete trials discounting task were more variable indicating that the PI/FI procedure may be a preferred task for assessing specific effects of the drug.

#28) Self-controlled behavior in humans exposed to a temporally defined procedure

Raul Avila, Hilda Palacios & Patricia Miranda

National Autonomous University of Mexico (Mexico)

Self-controlled behavior was studied in 32 adults that were exposed to pairs of TV videos. The first video was always presented within a time cycle and the other could be presented once the cycle elapsed, according to the following contingency. To try to watch the first video interrupted it and cancelled the second video presentation. Otherwise, watching the second video presentation could occur. Time-cycle lengths of 32, 64, or 128 s were combined with first-video durations of 8, 32, 64 or 128 s. To lengthen the first video presentation decreased the percentage of second-video presentations earned per session and this effect was modulated by the time-cycle duration. The implications of this procedure for self-control theory are discussed.

#29) Selective attention to visual compound stimuli in squirrel monkeys

Bertram O. Ploog

College of Staten Island of The City University of New York, Graduate School & University Center of The City University of New York (USA)

Five squirrel monkeys were trained on a simultaneous discrimination task with visual compound stimuli (black/white rectangle/circle). After training, unreinforced test trials with stimuli consisting of recombined form and luminance components were interspersed. Training/testing was then repeated with reversed S+/S- contingencies. Under the original condition, luminance acquired greater excitatory control than form. No such difference was found under the reversal condition or for inhibitory control under either condition. Overall, inhibitory control was less pronounced than excitatory control. Highly accurate performance on training trials suggested that a 4-s delay between stimulus presentation and the opportunity to respond reduced "impulsive" responding. This finding has implications for reducing errors due to impulsive responding observed in children with autism and with attention deficit disorder.

#30) Conditioned and unconditioned responding in pigeons and chickens under autoshaping contingencies

Bertram O. Ploog & Tara Anne McCloskey-Chillemi

College of Staten Island of The City University of New York, Hunter College of The City University of New York, Graduate School & University Center of The City University of New York (USA)

Chickens and pigeons were trained under autoshaping contingencies with water reinforcers. Their conditioned and unconditioned responses were videotaped and scored in an attempt to quantify species-specific differences in responding. (Pigeons continuously suck water with their beaks almost closed, without neck movement, whereas chickens drink aliquots of water by raising their heads with neck movement to allow the water to drain by gravity into their throats.) While there were clear differences in unconditioned responding (actual drinking), differences in conditioned responding (neck movements towards a keylight) were nonsignificant. Apparently, species-specific unconditioned behavior does not directly affect conditioned behavior. However, we were able to show in one experiment that response-contingencies superimposed over the autoshaping contingencies affected conditioned responding in both species.

#25) What can “reinforcers” signal?

Michael Davison & Douglas Elliffe
The University of Auckland (New Zealand)

Post-food preference pulses are accompanied by strikingly similar changes in relative obtained reinforcers that are driven by preference, and the relative-response versus relative-reinforcer relation is likely dynamical at the local level. To investigate one aspect of this relation, we arranged a procedure in which every food delivery signaled a subsequent higher probability of food on one key for a fixed period, followed by the reversal of this probability, with trials ending after food delivery. Choice crossed indifference at approximately the time of food-ratio reversal, and tended to overmatch in the first interval, and undermatch in the second interval. But choice was also biased toward the location of the prior food delivery. Food delivery thus did two things to choice: It had a reinforcement effect (repeat the choice just emitted); and, in conjunction with time since food, it had discriminative or signposting (Shahan, 2010) effect (signaling where foods will likely be located at times after foods). The conjoint control by food location and time since food was quantitatively modelled, but provided results that did not conform to the expected constant coefficient of variation. Timing research

#26) A behavioral momentum-based model of resurgence

Mary M. Sweeney & Timothy A. Shahan
Utah State University (USA)

Resurgence is the relapse phenomenon most applicable to the replacement of a problem behavior (e.g., drug abuse, self-injury) with a socially acceptable alternative. We have developed a quantitative model based on momentum theory to capture the specific effects of the resurgence preparation on resistance to change and relapse. The model fits existing resurgence data well, and takes into account aspects of this paradigm ignored by the previous relapse model. The new model allows for both the disruptive and strengthening effects of alternative reinforcement, and can therefore explain the effects of rate of alternative reinforcement on extinction and relapse. In addition, the model makes predictions about reducing resurgence that have not yet been investigated empirically.

#27) Saccadic amplitude variability controlled by consequences

Celine Paeye & Laurent Madelain
Universite Lille Nord de France (France)

Computational theories of motor control view sensorimotor variability as the outcome of internal noise whereas the operant approach suggests that variability might depend on reinforcement. We manipulated the spread of saccadic amplitude distributions by reinforcing the least frequent movement amplitudes. In the seven experimental subjects amplitude variability increased – SD increased by a factor of 2; ‘uncertainty’ (U values) increased by a factor of 1.5 – while the median remained mostly unchanged. Moreover, variability returned to baseline level following contingency reversal. In a yoke control group no consistent modification of amplitude distributions was observed. These results challenge the idea of a fixed motor noise and are consistent with an operant approach of motor control.

#3) Estrogen produces modest increases in polydipsic caffeine drinking in OVX rats

S. Engebretson & D. J. Spear
Western Michigan University and South Dakota State University (USA)

Female rats ovariectomized (OVX) shortly after birth were raised in an isolated or enriched environment. Either water, water and saccharin, or water and saccharin and caffeine served as the daily fluid available in this initial environment. As adults, rats were autoshaped for lever pressing with a saccharin + caffeine solution available. Once responding was stabilized on an FI 30 sec schedule rats were injected s.c. with 0.015, 0.02, or 0.04 ug/kg estradiol (in peanut oil) prior to the session. Neither estrogen, environment, nor original fluid access had any appreciable effect on response rates of adult rats. Estrogen (0.02 ug/kg dose only) modestly increased the amount of saccharin + caffeine fluid consumed via polydipsia. The effect was slightly greater for rats raised in an enriched environment and for rats exposed early to a saccharin + caffeine solution.

#4) Effects of feedback: Changing reinforcement rates in generalized matching analyses

Greg Jensen & Allen Neuringer
Columbia University & Reed College (USA)

Under concurrent schedules of reinforcement, with reinforcers programmed probabilistically, rats chose among five operanda. The operanda differed from one another in terms of distances from reinforcer dispenser and required response topographies. We investigated how overall reinforcer rate (reinforcers per response summed across all operanda) affected two parameters of the matching relationship, bias and sensitivity, these computed with the Barycentric Matching Model (Jensen & Neuringer, 2009). Although undermatching was obtained throughout, sensitivities increased significantly as overall reinforcement rate increased. Biases, which were large as expected, changed only slightly, first decreasing and then increasing again at the higher reinforcements-per-response values. These results suggest that overall rates of reinforcement substantially affect approximations to matching, even when inherent biases are present.

#5) Level of food deprivation does not affect degree of discounting in pigeons

Amanda Calvert, Luís Oliveira, Amy Baum, Leonard Green & Joel Myerson
Washington University in St. Louis (USA)

People of higher socioeconomic status (SES) discount delayed hypothetical monetary rewards less steeply than those of lower SES (Green et al., 1996). Using level of food deprivation as a proxy for SES, the discounting of delayed food reinforcers by pigeons was studied under two conditions: high deprivation (75-80% of free-feeding weight), and low deprivation (90-95% of free-feeding weight). An adjusting-amount procedure was used to estimate the subjective value of food at delays ranging from 1 to 24 seconds. Discounting under both deprivation levels was well described by the simple hyperbola. However, there was no systematic difference in degree of discounting between the two deprivation conditions.

#6) Self-administration of methylphenidate and sucrose pellets in a rat model of ADHD.

Julie A. Marusich, Travis McCuddy, & Michael T. Bardo
University of Kentucky (USA)

Despite its abuse potential in both human and nonhuman animals, methylphenidate (MPH) is the most widely prescribed drug for the treatment of Attention Deficit Hyperactivity Disorder (ADHD). A defining characteristic of ADHD is impulsivity, which has been shown to be positively correlated with drug abuse vulnerability. To determine the causality of this correlation two experiments were conducted. The first experiment examined the relative difference of MPH self-administration in three different rat strains: Sprague-Dawley (SD), a behavioral control strain, Spontaneous Hypertensive Rat (SHR), an animal model of ADHD, and Wistar Kyoto (WKY), the genetic control strain for SHRs. By examining the acquisition of MPH self-administration, and self-administration of a variety of MPH doses these three rat strains were used to assess the relative impact of inherent impulsivity on drug abuse vulnerability. Experiment 2 replicated Experiment 1 but replaced MPH with sucrose pellets. This alteration allowed examination of whether or not SHRs were more sensitive to a food reinforcer. Exponential curves were fit to the acquisition data for all strains for both experiments to compare the rate at which the strains acquired each type of behavior. The combined results of these two experiments showed that

#7) Unifying Davison-Nevin (1999) and Shepard's (1987) universal law of generalization.

Blake A. Hutsell & Eric A. Jacobs
Southern Illinois University (USA)

We sought to simplify the DNA detection model by employing constraints on its discriminability parameters. Application of the model to n-stimulus, m-response procedures require that n - 1 and m - 1 discriminabilities be estimated. In part 1, we fit the DNA model to data sets employing n > 2 stimuli by assuming that discriminabilities conform to a specific psychophysical function. Model comparisons showed that the full DNA model provided a better account of the data. In part 2, we fit a modified version of the DNA model assuming a relation between discriminability and generalization derived from Shepard's Universal Law of Generalization. Specifically, discriminabilities are the inverse of generalization, which is a negative exponential of the Minkowski distance between physical measurements of the stimuli. Model comparisons revealed that the DNA model incorporating Minkowski distances provided a more accurate description of psychometric functions.

#8) Resistance to change of choice

Anthony P McLean
University of Canterbury (New Zealand)

Birds were prefed prior to sessions in concurrent VI VI, concurrent VI VI with a signalled VI schedule on the changeover key, and yoked multiple VI VI. In none of these procedures was there any difference in resistance to change between components. These, and other data, suggest a role for probability of reinforcement in determining resistance to change.

#23) Risky choice in pigeons: Preference for fixed and variable amounts in a token-reinforcement paradigm

Carla H. Lagorio & Timothy D. Hackenberg
University of Florida (USA)

The current research employed a token reinforcement procedure to study risk taking with amounts. Pigeons made discrete choices between fixed amount (FA) and variable amount (VA) token payoffs, with earned tokens later exchangeable for food. The first experiment parametrically assessed preferences by altering the payoff associated with the VA across conditions, and altering the FA payoff across phases. Pigeons were strongly risk prone, preferring the VA when it provided equal and fewer tokens on average. A second study assessed risk preferences using an adjusting amount procedure. Indifference points were frequently higher than the average VA amount, indicating a risk-prone choice profile. Together, the two experiments illustrate an effective method for establishing and quantifying risky choice.

#24) Assessing choice between high and low risk options when earnings carryover across trials: A dynamic optimization analysis

Adam E. Fox, J. Adam Bennett, Jerrad E. Yaw & Cynthia J. Pietras
Western Michigan University (USA)

Risky choice was assessed in adult humans under laboratory conditions designed to model energy budget manipulations conducted with non-humans. Subjects were presented with choices between high- and low-variance monetary options in blocks of five choice trials. Block earnings were added to session earnings only if they exceeded a minimum earnings requirement. The requirement was manipulated across conditions to generate positive and negative earnings budgets. In some conditions, earnings that exceeded the minimum requirement were carried over to the next choice block. These carryover conditions were designed to simulate foraging conditions in which excess energy reserves could be saved for subsequent foraging periods. The primary aim of the experiment was to determine whether the opportunity to carryover excess earnings influenced risky choice. Similar to previous earnings-budget studies with humans, risk sensitivity varied as a function of budget condition in a manner consistent with predictions of the energy-budget rule. In carryover conditions, when the carryover earnings could shift the budget in the next block from negative to positive, choice tended to shift optimally towards risk aversion. Within-block choices were analyzed in greater detail by comparing choices against the predictions of a dynamic optimization model. Optimal choices were calculated using expected earnings from only the current block, and from expected cumulative earnings from 1, 4, and 9 blocks into the future. Choices tended to become more consistent with predictions as the number of blocks in the calculation increased. These results suggest that consequences delayed from current choices may influence human risk preferences.

#21) The effect of time constraints on the area under the curve using a delayed discounting task

Jennifer Upton, Erin Brackett, Darlene Crone-Todd & Nicole Lambert
Salem State College (USA)

A measure of impulsivity can be defined as choosing a smaller, more immediate reward over a larger, more delayed reward. When results from such choice behavior are graphed, the area under the curve is a measure of impulsivity: the smaller the area, the more impulsive the behavior. Previous research indicates that there is a relationship between states of the organism (establishing operations) and impulsivity. Few laboratory studies, however, have systematically manipulated the situation such that the environmental conditions may influence decision-making. The present study manipulated a timer at the top of a computer screen to count-up (no time constraint) or count-down (time constraint), during which undergraduate psychology students (N = 50) completed a delayed discounting task. The results demonstrate that the limited time condition produced statistically significant smaller areas (when compared with the unlimited time condition) under the curve for all discounting values. This suggests that when time constraints are present, that individuals make more impulsive choices. The implications for future research will be discussed.

#22) Scene gist categorization in pigeons

Kimberly Kirkpatrick,, David Ghormley, Michelle Guevara, Ana Garcia, Tannis Sears, Bruce Hansen, & Les Loschky
Kansas State University & Colgate University (USA)

Scene gist categorization in humans is rapid and accurate and appears to be tuned to fundamental statistical regularities in the visual world. Although pigeons have been reported to form many types of categorical judgments, little research has examined scene categorization by pigeons or the underlying mechanisms of it. The present study trained eight pigeons on a scene gist categorization task using a go/no-go procedure. Four birds were trained to discriminate between two natural categories (beach vs. mountain) and four were trained to discriminate between a natural (beach) and a man-made (street) category. The birds successfully learned both categorization tasks at a similar rate and to a high degree of accuracy (>80%). During a subsequent generalization test with novel images, strong transfer of discrimination was observed with only a modest generalization decrement. Finally, the birds were trained with progressively shorter stimulus durations (beginning with the original 5-sec duration and decreasing to less than 1 sec) to determine if they could still form a discrimination with limited visual information as with humans. Decreasing durations initially negatively affected performance, but over time the pigeons recovered and formed discriminations with stimulus presentations in the 200-500 ms range. The results indicate that, like humans, pigeons can form rapid scene gist categorization judgments. However, the visual information critical for these judgments remains to be determined.

#9) The reinforcement omission effect as a translational model of negative urgency

Gipson, C.D., Kelly, T.H, & Bardo, M.T.
University of Kentucky (USA)

Negative urgency is a facet of impulsivity, and it is the tendency to engage in risky behavior due to extreme affect. The current study determined if a reinforcement omission effect could be a model of negative urgency. Rats were trained with an initial component in which a light always led to sucrose pellets. Rats were then allowed to self-administer d-amphetamine (AMPH; 0.03 mg/kg/infusion) in a second component. Omission trials in which no sucrose pellets were delivered were then inserted, and rats self-administered more AMPH on these trials. To increase translational validity of this model, an analogous procedure was used with human subjects rated high in negative urgency on the UPPS personality scale. Subjects high in negative urgency responded at a higher rate on omission trials in the behavioral task.

#10) An opportunity cost reinterpretation of preference reversal experiments

E. Terry Mueller and Warren K. Bickel
Center for Addiction Research, University of Arkansas for Medical Sciences (USA)

A new construct, opportunity-cost-informed price (OCIPt), was assessed for its ability to predict preference (proportion of larger-later, LL, selections rather than smaller-sooner, SS) reversals observed in 17 published experiments. Implemented reinforcement amounts and delays were substituted into equations to produce OCIPSS and OCIPLL values for each condition. Predictions of LL proportion ≥ 0.50 based on relations between OCIPSS and OCIPLL were correct in 78.8% of the 786 conditions. Among the subset of cases in which both a predicted and an observed preference reversal occurred, the correlation between the delay-to-SS values at which the prediction and observation occurred was 0.95. OCIPt bridges a gap between demand-curve-oriented behavioral economics and matching-law-influenced behavioral economics and has implications for learning theory and research.

#11) Double bisection of auditory temporal intervals by humans

R. Emmanuel Trujano & Oscar Zamora
Universidad Nacional Autónoma de México (México)

Scalar Expectancy Theory (SET) has been the leading theory on timing research, influencing also human timing research; however, there are other timing theories, such as Learning to Time (LeT). The double bisection task has been employed to test SET and LeT in pigeons, and, since human timing resembles animal timing, it is expected that similar results would be obtained in a human's analogue of the double bisection task. The purpose of this experiment was to verify this hypothesis. Humans performed the double bisection task, and data from all phases were analyzed. The results showed that humans perform the double bisection task in the same way as pigeons do. However, as LeT's main assumption cannot be applied to our results, two other explanations are considered.

#12) Verbal and nonverbal discrimination of relative and absolute number in humans

Lavinia Tan & Randolph Grace
University of Canterbury (New Zealand)

We investigated the performance of humans in verbal and nonverbal, relative and absolute numerical discrimination tasks. Participants were randomly assigned to either a verbal or nonverbal counting group and had to estimate the number of red pictures, ranging from 1-20, presented randomly within a sequence of black pictures. Participants were required to make one of three numerical responses after stimulus presentation: bisection, reproduction or report. Responding was more variable in the nonverbal group than in the verbal group. Average response numbers increased with sample number, with increasing underestimation. Relative response variability was nonscalar for smaller numbers, decreasing for values 1-7, but was constant or increasing for larger numbers. Human performance was remarkably similar to pigeons' performance in analogous tasks.

#13) A bi-exponential model of response-bout analysis under differential effort requirements

Ryan Brackney, Timothy Cheung & Federico Sanabria
Arizona State University (USA)

Lever press response rates in rats is well-described by the superposition of two exponential distributions, one characterizing rapid responses during a bout and the other characterizing the much slower rate of initiating a bout (Shull, Gaynor & Grimes, 2001; Killeen et al., 2002). The bi-exponential model presented here contains four parameters: i) w – within bout response rate; ii) q – the probability of remaining in the bout state after each response; iii) b – bout initiation rate; and iv) δ – the refractory period, or minimum IRT. How these parameters vary under changing reinforcement schedules and extinction was investigated with six rats trained on a multiple schedule design in which the force requirement and operandum height varied between components.

#14) The gambler's fallacy as foraging: Two tests

Ángel A. Jiménez and Carlos F. Aparicio
Universidad de Guadalajara & The Aurora School (Mexico & USA)

Rats responded in two variable-interval concurrent schedules where, within sessions, seven reinforcer ratios separated by 60-s blackouts occurred randomly. In different conditions a changeover lever required 1, 8, 16, 32, or 48 responses to switch to the rich lever. Sensitivity to reinforcement was higher with changeover requirements of 1, 8, or 16 responses than with changeover requirements of 32 and 48 responses. Successive same-alternative reinforcers had rapidly diminishing effects on preference. Reinforcers obtained on the opposite lever always shifted preference, and these changes were greater with increasing changeover requirements. The influence of arranging concurrent schedules independently in combination with asymmetrical changeover requirements is discussed to explain the present results.

#18) Measuring the essential value of brands: A behavioral-economic analysis

Jorge Oliveira-Castro, Gordon Foxall, Ji Yan, & Victoria James
Universidade de Brasília & Cardiff Business School (Brasil & UK)

Recent developments in behavioral economics have measured the essential value of reinforcers based upon price elasticity of demand relative to their free consumption. Results from several experiments, most with nonhuman subjects, were consistent with this model. In the present paper we used this model to assess the essential value of different brands of products based upon grocery-shopping purchases and examined the effects of brand levels of utilitarian and informational reinforcement upon their essential values. Panel data concerning purchases of three different product categories by over a 1500 British consumers during 52 weeks were examined. Results indicate the reliability of the measure of essential value and that brand essential value increases with increases in informational and utilitarian reinforcement.

#19) Differential sensitivity of schedule-induced lever pressing and schedule-induced licking to response-food delays

Ángeles Pérez-Padilla & Ricardo Pellón
Universidad Nacional de Educación a Distancia (Spain)

Eight food-deprived Wistar rats developed stable patterns of lever pressing and licking when submitted to a fixed-time 30-sec schedule of food pellet presentation. In order to initiate lever pressing, rats received lever presentations 10 sec before food delivery, being levers withdrawn just before food delivery. Lever insertions then extended through the entire inter-food interval, being withdrawn with food delivery and reinserted 2 sec later. On successive phases of the study, a protective contingency prevented food delivery if responses (lever presses or licks) occurred within the last 1, 2, 5 or 10 sec of the inter-food interval. Lever pressing was sensitive to response-food delays that were much shorter to those that reduced licking. These results conform to the suggestion that reinforcement contributes to the maintenance of different response patterns within time schedules.

#20) Managing environmentally impactful behavior by operating on its controlling contingencies

Francis Mechner & Laurilyn Jones
The Mechner Foundation (USA)

Behavior analysis offers a methodology for analyzing and modifying behavioral contingencies that control environmentally impactful behavior. Such contingencies, once understood, can be modified to achieve desired changes. Regardless of whether the consequences of such behavior are positive or negative, immediate or delayed, and on which parties they have an impact, the contingencies that control the behavior share a specific set of features. The body of knowledge applicable to effective interventions includes principles of temporal and probability discounting, ways of signaling consequences to make them more perceptible, ways of providing effective education and training to make consequences more predictable, and ways of installing new short term consequences for actions in situations where consequences are too delayed or amorphous to be experienced.

#15) The effects of the location of an appetitive intruded event on peak-interval timing in pigeons

Joseph D. Jacobs & Bruce L. Brown
Queens College and the Graduate Center of City University of New York (USA)

The effect of an intruded event on timing performance of pigeons was investigated using a peak interval (PI) procedure. Pigeons were trained on a PI 30-s schedule signaled by a yellow side key light. In separate sessions, pigeons were trained to peck a 6-s red center key on an RI 12-s schedule. In a subsequent experimental phase, the 6-s red center key were presented 9 s before or 3 s after the PI stimulus onset on some trials. The 6-s red center key was not presented on other trials. There was a peak shift when the 6-s center key is presented both before and after the PI trials. The peak shift on before trial is direct evidence for a postcue effect. Another question of interest is to determine if the temporal variability covaries with the peak time (multiplicative shift) or stays constant as the peak time increases (additive shift). An additive shift would suggest a delay in the resumption of time mediated through the switch subcomponent of the clock, whereas a multiplicative shift would suggest a change in the production rate of temporal pulses mediated through pacemaker subcomponent of the clock.

#16) Does increasing a lever force requirement decrease motivation? Mathematical Principles of Reinforcement versus actual behavior

Andrew T. Fox, Dennis J. Hand, John R. Smethells, Jhordy J. Lytle & Mark P. Reilly
Central Michigan University (USA)

Four rats lever-pressed under fixed-ratio (FR) schedules of reinforcement with different lever force requirements. Response rates were a bitonic function of ratio value, increasing then decreasing as FR increased, as predicted by Mathematical Principles of Reinforcement (Killeen, 1994), which assumes invariance between the putative parameters that represent response capacity and incentive value of reinforcers. However, as response capacity was reduced by increasing the force requirement, incentive value of the reinforcer also declined. One explanation of this effect is that a high-force lever develops aversive properties and therefore becomes demotivating. A second experiment was undertaken in which FR behavior was video-recorded and scored for lever-approach and lever-contact. Contrary to prediction, increased force increased both lever-approach and lever-contact, contradicting the high-force lever aversion account.

#17) The dynamics of conditioning in a probabilistic automaintenance procedure

Tyler Beird, Jade Hill, & Federico Sanabria
Arizona State University (USA)

A probabilistic automaintenance procedure was implemented, in which the illumination of a key (CS) was followed probabilistically by food (US). Thirty-two pigeons were divided into four groups, defined by US probability (.2, .1 .05, and .025). In all conditions, erratic bouts of CS-elicited key-pecking, resembling random-walk patterns, were observed. A multimodel selection analysis favored a model in which prior pecking, feeding, and coincidences of pecking and feeding determined the probability of pecking on any given trial. These results are discussed in light of the Momentum/Pavlovian/Skinnerian (MPS) model of conditioning (Killeen, Sanabria & Dolgov, 2009).

#15) Modeling successive reversals of conditioned approach performance

Federico Sanabria & Christopher A. Podlesnik
Arizona State University & University of Michigan (USA)

Rats performed Pavlovian conditioned approach responses to successive reversals of conditioned stimuli (CS) differentially paired with food reinforcement. With continuous food following CS+, the likelihood of responding was high and constant across all reversals. In the absence of food following CS-, responding initially was high following reversals but decreased across sessions. Surprisingly, asymptotic decreases in CS- responding lessened with successive reversals. Within sessions, responding to CS- decreased more rapidly later in sessions, suggesting recovery of responding at the beginning of each session. A linear model developed to account for changes in responding as a function of likelihood of food and responding on previous trials accounted for all these effects with the exception of the enhanced CS- responding following later reversals.

#16) Sexual discounting: HIV risk behavior and the discounting of delayed sexual rewards

Matthew W. Johnson
Johns Hopkins University School of Medicine (USA)

Cocaine dependence is associated with high rates of HIV infection via sexual risk behavior. In this study cocaine dependent individuals select photos of people with whom they would be willing to have casual sex, and rate their likelihood of using a condom if one were immediately available. Then, participants rate their likelihood of waiting (delays varying across trials) to use a condom versus having unprotected sex now. Of the 9 currently completed participants, 3 indicated $\geq 95\%$ likelihood of having unprotected sex even when a condom was immediately available. For 6 participants, the decreased likelihood of condom use with delay was consistent with a hyperbolic function. Results suggest that delay discounting of sex may underlie HIV risk in cocaine dependence.

#17) Effects of baseline reinforcer rate on responding during extinction and renewal

Meredith S. Berry & Amy L. Odum
Utah State University (USA)

Six pigeons were exposed to ABA and ABC renewal conditions, in which responses during baseline were reinforced on a multiple variable-interval (VI) 120-s (lean) and 30-s (rich) schedule of food presentation. Following baseline in the ABA renewal paradigm, reinforcement was removed and responding was placed on extinction with flashing key lights for seven sessions. Baseline conditions were then reinstated, while extinction remained in effect. Responding on the key previously associated with the relatively rich schedule was generally more resistant during extinction relative to the lean. Upon reintroduction of the baseline context, recovery of responding in the rich context was greater than that of the lean for most subjects. A similar procedure was employed to investigate the effects of ABC renewal.

#18) Separability and compound stimuli in equivalence relations

Nora Giezek, Vinca Rivière & Jean-Claude Darcheville
Université Lille Nord de France (France)

Three experiments were implemented. In the first, we used a Matching to Sample procedure to teach A-B and B-C relations. In the second, we used instead compound stimuli with two elements in simple discrimination trials. In both experiments, each stimulus was presented single in a simple discrimination procedure. Half sets of stimuli were S+, the others became S-. Results are identical. Transitivity and Symmetry appeared only if single elements controlled responses in training. In a third experiment, simple discrimination trials were used. Responses on compounds and single stimuli were reinforced or responses on either compound or single or both were extinguished. Recombination of stimuli in testing appeared only if responses were reinforced on both compound and single stimuli during training.

#19) Reflexivity in pigeons following successive matching discriminations.

Mary M. Sweeney & Peter J. Urcuioli
Purdue University (USA)

This study explored the ability of animals without language (i.e., pigeons) to form equivalence relations. Specifically, we examined one facet of equivalence relations: reflexivity, the ability to match a stimulus to itself without any explicit training to do so. Urcuioli's recent theory of pigeons' equivalence class formation predicts reflexivity following successive matching to sample procedures that facilitate the formation and merger of reinforced stimulus classes. Two groups of pigeons were trained on three sets of successive conditional discriminations that should yield either reflexivity or its opposite in testing. Although the latter group did not show the predicted (opposite) effect, the former group showed evidence for reflexivity, which may be the first time this phenomenon has been demonstrated in any animal.

#20) The dynamics of choice in a discrete trial procedure

Jade Hill, Jonathan Schiro & Federico Sanabria
Arizona State University (USA)

The dynamics of choice in pigeons was assessed using a discrete trials procedure. A peck to the center key activated two side keys. A peck to either side key turned the other key off. After 10 pecks on the available key, a food reinforcer could be delivered. Reinforcement was scheduled probabilistically and independently on each key. Once reinforcement was scheduled it remained set up until collected, thus mimicking a free-operant concurrent VI VI arrangement. The ratio of reinforcement probabilities varied across conditions (1:1, 1:6, and 6:1). As in its free operant variant, choice between discretely available options undermatched obtained reinforcement rates. A dynamical analysis determined the extent to which choices were influenced by prior choices and their outcomes.

#12) Spatial Pavlovian conditioning

Gabriel J. Mazur, Colter Whillock, & Federico Sanabria
Arizona State University (USA)

Associative learning research has traditionally focused on how CSs disambiguate the temporal--but not spatial--location of USs. We investigated the effectiveness of CSs that are spatially informative of a US. First, responding to a first-order stimulus (CS1) was autoshaped. Then two different second-order stimuli (CS2 and CTRL) were simultaneously presented at random locations immediately preceding the CS1. CS1 was spatially correlated to CS2 but not CTRL. The CS2 was designed as a weak temporal cue, but a precise spatial cue for the upcoming CS1. Pigeons responded differentially to the CS2 over CTRL. Control conditions verified that a fixed CS1 location reduced responsiveness to CS2. Results demonstrate that spatial correlation between CS2 and CS1 elicited tracking responses to CS2.

#13) Within-session changes in response time during choice based on aesthetic preference

Elias Robles, Nicole A. Roberts, & Federico Sanabria
Arizona State University (USA)

Within-session changes in responding have been observed during assessment of subjective value in human choice. This study explored the occurrence of similar phenomena during choice based on aesthetic characteristics. In two experiments, college students (N=118) chose from pairs of body wash bottles. Relative frequency of choices and response times were measured. Within-session reductions in RT were unrelated to practice. A log linear model that includes a) the number of times of exposure to both images, b) preference for the chosen image, and c) preference for the rejected image, adequately predicts within-session changes in RT. Active comparison of the images appears necessary. The observed systematic reductions in RT may be due to categorization of the stimuli occurring during the choice task.

#14) Comparison of different models of delay discounting: Different commodities

Daniel Hutchison & Amy Odum
Utah State University (USA)

Various models have been suggested to account for indifference points obtained in delay discounting experiments. Here we compare a one-parameter hyperbolic (Mazur, 1987) and three two-parameter models: one in which the added free parameter represents the sensitivity of subjective value to delay (e.g., Rachlin, 2006), one for which the free parameter accounts for individual differences in the scaling of delay (e.g., Myerson & Green, 1995), and a two-parameter model based on Tsallis' statistics (e.g., Takahashi, 2008). We examined the models in two ways. First we simulated a family of curves for each model using Graphpad Prism to determine the effects of adjusting free parameter values. Then we used Graphpad Prism to fit each model to various sets of archival data.

#9) Does misery love company? Allocating punishment between oneself and another in a simple economic game

Kenny Oyama, Arthur Kennelly, & Edmund Fantino
University of California, San Diego (USA)

In the Sharing Game, a subject is given the task of choosing from among a set of options as to how to distribute a good between themselves and another unknown (and many times imaginary) participant. In the original study, Kennelly and Fantino (2007) used positive reinforcers, such as money, as the resource to be allocated, and found gender differences in choice behaviors. In this study, participants were instructed to divide a positive punisher of 'time on a boring task' between themselves and another subject. We are interested in not only seeing whether or not gender effects are present in this study, but if there is also an asymmetry of using reinforcing and punishing resources, and to what extent.

#10) How is the rate of the change in resistance-to-extinction affected by the rate of reinforcement in multiple VI VI schedules?

Taku Ishii & Toru Negishi
Keio University (Japan)

In our experiment, pigeons' key-pecking responses were reinforced with multiple VI 15-s VI 60-s schedules. After the response rates had become stable, the experimental condition began, with each experimental session starting with those same multiple schedules, but with reinforcement halted in both of the components at some unpredictable time during the session. We assessed the resistance-to-extinction of responding in each session by comparing the rate of response before and after the initiation of the extinction procedure. The results showed that resistance-to-change was higher in the rich component than in the lean component. However, resistance-to-extinction became weaker with repetition of experimental sessions that had the same rate of change in the two components.

#11) Shifts in the free-operant psychophysical function of humans

Kyle D. Dillon, Mika L.M. MacInnis & Paulo Guilhardi
Brown University & New England Center for Children (USA)

The goal was to develop a human analog to the free operant psychophysical procedure used in rats and pigeons, in order to examine the effects of differential rates of reinforcement on the psychophysical function in humans. Participants completed a computerized two-alternative free operant psychophysical procedure in which the early response provided reinforcement during the first half of the 6-s trial, while the late response provided reinforcement during the second half. Each half was further halved, and each quarter was reinforced with either a high or low random interval schedule, while the overall reinforcement rate was constant in the first and second halves of each trial. The data were examined in light of the results obtained on similar procedures with animals.

#21) Exploration as a mechanism for change detection

Andra Geana, David Freestone, & Russell Church
Brown University (USA)

On concurrent VI-VI schedules, rats match their time allocation to the reinforcement rates of the different alternatives. Matching maximizes reinforcement. On concurrent VR-VR schedules, rats should exclusively respond on the more rewarding alternative, but they do not. Is this non-exclusivity adaptive? We tested whether the responses on the less rewarding lever, "exploration," were affected by how, and how often, the reinforcement rates abruptly changed on a concurrent VR-VR procedure. The rats explored more when changes occurred more often (either every 1, 5 or 15 sessions). The rats also explored more when the lever with the more rewarding schedule was varied at each change (e.g. from left to right). The more the rats explored, the faster they detected the programmed change. This may suggest that exploration is a mechanism to detect changes quickly.

#22) Curve fitting active time functions and the impact of a change over delay

Mark Cleaveland & Andrew T. McKenzie
Vassar College (USA)

Previous research has shown that in concurrent variable-interval (VI) VI schedules animals allocate their choices based on the most immediate interresponse time. The functions which describe this relationship between time and choice are termed active time functions. This poster presents an experiment that examines the effect of a change over delay (COD) on active time functions. Two groups of birds were run under concurrent VI 30 VI 60 schedules of reinforcement. Groups differed on whether the procedure included a change over delay of 2 seconds. Clear group differences were found in the resulting active time functions. Finally, these functions were included with others reported in the literature and subjected to statistical curve fitting.

#23) Testing ATM with a discrete-trial multiple concurrent VI VI procedure

Mark Cleaveland & Erika Militana
Vassar College (USA)

This poster describes a direct test of the active time model for concurrent VI VI choice. The active time model (ATM) suggests that the time since the most recent response controls choice. Pigeons were trained in a discrete-trial multiple concurrent VI VI procedure. However, rather than being fixed, discrete trial intervals were allowed to vary according to a normal distribution. Schedule values consisted of a VI 20-s VI 40-s and a VI 40-s VI 80-s. After training, unreinforced probes were conducted in which discrete-trial intervals were biased to be either longer or shorter than normal. ATM predicts that overall preference will become less extreme with shorter intervals and more extreme with longer intervals.

#24) Can schedules perceived value be explained by the perceived value of just a few reinforcers?

Nicholas Hewlett Keen Commons-Miller, Michael Lamport Commons, Robin Francis Gane-McCalla, Alex Pekker, Michael Woodford, & John Bates Clark

Tufts University, Harvard Medical School, Dare Institute, University of Texas, & Columbia University (USA)

Can schedules perceived value be explained by the perceived value of just a few reinforcers? The additive noise model states that discounted reinforcer value simply adds together linearly but as time passes noise is added, $VO = \text{Overall value} = \sum v_i$ where v_i = effective or perceived value of a reinforcer at time i . Our unified theory integrates initial value of outcomes, delay and risk. Results from samples suffice to characterize entire schedules. Three derivatives of immediate reinforcer value with respect to time of a reinforcer summate many properties of discounting accounts of reinforcement schedules. A trial consisted of a two chain schedule. The first link consisted of the presentation of one of a large number of samples from a t schedule (Schoenfeld & Cole, 1972; Schoenfeld & Cole, 1972). The second link was a choice between a left key indicating the sample was lean or the right key indicating it rich. The value of an instantaneous reinforcer is A_i . The perceived sample value was an hyperbolic function of how soon before choice a single reinforcer was (first derivative) as the Commons et al. (1982)/Mazur's (1987) equation for delay found, $v_i(\text{delay}) = A_i / (1 + s_20 k_1 d_i)$. Risk is the derivative of Commons et al. (1982)/Mazur's (1987) equation for delay: $v_i(\text{risk}) = -A_i k / (k d_i + 1)^2$ was well fit by a negative power function as proposed.

#25) The evolution of operant behavior from the coordination of two instances of respondent conditioning shown using the Model of Hierarchical Complexity

Michael Lamport Commons
Harvard Medical School (USA)

At Sensory Motor Order 1 in the Model of Hierarchical Complexity, organisms engage in only single actions at a time. It includes simple respondent behavior and respondent conditioning. These actions are not coordinated with other actions. However, there are coordinations of stimuli. A reflex is a behavior that is characteristic of this order of complexity. A reflex is a biologically-based system linking stimuli to responses. At the circular Sensory Motor Order 2 two reflexive conditions from Order 1 are coordinated. This new behavioral process is operant conditioning by which consequences change the likelihood of future behavior. This occurs at the Circular Sensory Motor Order 2. The first instance of respondent conditioning is the pairing of brain event with a behavior. All behaviors are elicited by stimuli. Some stimuli are internal to the organism. Such brain events are firing of one or more neurons. For any behavior to occur, it must be preceded by neural firing (a brain event). The brain event that elicits the operant behavior becomes salient by preceding and predicting (being paired) the salient unconditioned reinforcing stimulus that follows it. This brain event that elicits the operant response may now act as a "plan". The second instance of respondent conditioning is the pairing of the "plan" with environmental stimuli. Because the brain event "plan" is now salient, the second instance of respondent conditioning may successfully proceed. These environmental stimuli now come to elicit these incipient "plans".

#6) Resistance to change of divided attention performance

Eric A. Thraillkill, Christopher A. Podlesnik, & Timothy A. Shahan
Utah State University & University of Michigan (USA)

Resistance to change of divided attention was assessed in pigeons responding on delayed matching-to-sample trials with compound sample (color + line orientation) and element comparisons (two colors or two line orientations). Different trial-ready stimuli signaled two multiple-schedule components with either high or low overall probabilities of reinforcement for accurate matches. Accuracy was similarly sensitive to variations in relative reinforcement within both components but relative resistance to pre-session feeding, extinction, and decreased sample duration were not. Between components, however, resistance to pre-session feeding and extinction, but not decreased sample duration, were greater in the Rich component. Consistent with behavioral momentum theory, our results suggest resistance to change of divided attention is determined by the overall reinforcement rate in a stimulus context.

#7) Reinforcer Magnitude and the Generalized Matching Law

Jacinta Cording, Anthony McLean & Randolph Grace
University of Canterbury (New Zealand)

According to the generalized matching law, the effects of relative reinforcer magnitude on response allocation in concurrent schedules can be described as a power function of the magnitude ratio and are independent from the effects of relative reinforcer rate. However these assumptions are difficult to test experimentally because individual studies typically lack sufficient statistical power to detect systematic but small deviations from fits of the generalized matching law. To overcome this problem, we conducted a residual meta-analysis with all available data (Sutton, Grace, McLean & Baum, 2008). We identified all previous studies which had reported data from at least four conditions in which relative reinforcer magnitude was varied in concurrent schedules ($n = 5$), and in which sensitivity to relative reinforcer magnitude (or rate) was determined at different levels of relative reinforcer rate (or magnitude; $n = 5$). Although comparatively few studies were available, results supported the assumption of the generalized matching law that effects of relative reinforcer magnitude can be described by a power function and are independent from relative reinforcer rate.

#8) Is resistance to change controlled by reinforcement rate or by the total number of reinforcers delivered?

David R. Maguire, Brian D. Kangas, Marc N. Branch, Tracy G. Taylor, Craig W. Cummings, Christine E. Hughes, & Raymond C. Pitts
University of Florida & University of North Carolina Wilmington (USA)

Key-pecking in pigeons and lever-pressing in rats were maintained under a two-component, multiple schedule of food presentation. Components differed with respect to average inter-food interval and were separated by an inter-component black-out. Component durations were arranged such that the ratio of component durations equaled the ratio of average inter-food intervals. This procedural variation allowed for average inter-food intervals to vary across components but held total number of food presentations across components constant throughout the duration of training. Resistance-to-change tests (response-independent food presentation during the black outs, prefeeding, and extinction) were then conducted. Results are discussed in terms of the nature of the contribution of reinforcement history to behavioral momentum.

#3) Looking beyond breakpoint in methylphenidate self-administration under a progressive ratio schedule of reinforcement

Joshua S. Beckmann, Julie A. Marusich, & Michael T. Bardo
University of Kentucky USA

Progressive ratio (PR) schedules have become a procedural staple in behavioral pharmacology used to measure drug reinforcement in the self-administration model (Richardson and Roberts, 1996). Most studies using these schedules in self-administration report a single data point: the break point or extinction ratio. The present study investigated within-session responding in methylphenidate self-administration on a PR schedule in rats. Contrary to food reinforced responding under PR, response rate was a dose-dependent, bitonic function of ratio requirement that decreased at smaller ratios and increased at larger ratios. In addition, post-reinforcement pausing increased dose dependently to asymptotic levels, suggestive of methylphenidate intake regulation. The data are discussed in terms of control system models including pharmacokinetics and satiety threshold.

#4) Prospective timing with duration sequences in rats

Oscar Zamora, Montserrat Vanegas & Arturo Bouzas
Universidad Nacional Autónoma de México (México)

To better understand the question in prospective cognition whether animals remember unique, personal past experiences, we show an experiment that has as central axes: 1) the study of the ability to estimate temporal sequences of durations, 2) the evaluation of the role of the introduction of a delay between the signals that compose the sequence, and at the end of the sequence, and 3) to evaluate in conditions of generalization the two previous axes. Eight rats were trained in a conditional discrimination task, where the sample stimulus consisted of sixteen possible sequences of durations; each sequence could be short or long and was composed by two tones modalities (high and low frequency). The effect of a delay was assessed in two conditions, in one, it was inserted between the components that formed the sequence (Delay Between Components); in the other it was located at the end of it (Delay at the End of Sequences). In both conditions, generalization tests were conducted, presenting five new sequences of durations. The results obtained allow us to conclude that the subjects discriminate sequences of durations perfectly. The location of the retention interval affected differently the discrimination in both conditions.

#5) The role of sample and comparison attending in the repeated acquisition of a temporal classification.

Blake A. Hutsell & Eric A. Jacobs
Southern Illinois University (USA)

Three rats responded in a 6-stimulus temporal classification task. A successive-reversal design was used in which the relationship between stimulus class and correct comparison location reversed every 15 sessions. After several reversals, the probabilities of reinforcement for correct classifications were manipulated. In each condition, response bias was acquired more rapidly than discrimination accuracy. A modified version of the attending model offered by Nevin, Davison, & Shahan (2005) accurately described the acquisition data. Furthermore, parameters expressing the probability of attending to comparisons increased at a higher rate than that of sample attending. These findings support a key assumption of the attending model; the conditioned value of a stimulus modulates the expression of discriminative control exerted over behavior.

#26) Nondifferential signaling of terminal links reduces initial- and terminal-link sensitivity to immediacy

Elizabeth Kyonka & Randolph Grace
West Virginia University & University of Canterbury (USA & New Zealand)

Four pigeons responded in a concurrent chains/peak procedure in which terminal links were 10 s and 20 s fixed-interval schedules. The location of the shorter terminal link changed unpredictably across sessions. During terminal links, the center key was lighted red for left and green for right terminal links in the differential condition, and white for all terminal links in the nondifferential condition. Sensitivity of initial-link response allocation to programmed relative immediacy was significantly higher in the differential condition than the nondifferential condition. Peak medians and response distributions for no-food terminal links were schedule-dependent in the differential but not the nondifferential condition. The attenuation preference and undifferentiated temporal control in the nondifferential condition indicate that schedules must be distinguishable by more than the subject's behavior in order to acquire control over initial- or terminal-link responding.

#27) Learning to stop or reset the internal clock

Vladimir Orduña, Federico Ramírez, & Arturo Bouzas
Universidad Nacional Autónoma de México (Mexico)

In the present experiments, we induced a change in the strategy employed by rats during gap trials, by means of presenting, during fixed interval (FI) training, 9-sec interruptions in 40% of the trials; in one type of interruption, after the discriminative stimulus resumed, the FI was re-started; in the second type of interruption, the FI had to be completed taking into consideration the time before the interruption. The effect of these manipulations was tested in a peak-interval with gaps procedure. The main result was that the strategy employed during gap trials depended on the type of interruption experienced during the training phase, both in a comparison between subjects (exp 1) and within subjects (exp 2).

#28) Generalization of latent inhibition in artificial neural networks

Cristina Dos Santos & José E. Burgos
University of Guadalajara (Mexico)

Latent inhibition is the retardation of Pavlovian conditioning after preexposure to the conditioned stimulus (CS). Such retardation has also been observed to occur if the preexposed CS (A) is similar to the trained CS (B), a phenomenon known as generalization of latent inhibition. A neural-network model was used to simulate this phenomenon. The model takes into account the roles of hippocampal and dopaminergic systems in conditioning. Partially connected networks first received 400 trials of A alone, followed by 200 pairings of B and the unconditioned stimulus (US). All stimuli were simulated as maximal activations of input units. The similarity between A and B was simulated by making the corresponding input vectors non-orthogonal (i.e., they shared an input unit). The number of trials required to meet an acquisition criterion was higher for the preexposed networks than for the non-preexposed networks. Likewise, networks that were preexposed to A required more B-US pairings to meet the acquisition criterion than networks that were not preexposed to A. Thus, the model correctly predicts the generalization of latent inhibition.

#29) Effects of partial reinforcement on Pavlovian acquisition and extinction in artificial neural networks

José M. Sánchez & José E. Burgos
University of Guadalajara (Mexico)

Latent inhibition is the retardation of Pavlovian conditioning after preexposure to the conditioned stimulus (CS). Such retardation has also been observed to occur if the preexposed CS (A) is similar to the trained CS (B), a phenomenon known as generalization of latent inhibition. A neural-network model was used to simulate this phenomenon. The model takes into account the roles of hippocampal and dopaminergic systems in conditioning. Partially connected networks first received 400 trials of A alone, followed by 200 pairings of B and the unconditioned stimulus (US). All stimuli were simulated as maximal activations of input units. The similarity between A and B was simulated by making the corresponding input vectors non-orthogonal (i.e., they shared an input unit). The number of trials required to meet an acquisition criterion was higher for the preexposed networks than for the non-preexposed networks. Likewise, networks that were preexposed to A required more B-US pairings to meet the acquisition criterion than networks that were not preexposed to A. Thus, the model correctly predicts the generalization of latent inhibition.

#30) Optimal risky choice with multiple targets

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Foraging theorists have argued that an organism's risk-sensitive foraging choices may be influenced not only by the energy amount needed to survive, but also by the energy amount needed to reproduce. Choice may maximize fitness by being risk prone when the energy-budget is negative, risk averse when the energy-budget is positive, and again risk prone in positive-budget conditions when energy reserves are high and risky choices can meet the upper energy target. The present study investigated risky choice in seven adult humans in an analogue "earnings-budget" procedure to determine whether human's choices would be influenced by multiple targets. Participants made repeated choices between fixed and variable money amounts in blocks of trials. Participants could keep block earnings (i.e., survive) only if earnings exceeded a minimum requirement. In some conditions, if block earnings exceeded an upper requirement participants received a monetary bonus. Positive and negative earnings-budgets were generated by manipulating the value of the minimum requirement. Consistent with the energy-budget rule, choice was risk averse in positive-budget conditions and risk prone in negative-budget conditions. In most cases, choice was also risk averse when the upper requirement was present. Trial-by-trial choices were generally consistent with predictions of a dynamic optimization model but were less consistent in conditions with the upper requirement. Many of the inconsistencies were risk-averse choices occurring when risk-prone choices could meet the upper requirement. These results suggest that human's risky choices were influenced by the minimum requirement but rarely by the upper requirement, and that choice was typically risk averse whenever the earnings budget was positive. Future research will investigate whether a larger bonus for meeting the upper requirement will enhance risk proneness.

#1) Overall reinforcer frequency impacts conditional discrimination accuracy and sensitivity to reinforcer frequency but not resistance to disruption

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The present study examined whether conditional discrimination accuracy and sensitivity to variation in relative reinforcer frequency would be higher and more resistant to disruption in a context of greater overall frequency of reinforcement. Four pigeons responded under a two component multiple schedule of conditional discrimination procedures. Within each component, the relative frequency of reinforcement was varied across two sub-components from 1:9 to 9:1. Across components, the overall reinforcer frequency was varied. Under baseline, discrimination accuracy was higher in the component with greater overall frequency of reinforcement, replicating numerous prior results. Sensitivity to reinforcer frequency was also higher in the component with greater overall frequency of reinforcement and there was a positive relation between discrimination accuracy and sensitivity. Although resistance to disruption of accuracy and sensitivity to a variety of test manipulations was not systematically greater in either component, there was a positive relation between disruption of discrimination accuracy and disruption of sensitivity, replicating recent results. These results replicate and extend results from concurrent schedules choice procedures and can be partially explained within a quantitative framework that posits decreases in attention to sample stimuli as a mechanism of disruption under the test manipulations employed here.

#2) Quantitative analyses of activity on a popular social bookmarking website

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Human behaviour in operant choice experiments is notoriously highly variable. Within the same experiment, sensitivity to reinforcement can range from indifference to extreme overmatching. This has been attributed to the rule-governed nature of human behaviour. The failure of behaviour to become contingency-shaped may not be surprising given the short (often less than 1 hour) sessions, often only experienced once. Additionally, the putative reinforcers (points, often not exchangeable for anything) may have no value. An alternative way to quantitatively investigate human choice behaviour may exist in analysis of user histories on websites with user-generated content. Reddit (www.reddit.com) is one such social bookmarking site where users post links to web-content and can comment on their own and others' links. Users can upvote or downvote links and comments, indicating approval or disapproval of the submitted content. The status of upvotes as positive reinforcers was evaluated by conducting generalized matching analyses comparing the relative rates of link and comment submissions (responses) to the relative upvotes received for links and comments (reinforcers). These analyses allowed for investigation of human choice behaviour in a situation with perhaps more highly valued reinforcers than in typical human operant experiments. Additionally, time spent in contact with the contingencies is not limited to a single session, allowing behaviour to more fully come into contact with the contingencies of reinforcement. Lastly, the popularity of the website (hundreds of thousands of accounts), provided huge amounts of data to analyse.