

Program - Conference on Comparative Cognition (CO3) - This conference was cancelled due to the covid-19 crisis

Wednesday Afternoon

3:30 PM Welcome Reception and Check-In

7:00 PM Opening Remarks (Steve Fountain)

7:05 PM Canine Cognition (Chair: Olga Lazareva)

7:05 PM **Decoding Odor Mixtures in the Dog Brain with fMRI**

Ashley Prichard (Georgia Institute of Technology), Raveena Chhibber, Jon King, Kate Athanassiades, & Gregory Berns (Emory University)

Dogs rely upon their ability to discriminate a target odor from distracting odors and other sensory stimuli. Using awake fMRI in 18 dogs, we examined the neural mechanisms underlying odor discrimination between two odors and a mixture. Neural activation was measured during the presentation of a target odor (A) associated with a reward, a distractor odor (B) associated with nothing, and a mixture of the two odors (A+B). Neural activation during the presentations of the odor stimuli was measured over time within three regions involved with odor processing: the caudate nucleus, amygdala, and olfactory bulbs. Average activation within the amygdala showed that dogs maximally differentiated between odor stimuli based on the stimulus-reward associations by the first run, while activation to the mixture was most like the no-reward (B) stimulus. To identify the neural representation of odor in the dog brain, we used machine learning to predict the classification of the odor mixture into its components. Using a random forest classifier, we found that the amygdala, piriform, and posterior cingulate cortices were most important for the classification of odors in the dog brain. Confusion matrices suggested that the dogs treated the odor mixture as a new configuration rather than elemental components.

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7:19 PM **The olfactory capabilities of dogs for smelling different quantities of food**

Jackson, S. M., Kathrene, G. M., Roberts, & W. A. (Western University)

Previous research has suggested dogs cannot smell the difference between quantities of hot dog slices (Horowitz et al., 2013). We offered 10 dogs a choice between one and five hot dog slices covered by opaque containers, after an initial investigation where the dogs were allowed to smell each container. Over 20 trials, dogs showed a strong preference for the larger quantity, $p < .001$. In a second experiment, we tested if 10 new dogs conformed to the distance effect and/or the ratio effect when smelling quantities. Although a significant preference for the larger quantity again was found, $p < .001$, no significant difference in discriminative ability for the larger quantity was found between the three tested ratios: 2:4, 4:6 and 4:8, $p = .737$, suggesting dogs do not follow the distance or ratio effect when smelling different quantities. Further results will be discussed.

2

7:26 PM **Whom do you prefer? Investigating the human-dog attachment system in pet dogs**

Sabrina Karl (Messerli Research Institute Veterinary University Vienna Medical University of Vienna and University of Vienna 1210 Vienna Austria), Magdalena Boch (Social Cognitive and Affective Neuroscience Unit Faculty of Psychology University of Vienna Vienna Austria Department of Cognitive Biology University of Vienna Vienna Austria), Claus Lamm (Social Cognitive and Affective Neuroscience Unit Faculty of Psychology University of Vienna Vienna Austria), & Ludwig Huber (Messerli Research Institute Veterinary University Vienna Medical University of Vienna and University of Vienna 1210 Vienna Austria)

Studies showed that the human-dog relationship resembles the human mother-child bond. But is the dogs' brain network comparable to humans? Do dogs prefer their caregiver over other humans? We used different methods to investigate the human-dog attachment system. Therefore, we conducted an fMRI study with 16 awake unrestrained dogs and an eye-tracking study (N=15) while perceiving visual stimuli. Additionally, we collected behavioral data in a two-choice task (N=24). We presented dynamic face pictures of the caregiver and other humans. Based on behavioral evidence we expected the dogs to show a preference for their caregiver. We predicted that the dogs would spend more time on the "caregivers side" of the test arena in the behavioral test. During the eye-tracker test we expected the dogs to fixate the caregiver stimuli comparatively more on the screen. Preliminary fMRI analyses suggest that dogs showed a stronger brain activation, e.g., in the hippocampus when they perceived the caregiver stimuli compared to the others. Cortical brain areas are involved in human attachment as well. Hence, our data suggest first indications for similar neural networks involved in attachment in humans and dogs. The data from the preference tests are less clear and will be discussed with caution.

3

7:33 PM **Proactive interference in canine olfactory matching-to-sample**

Adam Davila, Sarah Krichbaum, Lucia Lazarowski, Emma Cox, Paul Waggoner, & Jeffrey Katz (Auburn University)

In two experiments, the impact of proactive interference (PI) was tested in a matching-to-sample task using odors in purpose-bred detection dogs. In Experiment 1, PI was tested by manipulating the number of odors that occurred in a 24-trial session: 48 (trial-unique), 6 and 2 odors. Dogs performed well in the trial-unique sessions, showed a minor performance decrement in the 6-odor sessions, and the greatest decrement (10%) in the 2-odor sessions relative to the trial-unique sessions. In Experiment 2, interference probe trials, in which the non-matching odor occurred as the matching odor 1, 6, or 12, trials back (n-back), were inserted into otherwise trial-unique sessions. Half of the sessions in Experiment 2 had a 20-s delay occur between the sample and choice stimuli, while the other half had a 0-s delay. With the 0-s delay, there was a shallow interference function, as 1-back and 6-back probes produced a small interference effect. With the 20-s delay, there was a steep interference function. Overall, these data show evidence for time-based PI in dogs.

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7:40 PM **Olfactory Working Memory in Dogs in a Delayed Match-to-Sample Task**

Sarah Krichbaum, Lucia Lazarowski, Adam Davila, Emma Cox, Paul Waggoner, & Jeffrey Katz (Auburn University)

Delayed match-to-sample (DMTS) is commonly used to study working memory (WM) processes in non-humans. WM duration is typically measured by increasing the delay between the presentation of the sample stimulus and presentation of the comparison stimuli. Many species, including dogs, have demonstrated the ability to remember visual stimuli for delays up to two minutes. However, DMTS with olfactory stimuli has not been explored. Dogs (n = 4) trained on match-to-sample, with 48 odors, were tested on four delay lengths (0, 30, 60, and 90 sec) in a 24-trial session. Although there was a slight decline in accuracy across delays, dogs performed above chance on delays up to 90 seconds, suggesting a WM duration of at least 90 seconds. To explore the effect of proactive interference on working memory duration, we reduced the stimulus set to 6 and then 2 odors. There was little effect on the memory function with 6 odors. However, accuracy decreased at each delay length on the 2-odor set. These results will be discussed in relation to olfactory WM in dogs.

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7:47 PM **"Do that again!" Training dogs (Canis lupus familiaris) to repeat recent actions on cue**

Allison Scagel, & Eduardo Mercado (University at Buffalo)

Dog training usually depends on associating cues with specific actions. What exactly dogs remember about those actions remains unclear. Most studies of nonhuman animal memory focus on memories for objects, images, or spatial information. Less is understood about animals' abilities to flexibly retrieve memories of recent actions and to use those memories to guide their responses to cues. One way to reveal how animals encode and retrieve memories of their own actions is by testing their ability to self-imitate. Training dogs to repeat actions on cue can potentially reveal what they remember about their recent actions and how long they retain this information. This project examined self-imitation in domestic dogs using techniques previously applied to bottlenose dolphins, rhesus macaques, and pinnipeds. We tested two dogs' abilities to recall five trained behaviors immediately after completing an action and after a delay. Both dogs learned the "repeat" cue and one could correctly repeat actions after a delay. One dog is being tested on the ability to repeat novel behaviors upon first exposure. This study can advance our knowledge of what dogs remember and how they represent recent actions.

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7:54 PM **Matching-to-sample abstract-concept learning by dogs**

Lucia Lazarowski, Adam Davila, Sarah Krichbaum, Emma Cox, Paul Waggoner, & Jeffrey Katz (Auburn University)

Abstract-concept learning requires judging relationships between stimuli and forms the basis for many higher-order cognitive processes. Evidence of matching-to-sample (MTS) concept learning has been demonstrated in a wide range of species, but has not yet been shown in dogs. The lack of evidence for MTS concept learning in dogs could be attributed to a lack of cognitive capacity or, more likely, procedural limitations. We trained dogs (n=4) on a two-choice olfactory MTS task using a set of 48 odors in trial-unique sessions. Once dogs met an acquisition criterion (two consecutive sessions >83% correct), we tested for transfer to novel odors. Dogs matched novel odors with above-chance accuracy similar to baseline levels, satisfying the criteria for full abstract-concept learning. Procedural features that may have facilitated concept learning will be discussed.

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8:01 PM *Break*

8:11 PM Cognitive Processes I (Chair: Heidi Harley)

8:11 PM **Manipulation of mental images by rhesus monkeys**

Thomas C. Hassett, Victoria K. Lord, & Robert R. Hampton (Emory University)

Because nonhuman animals lack language, mental imagery may be a particularly important type of representation for them. The extent to which mental images are useful is determined in part by the fidelity with which they preserve physical features of the world. We tested the extent to which monkeys formed and manipulated mental images while preserving correspondence of physical features.

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Across three experiments, we found converging evidence that rhesus monkeys formed and rotated mental images, demonstrating the manipulation of mental images with substantial fidelity. In Experiment 1, monkeys took longer to rotate mental images into congruence with test images the more the test images were rotated, a hallmark of mental rotation in humans. In Experiment 2 monkeys learned to use a cue to rotate mental images to fairly precise positions. In Experiment 3 monkeys used this cue to speed responses to test stimuli. These results show that rhesus monkeys manipulate mental images.

8:18 PM

Motor Inhibition in the Pigeon, Investigating Variability in Performance Within and Across Cognitive Domains

Mary Flaim, & Aaron P Blaisdell (University of California - Los Angeles)

In humans and animals, performance across diverse cognitive tasks is correlated so that performance in one task is indicative of performance in another. This results in low levels of within-subject variability, but high levels of between-subject variability. Factor analysis indicates one factor that can account for half of the variance in performance, termed *g*. Even though *g* is found across humans and animals, the difference in tasks raises questions about if *g* differs across species. The use of motor inhibition tasks is a key difference. In humans, the relationship between *g* and motor inhibition is underexplored, but evidence suggests that they are not related in adults. In animals, motor inhibition tasks are more commonly included and are usually related to the *g* factor. However, the tasks used to measure motor inhibition varies strongly across species, further occluding our ability to determine if the same construct is being measured. We have designed a touchscreen version of the Go/No-go, stop signal and reversal learning task for pigeons. This more closely resembles the tasks given to humans to better investigate these questions. Our results will indicate if these three tasks are measuring the same construct and if its related to other cognitive measures.

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8:25 PM

Science, Eco-opportunities, and Wellbeing in Bottlenose Dolphins

Heidi E Harley (New College of Florida and Disney The Seas at Epcot®), Wendi Fellner, Kim Odell, & M. Andrew Stammer (Disney The Seas at Epcot®)

Good animal welfare often includes an animal's ability to engage in naturalistic behaviors and autonomous decisions. Here we offered dolphins the choice to participate in cognitive problem-solving "foraging" sessions designed to answer scientific questions. We asked: (1) Will our dolphins choose to participate? (2) Can dolphins use vision alone to distinguish marine species? Prey capture requires stealth; echolocation clicks may alert prey to dolphins' interest. Can vision serve? Three adult male bottlenose dolphins living in a large mixed-species salt water habitat discriminated 35 marine species in a matching task: Dolphins viewed a photo sample and chose among 3 video alternatives in 18-trial sessions balanced for sample identity and alternative position. Observers naïve to the sample identified dolphins' choices. In later sessions, sample stimuli alerted the dolphins to the opportunity to engage in these trainerless, self-initiated "foraging" sessions; correct matches led to food fish appearing at the water's surface. The dolphins successfully discriminated 30 3-alternative sets (5 sessions per set; $M=81.20\%$, $SD=10.04\%$), indicating they have the potential to forage using vision alone. They chose to participate 97% of the time with an average latency to response of 5 sec to first samples of sessions. A triple play: science, eco-opportunities, dolphin autonomy.

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Thursday Afternoon

12:00 PM Ron Weisman Outstanding Student Presentation Competition: Paper (Chair: Dave Brodbeck)

12:00 PM **Auditory perception and preference for male song in Estrildid finches**

Moises Rivera (The Graduate Center of the City University of New York), & Sarah M. N. Woolley (Columbia University)

Songbirds rely heavily on vocalizations in order to court mates, defend territories, and advertise presence. In Estrildid finches, juveniles learn their song from adult tutors during the song learning stage (ca. 25–90 days post-hatch), and development of the auditory system results in the perceptual abilities necessary for discrimination and preference of songs. These perceptual abilities may best be studied using females, whose ecological role as the "choosing sex" in reproductive courtship is postulated to have evolutionarily favored their development of auditory perceptual processes. My research explores the hypothesis that selection on acoustic signals has led to coevolution of the vocal production systems of senders and the perceptual processing systems of receivers. I have recorded and analyzed the songs of four Estrildid species for song acoustic feature comparisons within species, and have related the measures of acoustic features to phylogenetic relatedness for comparisons between species. Preliminary data suggest that species vary in the intraspecific variance of their modulation power spectra (MPS), and song MPS may be predicted to some extent by phylogenetic distance. My study aims to test the effects of acoustic song features and phylogenetic relatedness on the behavioral preference of females for songs.

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12:07 PM **Metacognitive monitoring of visual and auditory discriminations by rhesus monkeys**

Jonathan Engelberg, Ryan Brady, & Robert Hampton (Emory University)

Monkeys learn visual discriminations and memory tasks much more readily than auditory tasks (Scott & Mishkin, 2016; Wright, 1988). The reason for this difference is unclear, especially because monkeys naturally engage in sophisticated vocal communication. We tested whether visual and auditory stimuli are equally accessible to metacognition, investigating the hypothesis that auditory processing in monkeys is implicit, or less accessible to cognitive monitoring, than is visual processing. Rhesus macaques (*Macaca mulatta*) were given discrimination tests of varying difficulty levels and the option to accept or decline each test. Monkeys could maximize rewards by accepting easy tests and declining difficult tests. Accuracy was titrated such that monkeys showed similar difficulty functions for auditory and visual discriminations. Two monkeys declined more difficult than easy visual discriminations, showing evidence for metacognition. In intermixed auditory discriminations they declined most trials, showing no difference in decline rate between difficulty levels even with extended training. These data suggest that monkeys cannot readily monitor their auditory knowledge, a finding that may explain their difficulties on auditory tasks. Notably, in humans, monitoring auditory information is important for processes such as the phonological loop of working memory. Humans may have developed novel cognitive monitoring processes that facilitate language.

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12:14 PM **Effects of Predictive Stimuli on Human Choice in a Concurrent Chains Procedure**

Vincent Edwards, Robert Southern, Sara Bond, Jeremy Jasmer, Melvin Marsh, Jessica Stagner, & Kent Bodily (Georgia Southern University)

When given the choice between two alternatives with unequal payouts, pigeons preferred the alternative that resulted in less food on average when it was followed by stimuli that predicted reinforcement (terminal links) (Zentall & Stagner, 2010). The concurrent chain procedure used in this study was adapted to test the effect that predictive terminal links have on human choice behavior. Participants were randomly assigned to one of three conditions where, upon choosing an initial link, they experienced either a predictive terminal link, a non-predictive terminal link, or the absence of a terminal link entirely. Confirmatory data analysis failed to show a significant effect of block and terminal link type. There was no interaction between block and terminal link type. Choice allocation in the first and final blocks were analyzed and compared to generalized matching law predictions for exploratory analysis. The results of the study suggest that obtained reinforcement has greater influence on human choice than the predictiveness of the terminal link stimuli.

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12:21 PM **Black-capped chickadees (*Poecile atricapillus*) can identify individual females by their fee- bee songs I: Initial baseline performance**

Carolina Montenegro, William Service, Erin Scully, Shannon Mischler, Kimberley Campbell, & Christopher Sturdy (University of Alberta)

Individual recognition occurs in many bird species. The ability to discriminate between familiar and unfamiliar conspecifics is critical to avoid wasted time and energy during social interactions. Black-capped chickadees are able to discriminate between individual female and male chick-a-dee calls, potentially male and female tset calls, and male fee-bee songs. In the current study, we used an operant discrimination go/no-go paradigm to determine whether female and male chickadees can discriminate between fee-bee songs produced by individual female chickadees as well as to test which song component(s) could enable this discrimination. Birds trained on natural categories—the songs of different individual females—learned to respond to rewarded stimuli more quickly than birds trained on randomly selected song stimuli, and were able to transfer this learning to new songs from the same categories. In addition, when exposed to only the fee portion of the fee-bee song of rewarded individuals, chickadees were able to generalize their responding, however this generalization did not extend to the bee portions of rewarded individuals. Our results provide evidence that black-capped chickadees can use female-produced fee-bee songs for individual identification. However, the acoustic features underlying individual identification require further investigation.

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12:28 PM **Developing an avian model for human rhythm perception**

Andrew Rouse, Aniruddh Patel, & Mimi Kao (Tufts University)

Every human culture has music with a beat: a regularly occurring perceived event to which people can synchronize or entrain when dancing. Beat perception is predictive and appears to involve the motor system, even in the absence of movement. Beat-based processing also has interesting connections to timing-related disorders, from Parkinson's disease to dyslexia. To investigate the neural mechanisms underlying beat perception, it would help to have a model system. The zebra finch (*Taeniopygia guttata*) is a vocal-learning songbird with excellent auditory discrimination abilities that can learn to predict timing of antiphonal calls. To evaluate their suitability as a model, we first examined whether these birds can discriminate regularly (rhythmic) versus irregularly timed (arrhythmic) sound sequences. Previous work showed that zebra finches could learn to discriminate these stimuli with feedback but were unable to generalize to novel stimuli. Using juvenile males (97-116 days old) and sequences of naturalistic sounds, we show that male zebra finches ($n=4$ of 5) can learn to discriminate between rhythmic and arrhythmic sequences at several tempi. Moreover, males generalize this discrimination to novel tempi without reinforcement. Developing an animal model of rhythm perception would allow more fine-grained investigation of neural mechanisms underlying human rhythmic abilities.

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12:35 PM **The impact of environmental factors on cognitive abilities: A meta-analysis**

Connor T. Lambert (University of Alberta), & Lauren M. Guillette (University of Alberta and University of St Andrews)

Since the 1950's, researchers have examined how differences in the social and non-social environment affect the learning and memory of rats, mice, and, more recently, a variety other species. Despite this large body of research, little has been done to synthesize these extant findings; as such, we asked the following questions: are effects consistent across differing types of environmental variables (e.g., social, non-social) and is the timing of these treatments important? To address these questions, we conducted a meta-analysis examining how different environmental features impact cognitive abilities. Using 537 mean-differences from 179 published articles across 27 species we conducted phylogenetically-corrected mixed-effects models that reveal: 1) the average absolute effect is

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significant at $d = 0.51$; 2) social and asocial treatments effects do not differ from one another, but the combination of treatments result in a significantly higher affect than social treatments alone; 3) effects of treatment administered in early life are smaller than those that occurred after nutritional independence, and 4) the delay between treatment and the cognitive test does not influence the effect size. These results suggest environmental factors do significantly affect cognitive abilities, and the type and timing of treatments impacts the strength of the effect.

12:42 PM Choice (Chair: Noam Miller)

Preference assessments of environmental enrichment device color and foraging behavior in Loggerhead sea turtles (*Caretta caretta*)

12:42 PM *Erin Frick (Eckerd College), Amanda Mahoney (The Chicago School of Professional Psychology), Andrew Bulla (Georgia Southern University), Devin Dumont, & Lisa Olanderski (University of Georgia Marine Extension Service Aquarium)*

17 Physical and cognitive environmental enrichment are utilized in animal welfare science and have been demonstrated to improve the physical and psychological health of animals. The effectiveness of various forms of enrichment can vary based on motivational preferences for food, objects, locations, and other parameters, but little attention has been given to the phylogenetic variables that impact enrichment efficacy. Reptilians such as Loggerhead sea turtle (*Caretta caretta*) are typically understudied and underrepresented in cognitive assessments of environmental enrichment. Recently it has been demonstrated that Loggerhead sea turtles have true color vision and that colors may differentially strengthen certain choice response classes (e.g., phototaxis). Utilizing both restrictive operant and free operant paradigms, we assessed color sensitivity and its effect on foraging choice responses in several turtles housed in an aquarium. Results indicate a strong sensitivity for yellow in some subjects, whereas another exhibited a higher preference for green. Data also indicates choice is affected by the interaction between the color of the object and contrasting background color stimuli. These results suggest that individual differences in color sensitivity and preference should be considered when developing enrichment or other devices meant to elicit species-typical responses from reptilians and other animals.

12:56 PM Sequential choice by pigeons and humans: Don't let the pigeon chair the search committee.

18 *Walter Herbranson (Whitman College)*

The Secretary Problem is a brain teaser of interest to mathematicians and behavioral scientists, usually articulated as a hiring decision. Individual applicants are considered sequentially, and each can either be hired or irrevocably rejected. If an applicant is rejected, the next is presented, and another hire/reject decision is made. The mathematically optimal strategy is to reject the first n/e applicants, and then select the first applicant that ranks higher. To see if pigeons could learn the optimal strategy, a task was designed with the same structure and solution as the Secretary Problem. Pigeons viewed sequences of 10 colors, associated with different probabilities of reinforcement. Birds made a decision after seeing each to accept (by pecking the color) or reject (by pecking an alternate "reject" key). After accepting, birds received reinforcement according to the probability linked to that color. At the end of training, pigeons' responses matched the optimal strategy on only 15% of trials, and the consistently viewed fewer applicants than is optimal. Nevertheless, pigeons earned close to the optimal number of reinforcers. In a second experiment, human participants faced the same task. Like pigeons, they failed to adopt the optimal strategy, making their selections too early.

1:10 PM Outcomes of Forced Experiences May Not Affect Human Choice Behavior

19 *Jessica Stagner, Sara Bond, Vincent Edwards, Jeremy Jasmer, Robert Southern, & Kent D. Bodily (Georgia Southern University)*

Pigeons prefer an alternative that precedes stimuli which predict the presence or absence of reinforcement (Roper & Zentall, 1999), even when this choice results in less food (Stagner & Zentall, 2010). To assess the generalizability of this preference, the current research tested human participants with similar tasks. Overall, human participants did not show a preference for reinforcement-predictive stimuli. That is, the extent to which the stimuli presented following choice of an alternative indicated the presence or absence of reinforcement did not seem to affect human choice behavior. Interestingly, the choice allocation of participants that received forced experience trials did not differ from participants that were given only choice trials. Across all conditions, what seemed to account for the majority of variability in participants' choices were the obtained reinforcements that followed those choices. These data suggest that outcomes following forced-experience trials may not factor in to participants' choices in these tasks.

1:24 PM Relative Size Learning in Honeybees (*Apis mellifera*)

20 *Max Nakamoto, & Patricia A. Couvillon (University of Hawaii at Manoa)*

Associative learning in honeybees has been extensively studied with results surprisingly similar to those of vertebrates. Studies of more complex phenomena, such as relational learning, also have produced similarity. In the present experiments, bees were trained to discriminate relative size, an inherently relational problem, and, in a subsequent experiment, were trained to discriminate the odd size in a three-stimulus oddity problem. The stimuli were wooden blocks of equal height and four different lengths. In Experiment 1, bees were trained with pairs of different-sized blocks on each trial, with all six possible size pairs used across the 16 trials. Half were rewarded for choosing the longer block, and the others for choosing the shorter block. The bees learned the relative size discrimination. In Experiment 2, bees were rewarded for choice of the odd-sized block from a set of three blocks, with all 12 possible block combinations used across the 18 trials. On half the trials, the odd-sized block was longer than the others, and on the other half, it was shorter. The bees learned to choose the odd-sized block. These results suggest that honeybees can use two relational concepts simultaneously, an ability demonstrated in very few vertebrate species.

1:38 PM Break

1:48 PM Spatio-temporal Dynamics (Chair: Maria Tello-Ramos)

1:48 PM Interaction effects of food and water deprivation on the spatio-temporal organization of behavior in Wistar rats

21 *Varsovia Hernandez-Eslava, & Alejandro Leon Victor Quintero (Comparative Psychology Lab of Veracruz University)*

The effects of food or water deprivation conditions on food or water consumption has been extensively reported in the literature. The effect of the interaction of those deprivation conditions on food and water consumption and on the temporal organization of behavior is less known. The purpose of the present study was to evaluate the effects of four different conditions of food and water deprivation on the spatio-temporal organization of behavior when food and water are concurrently available. Six rats were exposed to each of four different conditions of food and water deprivation: a) food deprivation, b) water deprivation, c) food and water deprivation and d) no deprivation. Six experimental sessions were conducted under each deprivation condition. Sessions consisted in simultaneously presenting a pellet of food and a drop of water using a Concurrent Fixed Time 30s schedule on dispensers located on opposite walls of an extended experimental chamber. Results show an effect of the interaction of deprivation conditions on the direction of behavior (displacement routes), head entries to dispensers and number of drops of water and pellets consumed. We discuss our results in terms of the function of deprivation conditions on different dimensions of behavior.

2:02 PM Food deprivation and evolution of the orienting reflex in jumping spiders mexigonus minutus (Araneae: Salticidae)

22 *Alejandro Leon Ursula Huerta (Comparative Psychology Lab)*

Among all the families of spiders, Salticidae are known for having a sharp vision, therefore, a special interest has been developed on the analysis of their response to visual stimuli. The purpose of this study was to evaluate, using single subject designs, the ontogenetic evolution of orienting reflexes in jumping spiders mexigonus minutus to three visual stimuli, under different food deprivation conditions: one, three, five, seven and nine days of deprivation. Twelve jumping spiders were exposed to six experimental sessions in which three pairs of visual stimuli were presented under the five different deprivation conditions. Sessions began for each subject in a different level of deprivation. The experimental space was a "V" maze with a OLED screen at the end of each arm, screens were connected to an Arduino One board controlled by a PC to present stimuli to the screens. Using a specialized software we presented routes, distance, speed, acceleration and latency of the locomotion response of subjects. Comparisons were conducted as a function of food deprivation and the qualities of the stimuli presented. We discuss the utility of the apparatus and the analysis of the spatial behavioral dynamics employed for the study of orienting reflex in Araneae: Salticidae.

2:16 PM Functional location of water-dispenser and behavioral dynamics in a Fixed Time schedule in Wistar rats

23 *Alejandro León, Varsovia Hernandez, & Ursula Huerta Itzel Luna (Comparative Psychology Lab of Veracruz University)*

In non-contingent schedules, using extended experimental chambers, it has been reported that spatio-temporal variation in water deliveries is positive co-related with the variety of translational patterns of behavior and its several dimensions (e.g. routes, speed). Usually, spatial variation is accomplished by varying the number of dispensers and distance among them. Such criteria do not consider the possible eco-functional relevance of the location of the water dispenser (e.g., on a "open space"- center of the experimental chamber- vs. "close space"- corner or wall of the experimental chamber-). In the present study we evaluated the eco-functional relevance of two locations of the dispensers upon behavioral dynamics in Wistar rats using a Fixed Time 30s. schedule in an extended experimental chamber. Six subjects were presented to 40 sessions, 20 minutes each, using a Fixed Time 30s. of water delivery under two sequences of location of the dispenser: a) Center-Wall; b) Wall-center. Each location was present in 20-sessions blocks. Recurrence patterns, routes, time at zones and number of drops of water consumed were analyzed. Our findings suggest a differential relevance of the location of the dispensers. Results discuss, from a field perspective, in relation to the concept of functional densification of space.

2:30 PM Spatial Cognition (Chair: Sue Healy)

The antarium: A reconstructed visual reality arena

24 *Trevor Murray (Macquarie University Sydney and Australian National University), Zoltan Kosci, Jochen Zeil (Australian National University), Ajay Narendra, & Ken Cheng (Macquarie University Sydney)*

We introduce the antarium and present some preliminary results. The antarium consists of a dome decked with many LEDs projecting in green, blue and ultraviolet wavelengths, in the range that most ants perceive. The LEDs project visual scenes that ants would perceive at a location in their physical habitat. The scene is created by taking many photos and making a 3D model of the outdoor world. In an open-loop system, a constant scene is projected, while in a closed-loop system, the scene changes as it would change outside in accord with the test ant's movement. The test ant is moving inside

the dome on a track ball floating on air. The ant is attached loosely to a rod via a small piece of string, so that it is supporting its own weight on the ball; the system provides all the natural proprioceptive cues. We present data showing that ants in the antarium are correctly directed in a reconstruction of a familiar scene, but not in a reconstruction of an unfamiliar scene or with no scene at all. We discuss how the antarium can be improved.

25 2:37 PM **Directionality, the celestial compass and trail pheromones as a corridor cue in the desert harvester ant, *Veromessor pergandei***

Cody A Freas, & Marcia L Spetch (University of Alberta)

Navigating ants find their way using a variety of mechanisms, including keeping track of their relative location via a celestial compass-based path integrator (vector) and depositing a pheromone trail which can be retraced. These navigational systems are often in use simultaneously and when in agreement can direct the navigator to goal locations. By rotating the ground beneath navigating *Veromessor pergandei* foragers, we found that ants on the pheromone trail maintain orientation to the celestial compass dictated nest direction even when manipulations result in these foragers traveling backwards along the pheromone trail. However, when directional conflicts led foragers off their pheromone trail, individuals were particularly hesitant to leave the trail, especially when their path integrator indicated they were close to the nest. Additionally, these foragers were adept at continuously updating their body orientation to the homeward vector even while its direction is fluid and able to maintain their headings at rotational speeds of up to 45 deg/s. Our findings suggest that path integration and pheromone cues work together to aid successful navigation in *V. pergandei* with the path integration system providing directionality on the trail while the pheromone acts as a corridor cue inhibiting travel in incorrect directions.

26 2:44 PM **“Are we there yet?” An exploration of time’s effect on distance perception.**

Zebulon K. Bell and Martha Escobar (Oakland University)

The effect of exteroceptive stimuli on subjective timing is well established (Penton-Voak, Edwards, Percival, & Wearden, 1996). Generally speaking, exposure to an auditory stimulus (e.g., a click train) appears to increase internal clock speed and alter interval timing. In the present study, we sought to determine whether the frequency of a click train (reported in beats per minute, or BPM) could alter interval timing in rats. Subjects were habituated to a moderate frequency click train (90 BPM) and trained to dig for a reward in an open field apparatus. Unrewarded probe trials were then given under either a slower (60 BPM) or faster (180 BPM) frequency click train to determine whether the rats would overestimate or underestimate the distance to the rewarded goal location in the presence of different auditory stimuli. The differential effect of click train frequency on subjective time perception was assessed, and the implications for distance perception based on internal clock speed will be discussed.

27 2:51 PM **Numerical ordinality in wild hummingbirds**

Maria Tello-Ramos, Tas Vámos (University of St Andrews), Andrew Hurlly (University of Lethbridge), & Susan Healy (University of St Andrews)

Nectarivores might use ordinality while foraging to remember the specific order in which to visit a sequence of flowers, a foraging strategy known as traplining. We tested whether wild, free-living rufous hummingbirds (*Selasphorus rufus*) could use ordinality to visit a rewarded flower. Individual hummingbirds were presented with a series of linear arrays of 10 artificial flowers; only one flower in each array was rewarded. During training, birds learned to locate the correct flower independent of absolute spatial location. The birds showed no significant decrease in accuracy depending on ordinal position (1st, 2nd, 3rd or 4th). This suggests that hummingbirds were using an object-indexing mechanism of numerical processing, rather than a magnitude-based system. When distance cues between flowers were made irrelevant during test trials, birds were still able to locate the correct flower. The distribution of errors during both training and testing indicates that the birds may have used a so-called ‘working up’ strategy to locate the correct ordinal position. These results provide the first demonstration of numerical ordinal abilities in a wild vertebrate and suggest that such abilities are relevant to the foraging behavior of hummingbirds.

3:05 PM **Snack Break**

3:35 PM (Chair: Anna Wilkinson)

28 3:35 PM **Science, Eco-opportunities, and Wellbeing in Bottlenose Dolphins**

Heidi E Harley (New College of Florida and Disney The Seas at Epcot®), Wendi Fellner, Kim Odell, & M. Andrew Stammer (Disney The Seas at Epcot®)

Good animal welfare often includes an animal’s ability to engage in naturalistic behaviors and autonomous decisions. Here we offered dolphins the choice to participate in cognitive problem-solving “foraging” sessions designed to answer scientific questions. We asked: (1) Will our dolphins choose to participate? (2) Can dolphins use vision alone to distinguish marine species? Prey capture requires stealth; echolocation clicks may alert prey to dolphins’ interest. Can vision serve? Three adult male bottlenose dolphins living in a large mixed-species salt water habitat discriminated 35 marine species in a matching task: Dolphins viewed a photo sample and chose among 3 video alternatives in 18-trial sessions balanced for sample identity and alternative position. Observers naïve to the sample identified dolphins’ choices. In later sessions, sample stimuli alerted the dolphins to the opportunity to engage in these trainerless, self-initiated “foraging” sessions; correct matches led to food fish appearing at the water’s surface. The dolphins successfully discriminated 30 3-alternative sets (5 sessions per set; M=81.20%, SD=10.04%), indicating they have the potential to forage using vision alone. They chose to participate 97% of the time with an average latency to response of 5 sec to first samples of sessions. A triple play: science, eco-opportunities, dolphin autonomy.

29 3:49 PM **The Method of Validation by Zenith**

David Leavens (University of Sussex)

Many contemporary theories of the genesis of language point to Plio-Pleistocene origins for language-relevant cognitive innovations in the human lineage, after our split from the last common ancestor of chimpanzees, bonobos, and humans. A key empirical foundation for these Discontinuity Theories is based on direct comparisons between humans and apes. The typical finding is that human children raised in postindustrialised societies respond differently in these tests, compared to older, institutionalised apes. Here, I describe a validation protocol for tests administered to representations of different species at different life history stages. Previous applications of this validation procedure reveal that adult humans tend to respond more like adult great apes than like human children. This supports a family of Continuity Theories, which posit important elements of psychological continuity between apes and humans. Specifically, our hominin ancestors were pre-adapted for key elements of joint attention, which facilitates language acquisition.

30 4:03 PM **Evaluating the connection between personality and cognition in captive Asian elephants**

Lisa P. Barrett, & Sarah Benson-Amram (University of Wyoming Zoology and Physiology Department and Program in Ecology)

Despite significant interest in both animal personality and animal cognition, the effect of personality on performance on problem-solving tasks remains equivocal. Importantly, the interaction between personality and problem solving could influence learning ability. In this study, we utilize behavioral observations, novel object tests, and zookeeper surveys to measure individual variation in personality in captive Asian elephants (*Elephas maximus*). We then ask whether individual variation in personality predicts individual variation in problem-solving ability on novel foraging puzzle-feeders. Results from this work will inform the cognition literature by providing experimental data on the intersection between cognition and personality. Additionally, Asian elephants are considered endangered due to habitat loss and human-elephant conflict. In light of this, we discuss important implications for conservation.

31 4:10 PM **The Method of Validation by Zenith**

David Leavens (University of Sussex)

Many contemporary theories of the genesis of language point to Plio-Pleistocene origins for language-relevant cognitive innovations in the human lineage, after our split from the last common ancestor of chimpanzees, bonobos, and humans. A key empirical foundation for these Discontinuity Theories is based on direct comparisons between humans and apes. The typical finding is that human children raised in postindustrialised societies respond differently in these tests, compared to older, institutionalised apes. Here, I describe a validation protocol for tests administered to representations of different species at different life history stages. Previous applications of this validation procedure reveal that adult humans tend to respond more like adult great apes than like human children. This supports a family of Continuity Theories, which posit important elements of psychological continuity between apes and humans. Specifically, our hominin ancestors were pre-adapted for key elements of joint attention, which facilitates language acquisition.

32 4:24 PM **The effect of within-cage environmental complexity on corn snake (*Pantherophis guttatus*) cognition**

Anna Wilkinson, Gokulan Nagabaskaran, Tatjana Hoehfurner, & Oliver H. P. Burman (University of Lincoln)

Reptiles have traditionally been viewed as sluggish, inert and unresponsive and as such there has been little focus on their welfare in captivity. Our research has revealed remarkable cognitive abilities in this group. These findings emphasise the need for captive reptiles to experience cognitively complex housing environments and appropriately tailored husbandry regimes in order to maximize their health and welfare. However, we have little knowledge about how captive conditions impact cognition and behaviour. This experiment examined the impact of increased within-cage environmental complexity on cognition in corn snakes (*Pantherophis guttatus*). Animals were kept in super enriched vs standard housing for a period of 1 month and then their cognition examined in a suite of tests before being switched to the other housing condition. The impact of these manipulations of cognitive performance will be presented in this talk. We will offer insights into the implications of enriched housing on cognition in this group.

8:30 PM **Poster Session I (8:30 - 11:00)**

See Poster Abstracts Starting on Page ##

Poster Presenters: Please set up your posters between 8:00 and 8:30

Friday Afternoon

12:00 PM (Chair: Lauren Guillette)

12:00 PM **Do birds with experience use social information?**

Lauren M. Guillette (University of Alberta and University of St Andrews), Alexis J. Breen, & Susan D. Healy (University of St Andrews)

Inexperienced nest-building birds, those that have neither interacted with nest material nor built a nest, use social information when building their first nest. Specifically, first time nest-building zebra finches (*Taeniopygia guttata*) copy the material choices of familiar conspecifics. These data are consistent with the hypothesis that social information is advantageous when an individual lacks their own (asocial) knowledge. To test whether birds with experience also use social information (i.e., will they copy as do inexperienced birds) we provided zebra finches with an asocial experience: building a nest with 100 pieces of material. As the material was either stiff (preferred) or flexible we could also determine whether the quality of the asocial information affected whether the birds used social information. We then asked if these nest builders would copy the material choice of conspecific demonstrators. We found that birds that had built with the preferred material did not copy the material choice of conspecifics. The birds that had built with the flexible material, however, increased their preference for the material used by conspecifics they had observed building with that material. The use of social information for experienced nest builders appear to be based on the quality of their previous experience.

33

12:14 PM **Does breeding success affect social information use in future nest building attempts?**

Tristan S. Eckersley, Connor T. Lambert, Andrés Camacho-Apízar, Gopika Balasubramanian, Briana S. Kroeker (University of Alberta), & Lauren M. Guillette (University of Alberta and University of St Andrews)

Previous research shows that birds with no nest-building experience use social information when choosing material to build their nest. Specifically, zebra finches (*Taeniopygia guttata*) that are first time nest-builders will copy the material choice of familiar conspecifics. Additionally, zebra finches learn to associate nest material with nest success. However, if past experiences influence the use of social information in subsequent nest-building is unknown. Social learning theory suggests that when the outcome of a behaviour is unproductive, individuals are more likely to use social information. Thus, we ran an experiment asking: a) will birds use social information in a second nest-building attempt (i.e., will they copy the material choice of demonstrated by familiar conspecifics building a nest)? And; b) does nest success differentially affect the use of social information in subsequent nest building attempts? To test this, male-female pairs built an initial nest; half of these pairs were allowed to raise their chicks (successful pairs), while the other half had their eggs taken away during incubation (unsuccessful pairs). Our results suggest that, regardless of nesting success, birds did not copy the material choice demonstrated by conspecifics in a second nest-building attempt.

34

12:21 PM **Digging one for the team: Costs and benefits of collective clustering in *Drosophila melanogaster* larvae**

Tanya T. Shoot (Department of Psychology Wilfrid Laurier University), Tristan A.F. Long (Department of Biology Wilfrid Laurier University), & Noam Y. Miller (Department of Psychology Department of Biology Wilfrid Laurier University)

Collective behavior has been studied in a range of taxa from flocking birds to clustering spiders. There are many benefits to being in a group: increased resources, mating opportunities, and protection from predators. In some cases, members of groups cooperate to gain access to resources not available to solitary individuals. Recent research has shown that *Drosophila* larvae sometimes cluster during feeding bouts, more often with kin than non-kin. Larvae cluster to dig pits to expose higher quality food than would be available from surface foraging. We constructed an agent-based model of a larval colony on a food medium to understand when larvae cluster, how many larvae make an ideal cluster size, and what the fitness benefits of clustering are. Each agent in our model can move, forage on the surface, or cluster with others and start creating a pit. We altered the number of larvae in the environment, food availability, and the probability of clustering, and recorded how each larva behaved and how many larvae survived to pupate. Our results provide testable hypotheses for how larvae should react in different environments. By modeling both collective and individual behaviours, observations of group dynamics can be understood at a mechanistic level.

35

12:28 PM **The development of sociability in Eastern garter snakes**

Morgan Skinner, & Noam Miller (Wilfrid Laurier University)

There is little research on snake social behavior, and even less about how their social preferences change over time. We placed a group of 6 juvenile garter snakes (*Thamnophis sirtalis*) into a square enclosure with 6 shelters, and recorded their locations during all 12 hours of light for 8 days. Twice a day, the snakes were shuffled: they were removed from their chosen social groups and placed back into the apparatus either in the center or into specific shelters. We repeated this 8-day experiment 7 times at intervals of two months, starting when the snakes were 2 months old. In the last two repetitions, we removed individual snakes to further explore the consistency of their social choices. We constructed social networks of the snakes' interactions, and examined their social preferences over time. We find that patterns of social preference change over the course of development: female snakes become gradually and consistently more social as they age; males, however, vary much more in how their sociability changes, some becoming much more social and others less social as they age. Removing an individual from the social environment results in more stable social grouping and strengthening of connections between the remaining individuals.

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12:42 PM **Florida Manatee (*Trichechus manatus latirostris*) and Green Sea Turtle (*Chelonia mydas*) Interactions: An Example of Social Play?**

Moriah J. Deimeke (New College of Florida), Gordon B. Bauer (New College of Florida and Mote Marine Laboratory and Aquarium), & Amanda Foltz (Mote Marine Laboratory and Aquarium)

Social interactions between individuals of different species can be difficult to interpret. We evaluated behaviors of a Florida manatee (*Trichechus manatus latirostris*) and a green sea turtle (*Chelonia mydas*) that suggest social play. Both animals were housed in a common tank at Mote Marine Laboratory and Aquarium and were observed to interact regularly. Video analysis indicated that the manatee and the turtle engaged in a variety of behavioral exchanges — flipper/torso touching, body riding (turtle on manatee), face-to-face touching, and tandem swimming — with the manatee initiating these behaviors more frequently. Although these activities might be attributed to a variety of motivations (e.g., affiliation, curiosity, or even aggression), the interactions were consistent with Gordon M. Burghardt's five criteria for play: (1) limited in immediate function; (2) spontaneous, apparently intentional, or autotelic; (3) structurally or temporally different than ethotypic behavior; (4) repeated but not rigidly stereotyped; (5) initiated in an apparently relaxed field or competing systems. This report offers an unusual observation between species that suggests social play, which could provide an example of behavioral flexibility not traditionally attributed to either manatees or sea turtles.

37

12:49 PM (Chair: Jessica Stagner)

12:49 PM **Evidence for the Effects of Stimulus-Response Compatibility on a Spatial Occasion Setting Procedure With Pigeons.**

Joshua Wolf (Carroll University), Cheyenne Elliot, Jackson White, Cokie Nerz, & Ken Leising (Texas Christian University)

An occasion setting procedure can be used to investigate stimulus-response compatibility (SRC) effects within spatial learning. Differing levels of response compatibility during training may influence the degree (e.g., latency and accuracy) of stimulus control by an occasion setter paired with a landmark. Occasion setting trials began with the OS (i.e., a colored square) positioned on the left or right side of a touchscreen-equipped display. After a peck to the OS, the LM appeared to the left or right of the OS, and subjects were required to peck a hidden goal location in the same (compatible, e.g., OS LM goal) or opposite (incompatible, e.g., OS goal LM) direction. On other trials, LMs were presented alone and non-reinforced. Previous research with humans and pigeons demonstrated that the proximity of stimuli to the goal influenced stimulus control more than stimulus-response compatibility. The current experiment included different combinations of transfer trials, in addition to limiting subjects to a single response during training. During the second half of acquisition pigeons responded faster on compatible trials. The data from transfer testing indicated equal control by the OSs, but the LM from the compatible training trial type controlled responding better than the LM from the incompatible training trial type.

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1:03 PM **Categorical and Item-Specific Mechanisms during Mid-Session Reversal with Pigeons**

Muhammad A. Qadri, Rebecca M. Rayburn-Reeves, & Robert G. Cook (Tufts University)

To understand how categorization and memorization mechanisms are deployed during learning, eight pigeons were trained on a category-based midsession reversal task, using 80 distinct cars and 80 distinct flowers to compose the categories. In this task, one stimulus of each category was presented on each trial, with Category 1 correct for the first 40 trials and Category 2 correct for the second 40 trials. Critically, the pairs of stimuli displayed in each trial were always presented in the same order across sessions, making item-specific and category information available for each trial in the session. Using transposition tests and non-differentially reinforced probe trials, we identified that the pigeons were first controlled by the category-common features before learning the item-specific information. Additionally, both category and item-specific processing continued to occur after extended training. Implications regarding category learning and attention will be discussed.

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1:15 PM *Break*

1:27 PM (Chair: Marisa Hoeschele)

1:27 PM **What's that sound? Can gorillas match auditory categories to associated symbols?**

Jennifer Vonk, & Jordyn Truax (Oakland University)

We assessed the preferences of three adult male gorillas for sounds from six categories (silence, white noise, nature, animal, percussive, electronic). All gorillas discriminated between icons representing the different sound categories with one gorilla exhibiting a clear preference for silence. However, when presented with a match-to-sample task in which the sound was the sample and the task was to choose the symbolic icon that had been associated with the sound category, gorillas generally continued to select the preferred icons rather than the correctly matching icons. Although this

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result might suggest that they failed to represent the categories in an abstract manner, their persistent preferences for certain stimuli also clearly indicate their ability to discriminate symbols that represent preferred from less preferred sounds. The gorillas' general preference for silence is consistent with some prior research but, surprisingly, the gorillas also preferred white noise and electronic music to nature and animal sounds and percussive music. Follow-up tests will assess their preferences for specific familiar animal sounds.

1:41 PM **Why do female budgerigars and humans like rhythm?**

Marisa Hoeschele (Austrian Academy of Sciences), Jan Kopač, & Shahrzad Afroozeh (University of Vienna)

Snowball, the YouTube famous dancing cockatoo, sparked a scientific investigation into the rhythmic abilities of other species. These investigations demonstrated that parrot species appear to spontaneously be able to move in time with acoustic rhythms. Prior to this work, this rhythmic entrainment ability was thought to be unique to humans. In a previous study, we asked whether parrots also enjoy rhythm the way we do. Our results showed that both female budgerigars, a small parrot species, and humans prefer to spend time in a room with a rhythmic sound than with an arrhythmic sound. Here we replicated and extended our findings using a novel apparatus that allowed both species to trigger the sounds they wanted to hear. We found that not only do female budgerigars prefer listening to rhythmic sounds over arrhythmic sounds, but they trigger them more often and listen to them longer than males, who preferred not to trigger either stimulus. We also tested intermediary stimuli to determine what qualities of rhythm the females budgerigars prefer. We found that female budgerigars are attracted to both repetition and meter (beat structure) when choosing rhythmic stimuli. The implications of this and their relation to human preferences will be discussed.

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1:48 PM **Black-capped chickadees (Poecile atricapillus) can identify individual females by their fee- bee songs II: The impact of anthropogenic noise**

Carolina Montenegro, William Service, Erin Scully, Shannon Mischler, Thomas Benowicz, Katelyn Fox, Prateek Sahu, Kimberley Campbell, & Christopher Sturdy (University of Alberta)

Anthropogenic noise can mask acoustic signals that animals produce, thus jeopardizing perception and discrimination. However, little research has focused on how anthropogenic noise affects the identification of acoustic communication signals. Black-capped chickadees produce several vocalizations including the fee-bee song which is used for mate attraction and territorial defense, and contains information about dominance hierarchy and native geographic location. Previously, we have demonstrated that black-capped chickadees can discriminate individual female chickadees via their fee-bee songs. The current study used an operant discrimination go/no go paradigm to discern whether the ability to discriminate between individual females chickadees by song would be impacted by differing levels of anthropogenic noise. Following discrimination training, two levels of anthropogenic noise (low: 35-40 dB; high: 70-75 dB) were played simultaneously with stimuli to determine how anthropogenic noise would impact discrimination. Our results suggest that discrimination performance declined as the noise levels increased. These results add to the growing literature underscoring the impact of human-made noise on avian wildlife, specifically the impact on perception of auditory signals.

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1:55 PM **Can humans understand birds? An investigation of humans' ability to categorize black-capped chickadee songs that vary in the sex and geography of the producer**

Jenna V. Congdon (University of Alberta), Allison H. Hahn (St. Norbert College), Kimberley A. Campbell, & Christopher B. Sturdy (University of Alberta)

The black-capped chickadee is a monomorphic species of songbird, common across North America. The black-capped chickadee's fee-bee song is primarily used for mating and territoriality. Hahn et al. (2015, 2016) conducted operant go/no-go discrimination experiments and determined that black-capped chickadees could discriminate between conspecific songs produced by: (1) males vs. females, and (2) Ontario vs. British Columbia chickadees. Songbirds and humans are often subjects of comparative auditory perception studies as both species are vocal learners and have to learn their species-specific vocalizations. Thus, we sought to replicate the Hahn et al. (2015, 2016) findings with humans. We predicted that participants would be able to discriminate songs based on sex and geography (Experiment 1 and 2). Our results indicate that although human participants could not discriminate between songs based on the sex of the producer, they could discriminate between songs based on the geographical location of the producer. These results suggest that the sex of heterospecific signalers may be unimportant. However, the latter results support the notion that chickadees' 'dialect' varies across geographical locations and that this is a salient auditory cue that a heterospecific vocal learner (i.e., humans) are capable of recognizing and using to discriminate between songs.

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2:02 PM **Preference for and discrimination of syntactically ordered or scrambled chick-a-dee calls in black-capped chickadees (Poecile atricapillus)**

Kimberley A. Campbell (University of Alberta), Marisa Hoeschele, Daniel Mann (Universität Wien), Jenna V. Congdon, Erin N. Scully, Shannon K. Mischler, Carolina Montenegro, William D. Service, & Christopher B. Sturdy (University of Alberta)

The North American black-capped chickadee (Poecile atricapillus) is a small songbird that produces an acoustically complex vocalization, the chick-a-dee call. Within this call notes occur in a set order (A>B>C>D), though in any given call note types may be repeated or omitted (Smith, 1991). Call direction (e.g., forward or reversed) is thought to affect the signal contained within a call and considering the fixed order of notes within the chick-a-dee call, we sought to determine how chickadees perceive calls that follow their natural A>B>C>D order in comparison to calls that deviate from that order. In the present study, we used two behavioural tasks to evaluate the relationship between preference for and ability to discriminate between natural- and scrambled-order chick-a-dee calls. Our results indicate that, not only do chickadees display individual preference for one type of call over the other, the magnitude and direction of their preference influences the rate at which they learn to discriminate between the two types of calls. The fact that birds applied the learned contingencies to testing stimuli suggests that natural- and scrambled-order calls may form distinct perceptual categories.

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2:09 PM **The emergence of creative behavior by bottlenose dolphins (Tursiops truncatus)**

Raymond J. Van Steyn (The Graduate Center City University of New York), & Diana Reiss (Hunter College City University of New York)

Bottlenose dolphins (Tursiops truncatus) previously demonstrated comprehension of the concept "innovate" (Pryor, Haag & O'Reilly, 1969). For cognitive enrichment, dolphins at the National Aquarium were trained to respond to a cue (SD) "do something different". Reinforcement was contingent on dolphins exhibiting behavior (natural behaviors, trained behaviors, or novel behaviors) that differed from that previously offered in response to the SD within the same session. We analyzed the responses of two dolphins' during the first year of training and we subsequently collected and analyzed data during sessions conducted three years later. Training sessions with individual dolphins were conducted by multiple trainers resulting in some variability in reinforcement criteria across trainers and session. Similar to the seminal work of Pryor et. al. and a subsequent "vary" task reported (Kuczaj & Eskelinen, 2014), behavioral variability in response to the SD increased over the initial training period. During the third year the dolphins continued to exhibit "runs" of different behaviors in response to the SD. Despite inter-trainer and inter-session inconsistencies in criteria primarily due to the abstract nature of what constitutes "different" for each trainer, both dolphins demonstrated comprehension of the task. A transactional framework can be helpful in analyzing the complex dolphin-trainer interplay.

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2:16 PM (Chair: Marisa Hoeschele)

2:16 PM **Comparing Dogs and Humans on an Odor Span Task**

Jeffrey Katz, Sarah Krichbaum, & Jacob Vaughn (Auburn University)

An incrementing non-match-to-sample task with odors, known as the odor span task (OST), is used to study working memory. In this study, dogs (n = 6) and humans (n = 24) were compared on a 72-trial session that consisted of 72 different odors. On every trial, a response to a session novel odor but not a previously encountered odor from the session was marked correct. Overall performance was better for dogs (79%) than humans (71%). Within session performance over 12-trial blocks revealed a similar decrease in accuracy as trial-blocks increased for both species. These results show a qualitative similarity with a quantitative difference between dogs and humans in the OST. The variables that may influence these functional relationships will be discussed.

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2:23 PM **Episodic memory in an animal model of Alzheimer's disease**

Danielle Panoz-Brown, & Jonathon D. Crystal (Indiana University)

Vivid episodic memories in people have been described as the replay, or detailed remembering, of multiple unique events and the contexts in which they occurred. Episodic memory is impaired in Alzheimer's disease (AD). Currently, we lack an animal model of episodic memory impairment in AD. The aim of the current study is to characterize episodic memory function in a transgenic Alzheimer rat model (referred to as TgF344-AD) using the items-in-context approach (Panoz-Brown et al., 2016, Current Biology) previously developed by our lab. TgF344-AD rats manifest progressive AD neuropathology and age-dependent deficits in spatial learning and memory. However, it is currently unknown if TgF344-AD rats (1) have intact episodic memory function at an early time point that precedes the development of neuropathology and (2) exhibit age-dependent episodic memory loss. Here we show that at an early time point, 9-10 month old TgF344-AD and wildtype rats remember multiple unique events and the contexts in which they occurred using episodic memory. Our findings suggest that episodic memory is intact in TgF344-AD and wildtype rats. This work validates the TgF344-AD transgenic Alzheimer rat model as a tool to study episodic memory decline associated with the development of AD neuropathology.

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2:30 PM **Snack break**

3:00 PM (Chair: Jennifer Vonk)

3:00 PM **Integrating Patterning Discrimination Learning with Interval Timing**

Andrew Delamater, Nicole Ng, & Norman Tu (Brooklyn College - CUNY)

The negative patterning task has posed important challenges to theories of discrimination learning. In this task, two different stimuli are each paired with reward when presented individually but with nonreward when presented as a stimulus compound (i.e., A+, B+, AB-). Animals can learn this task, but with some difficulty. In the present study we asked whether rats can learn a peak interval timing problem in which two stimuli each indicated reward availability at one specific time interval (e.g., 5s after stimulus onset) when presented individually but at a different time interval (e.g., 30s after stimulus onset) when presented as a stimulus compound (e.g., A: 5s, B: 5s, AB: 30s). We present data showing that rats can learn this task (again, with difficulty) and consider how associative and interval timing mechanisms might interact to explain the data.

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3:14 PM **Devaluing Time in a Midsession Reversal Task: Can Pigeons Win-Stay/Lose-Shift?**

Angelle Antoun, Muhammad A. Qadri, & Robert G. Cook (Tufts University)

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One goal of research using midsession reversal tasks has been to study the organization of extended behavior and sequence learning. Past research indicates that pigeons (*Columba livia*) track the passage of time and anticipate when reversals will occur, a timing strategy that interferes with sequence learning. This strategy differs from the win-stay/lose-shift method employed by mammals, who attend to the local reinforcement history. Our goal was to shift pigeons from a timing strategy to utilizing local history of reinforcement in a four-phase, four-item midsession reversal task. To reduce the reliability of time as a cue, phase lengths and inter-trial intervals were varied randomly, and a correction procedure was enforced. Using test sessions with all choices reinforced, we found pigeons engaged in a variety of strategies. In some cases, birds seemed sensitive to local reinforcement, while in others, timing was still prevalent. Thus, when timing reliability is reduced, pigeons can utilize their less preferred strategy of local reinforcement.

3:21 PM **If it ain't broke don't fix it: breeding success affects nest-building decisions**

Andrés Camacho-Alpízar, Tristan S. Eckerlesley, Connor T. Lambert (University of Alberta), & Lauren M. Guillette (University of Alberta and University of St Andrews)

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In the wild, nest-building birds have a variety of material with which they can build their nest. Previous experiments in the laboratory with zebra finches (*Taeniopygia guttata*) show that birds learn to associate nest material with nesting success, and that this affects subsequent nest-building decisions when selecting between two familiar nest materials. In the current experiment, we ask if nesting success affects the subsequent selection of familiar versus novel materials that differ in their structural properties. Male-female pairs experienced one breeding attempt, all using the same nesting material (coconut fiber), and their breeding success was manipulated by allowing them to raise chicks (successful pairs) or removing their eggs (unsuccessful pairs). During a second breeding attempt, birds were provided with the material from their first nesting event (coconut fiber) and a novel material (white cotton string). Successful pairs used significantly more familiar material compared to novel material, while unsuccessful birds used the familiar and novel material types equally. Unsuccessful pairs, moreover, used more novel material compared to successful birds. These results show that birds use their experience in selecting between nesting materials that differ on their structural properties to build a subsequent nest.

3:28 PM **Benefitting from Increased Trial Spacing and More Training Trials without Increasing Training Time: There Is a Free Lunch**

Ralph R. Miller (State University of New York), Santiago Castiello, James E. Witnauer, & Andrew Cook Robin A. Murphy (University of Oxford)

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Two 'rules of learning' with uncommonly wide generality are the benefits of increased trials spacing and more training trials. Conventionally, benefitting from either of these manipulations lengthens the training session. Using primates as subjects in a contingency learning task designed to level the playing field when comparing the influence of Number of trials with Duration of trials, Number was found to have a much larger effect size than Duration. Hence, increasing Number of trials while inversely decreasing the Duration of those trials enhances the effects of training without increasing the length of the training session. We demonstrate this relationship with respect to cue-outcome pairings, extinction learning, and the trial spacing effect.

3:42 PM **The role of inhibition in the suboptimal choice task**

Valeria V. González (University of Minho and UCLA), & Aaron P. Blaisdell (UCLA)

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Given a choice, pigeons prefer an initial-link stimulus that is followed by reliable signals that food will be delivered (S+) or not (S-) after a delay, over an alternative initial-link stimulus that is followed by unreliable signals of food; even when the former yields a lower overall probability of food. This suboptimal preference has been attributed to the combination of a biased attraction to the S+ and ignoring the S-. We evaluated the inhibitory properties of the S- in two experiments to investigate its role in suboptimal choice. In Experiment 1, pigeons were trained in an autoshaping procedure with the four terminal link stimuli of the suboptimal choice task; S+ was continuously reinforced, S3 and S4 were each partially reinforced on a 50% schedule, and S- was never reinforced. Summation tests showed that S- acquired inhibitory properties during training. Experiment 2 replicated the results of the summation tests after training on the full suboptimal choice procedure. Furthermore, the inhibitory properties of the S- positively correlated with the strength of suboptimal preference. Future models explaining performance in the suboptimal choice task should take into account inhibition to the S- as key player in suboptimal choice.

3:56 PM *Break*

4:06 PM (Chair: TBD)

4:06 PM **Physical and social domains of primate intelligence: a review of the evidence for distinct and co-evolved domains**

Jolene van der Mescht (University of Edinburgh)

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In the field of comparative literature three main theories have emerged to try and explain the evolution of primate intelligence, namely the tool use theory, the social brain theory and the cultural intelligence hypothesis. The tool use theory and the social brain theory favour the development of distinct physical and social domains of intelligence. Whereas the cultural intelligence hypothesis favours the development of co-evolved intelligence domains. I set out to collect and compare the evidence for the distinct and co-evolved domains of primate intelligence. To do this I conducted a systematic review on the comparative literature to date, using the following search parameters: 'primate' AND 'physical cognition', mp. Physical intelligence, tool use 'primate' AND 'social cognition', mp. Social intelligence I examined the main claims made in support of the distinct and co-evolved domains of intelligence, as well as the results and sample size. I also examined any potential differences emerging from the housing facilities of the primates and the type of study design.

4:13 PM **Behavioral Flexibility in Binturongs using a Multi-access box**

Victoria O'Connor, Taryn Eaton (Oakland University), Patricia Billette, Sruti Jamalapuram (Creature Conservancy), Jacob Pappas, & Jennifer Vonk (Oakland University)

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Behavioral flexibility, including inhibition and innovation, has recently been explored as a measure of general intelligence in a variety of species. Yet, despite the ecological consequences of flexibility in changing environments, little is known about behavioral flexibility in a variety of species. Vastly understudied species, binturongs (*Arctictis binturong*) are large viverrids with prehensile tails and a generalist diet. No previous work in binturongs has explored their general cognitive abilities. We investigated innovation and inhibition in three captive adult binturongs using two multi-access puzzle boxes (MABs). On the first puzzle box, a male opened two of four solutions, and two females opened three of four solutions. Use of the MAB allows us to explore neophobia, persistence and motor diversity as predictors of individual success. Our results thus far suggest that binturongs are able to learn new solutions and inhibit past solutions, similar to other carnivores tested previously.

4:20 PM (Chair: TBD)

4:20 PM **Dynamically Occluded Action Recognition in Pigeons**

Suzanne L. Gray, Muhammad A. Qadri, & Robert G. Cook (Tufts University)

55

Identifying the behaviors of actors in the world is essential for survival, but this can be difficult as actors are often fragmented or dynamically occluded as they move behind other objects. Humans can recognize behaviors and perceive objects or actors holistically even though they are fragmented in time and space, but previous studies have shown pigeons may rely on local features to process fragmented information. Using a go/no-go procedure, we investigated the ability of six pigeons to perceive locomotion behaviors using dynamically occluded digital animal models. Pigeons were trained using three different digital models that transited across a semi-realistic scene behind multiple identical occluders. Pigeons were able to learn to discriminate between these behaviors despite never being able to see the figure in its entirety at any given time. Critical tests in which the pigeons were presented with scrambled and intact models both with and without occluders present, evaluate the holistic or elemental processing of pigeons.

4:27 PM **Coding of stimulus sequences in pigeons**

Olga F. Lazareva (Drake University), Martin J. Acerbo (Iowa State University), Kelsey M. Pogatz (Drake University), & Verner P. Bingman (Bowling Green State University)

56

Ghirlanda, Lind, and Enquist (2017) posited that animals, including pigeons, are unable to faithfully represent sequential information (e.g., whether a stimulus appeared first or second in a sequence). We have tested this proposal in a new behavioral task, in which pigeons were trained to respond whether a stimulus appeared first or second in a sequence within the same session. We found that the birds were able to acquire the task, although they were more accurate at classifying the second than the first stimulus in a sequence. Delaying a choice response, however, decreased the accuracy of classifying the second stimulus but did not affect classification of the second stimulus. This result suggested more robust memory for the first sample in the sequence. Together, our results call into question the trace model proposed by Ghirlanda and coauthors, and suggest quantitative, rather than qualitative, differences in sequence discrimination between humans and non-human animals.

8:30 PM **Poster Session II (8:30 - 11:00)**

See Poster Abstracts Starting on Page ##

Poster Presenters: Please set up your posters between 8:00 and 8:30

Saturday Afternoon

12:00 PM Business Meeting of the Comparative Cognition Society

1:10 PM Group Photo Shoot

1:30 PM (Chair: Reggie Gazes)

1:30 PM **Rats Can Distinguish Grape Varieties in Wine**

Elisa Frasnelli, Benedict Chivers (University of Lincoln), Barry C. Smith (University of London), & W Tecumseh Fitch (University of Vienna)

57 Within mammals, there is a great variability in the sense of smell: e.g., rats have roughly 1200 olfactory receptor genes, while humans have only about 400. Humans may have compensated for losses at the sensory periphery with changes in central processing (e.g. increased cognitive resources, language). Thus, although the basic olfactory discrimination abilities of mammals such as rats are clearly excellent, it remains possible that the high development of human cognition leads to fundamental differences in the way olfactory stimuli are processed, categorized, and remembered. Here, we investigated this issue in rats, by using an olfactory task widely seen as challenging even for humans: the determination of specific grape varieties in wine. Using a Go/No-Go procedure task, we tested rats' capacity to distinguish Riesling and Sauvignon Blanc. For each grape variety, we used several different wines from diverse wine growing regions. After training in operant chambers with food reinforcement (80% correct first choices), rats were tested on the 8 trained wines plus 6 novel wines produced using the same grape varieties. Results showed that rats learned the association between the odor of a grape variety and food reward, and they generalized to new wines made from the same variety.

1:44 PM **Training with multiple exemplars of change does not improve transfer or baseline change detection performance**

Ken Leising, Jackson White, Lauren Cleland, Cheyenne Elliott (Texas Christian University), & Anthony Wright (University of Texas Health Science Center at Houston)

58 Change detection procedures are commonly used to assess the capacity (number of items) of working memory. In our study, we initially trained pigeons to complete a location ("where") change-detection task. Pigeons were trained to peck a visual item (colored circle) presented on a touchscreen that changed location across a brief delay (e.g., 100 or 1000 ms). Performance was then tested with novel changes (size, shape, and color). Transfer tests indicated that pigeons did not generalize location change to other kinds of changes. Pigeons were then trained on sessions with location and color change-detection trials followed by test sessions with size and shape changes. Results indicated gradual improvement on color-change trials until nearly equivalent to location-change performance, but poor transfer. Finally, all subjects were trained on sessions with trials of location, color, shape, size, and color-shape-size (combo) change. The data from these sessions revealed that performance on combo trials was greater than all but location-change trials. This summation of change effect supports a signal detection, rather than conceptual learning interpretation of performance following training with multiple exemplars of change.

1:58 PM **Relational Complexity Influences Analogical Reasoning**

Kevin Leonard, Parisa Sepehri, Breanna Cheri, & Debbie M. Kelly (University of Manitoba)

59 Analogical reasoning is a complex cognitive skill, wherein an individual makes inferences about some novel situation or stimulus by drawing upon their knowledge of familiar situations, and the systematic correspondences between them. Recent work in comparative cognition has used relational matching-to-sample (RMTS) tasks to assess analogical reasoning in non-human animals. These tests provide evidence that some primates and corvids are capable of reasoning by analogy. We developed an operant experiment which expands on previous RMTS tasks, but structured to more closely examine how individual stimulus elements, and overall relational complexity, influence analogical reasoning ability. Human participants were presented with a pair of exemplar stimuli that were either the same or different according to a stimulus dimension (colour, shape, or pattern), followed by a probe stimulus and several choice stimuli. Participants needed to select the single choice stimulus which was related to the probe in the same way as existed between the two exemplars. Trials were made successively more difficult by increasing the number of relevant dimensions existing between the exemplar stimuli. Overall, as relational complexity increased, response accuracy decreased and reaction time increased. This task offers a new comparative approach for the study of analogical reasoning in non-human animals.

2:05 PM (Chair: Jenna Congdon)

2:05 PM **Self-referent egg rejection in hosts of avian brood parasites?**

Caterina R. Kim (University of Illinois-Urbana-Champaign), Daniel Hanley (Long Island University-Post), & Mark E. Hauber (University of Illinois-Urbana-Champaign)

60 In self-referencing, individuals use aspects of their own (potentially, extended) phenotypes to compare the targets of social recognition systems. When these targets are more similar, they are accepted and when they are more dissimilar, they are rejected. This mechanism might also explain why some hosts of brood parasitic birds accept foreign eggs in the nest. However, to date, few studies have experimentally tested whether those hosts that reject foreign eggs from the nest have greater dissimilarity between the foreign egg and their own egg(s) relative to acceptors. We tapped into the substantial variability regarding color, shape, and size of host American robin (*Turdus migratorius*) eggs and examined their rejection responses to a single, parasitic brown-headed cowbird (*Molothrus ater*) sized model egg type. Contrary to expectations, host vs. model egg dissimilarity in overall avian-perceivable color, as well as in shape and size, did not predict rejection rates of the model egg. Still, human-perceivable "blueness" of the robins' own egg relative to the model egg, was a significant and positive predictor hosts' responses, supporting predictions of self-referenced egg rejection.

2:19 PM **Categorizing familiar and unfamiliar human faces in kea parrots (*Nestor notabilis*)**

Raoul Schwing, Elisabeth Suwandschieff, & Ludwig Huber (Comparative Cognition Unit Messerli research Institute University of Veterinary Medicine Vienna)

61 Applying familiarity as a discriminative feature to hetero-specifics is useful for predator avoidance, but also for captive animals in regular contact with humans. Previous studies showed that pigeons were able to use 'familiarity' as a categorical rule to classify between pictures of humans. The kea parrots tested in this study have interacted with humans their entire lives and anecdotally, it seems clear that kea discriminate between familiar and unfamiliar humans. The objective of this study was to verify whether kea can use categorisation of humans along familiarity/unfamiliarity lines to help solve a two-choice discrimination task. Subjects were confronted with two pictures of human faces on a touchscreen, one familiar and one unfamiliar. The test group was rewarded along familiarity/unfamiliarity lines. A control group was given the same picture combinations, and rewarded for choosing the pictures of specific humans, two familiar and two unfamiliar. Following acquisition, subjects were first tested on generalisation (novel pictures of the same humans) before entering the test phase (half of pictures of novel familiar and unfamiliar humans). Results indicate that kea are highly proficient at distinguishing human faces from a variety of different angles, and that they can use familiarity/unfamiliarity to categorise humans in pictures.

2:26 PM **Judgment bias in pigs - improved assessment of a cognitive measure of affective state**

Sanne Roelofs, & Thomas Parsons (University of Pennsylvania)

62 Judgment bias tasks may provide a cognitive measure of an animal's affective state. These tasks are based on decision-making under ambiguity, with a more positive affective state resulting in a more optimistic interpretation of ambiguous information. There are several key requirements for judgment bias tasks to successfully capture affective state. A period of discrimination training is necessary for animals to consistently perform different behavioral responses to positive and negative stimuli. Only after completing training can animals be presented with intermediate, ambiguous stimuli. Responses to these ambiguous stimuli are then scored as optimistic (animal displays trained 'positive' response) or pessimistic (animal displays trained 'negative' response). It is also crucial for judgment bias assessment that ambiguous stimuli retain their ambiguity with repeated testing, i.e. animals should not learn about the outcome of ambiguous stimuli. We describe an improved paradigm to assess judgment bias in pigs. This task has a relatively short training duration, likely due to species-specific adjustments and implementation of self-initiation of training trials. During testing, pigs displayed the desired response gradient, increasing optimistic responding from negative to ambiguous to positive stimuli. Loss of ambiguity was avoided by applying a high ratio of trained to ambiguous stimuli.

2:40 PM **A Pavlovian Mid-Session Reversal Task in Leopard Geckos (*Eublepharis macularius*)**

Matthew S. Murphy, & Scott G. Parker (Coastal Carolina University)

63 Reptiles represent an under-studied taxa of vertebrates in the field of comparative cognition, partially because they are not as mobile or easily-reinforced as mammals and birds. We wanted to study a complex discrimination reversal task as a comparison to birds and mammals. We trained leopard geckos in a Pavlovian mid-session reversal, in which color-food associations were reversed at the temporal mid-point of a 40-minute session, and tested them in a choice preference task. One group of geckos received a hypoxia treatment during incubation, compared to sham. Results show strong individual differences, with some subjects showing marginal evidence of reversal, and some showing a response bias. There is little to no evidence of hypoxia treatment on the success rate of this reversal.

2:54 PM *Snack Break*

3:24 PM (Chair: Debbie Kelly)

3:24 PM **Midsession Reversal in Kea**

Ludwig Huber, Monika Laschober, & Raoul Schwing (Messerli Research Institute)

64 Scientific progress is built on the backs of paradigm shifting research by dedicated individuals. Over the last century, few have caused a shift as substantial as Irene Pepperberg's work did for psittacine research. Her work with grey parrots challenged preconceptions about what "bird-brained" subjects should be capable of. This allowed parrots, which had been vastly underestimated, not only to be tested more, but the results showed advanced capabilities found in only very few non-human animals. Here we conducted the first mid-session-reversal study with kea parrots, presenting subjects with 40 trial sessions of a two-choice discrimination task, where the S+ and S- switch after 20 trials. Previous research had shown that two main patterns of stimulus choice emerge when animals were confronted with this potentially predictable change in reward contingency: win-stay/lose-shift, a more trial-by-trial reactionary strategy, and reversal estimation, a more global proactive strategy. The results showed that similar to previous research, distinguishing information between the stimuli and a more unpredictable position of the reversal affected choice patterns in kea overall. However, kea varied between both choice patterns more than has been reported for other species, and some were even able to predict the reversal accurately enough to achieve errorless performance.

65 3:38 PM **Contribution to Irene Pepperberg**
Debbie M. Kelly (University of Manitoba)

3:52 PM **Investigating prosocial tool transfers in Goffin's cockatoos**
Alice Auersperg (University of Veterinary Medicine Vienna), & Isabelle Laumer Jorg Massen (University of California)

66 Flexible targeted helping is considered an advanced form of prosocial behavior in hominoids. We tested Goffin's cockatoos in a tool transfer task in which an actor had access to four different objects and a partner had access to one of two different apparatuses, each operable with a different one of the four objects. Actors additionally received conditions in which the adjacent compartment either lacked a social partner or an apparatus. As expected from this species, we recorded a lot of playful object transfers across all conditions. However, similar to apes, they picked the correct tool more often for transfers in the test condition. Furthermore, subjects transferred that correct tool first more often and above chance expectation in the test condition. There was no difference in the likelihood of the correct tool being transferred first for the two apparatuses, suggesting that these birds flexibly adjusted what to transfer based on their partner's current situation.

4:06 PM **Can cognitive abilities evolve by selection for 'smart' mates?**
Carel ten Cate (Leiden University - Netherlands), & Jiani Chen (Lanzhou University - China)

67 Darwin proposed that mate choice might contribute to the evolution of cognitive abilities. An open question is whether observing the cognitive skills of another individual makes it more attractive as a mate. I present an experiment showing that initially less-preferred budgerigar males became preferred after females observed that these males, but not the initially preferred ones, were able to solve extractive foraging problems. This preference shift did not occur in control experiments in which females observed males with free access to food or in which females observed female demonstrators solving these extractive foraging problems. I will discuss whether the solving task as we used it provides females with information concerning variation in cognitive abilities of the observed males or whether it may only serve to reveal non-cognitive variation in problem-solving skills of the observed males. If the tasks are suitable to demonstrate differences in cognitive skills, female preferences for skilled males will contribute to the evolution of the cognitive abilities underlying such skills.

4:20 PM **Talking Productively with Pigeons**
Robert G. Cook, Suzanne Gray, & Muhammad Qadri (Tufts University)

68 The testing of different production tasks with language-trained animals, such as Pepperberg's research with Alex, has been one of the most important developments in animal cognition. Their capacity to allow generate flexible, open-ended, productive responses during experimental testing has been highly valuable in providing insights into the cognitive representations used by animals. Animals, like rats and pigeons, have not been as easily tested in such tasks for a variety of reasons. We describe several efforts to overcome this limitation in pigeons by using more open-ended discrimination tasks involving multiple choices. For instance, we have successfully trained pigeons to indicate the depth ordering of several objects in artificially generated scenes points. Besides describing several of these experimental approaches and outcomes, the possibilities and difficulties of using such flexible "production-like" techniques with non-verbal animals will be discussed.

4:39 PM Closing Remarks (Steve Fountain)

6:00 PM Introductoin

6:05 PM Master Lecture - - Irene Pepperberg

7:30 PM Banquet

Posters

Poster Session I - Friday Evening

The effect of dimensional reinforcement expectancy on discrimination of visual compound stimuli by pigeons

Olga V. Vyazovska (V.N. Karazin Kharkiv National University)

A prior study has shown selective attention to learn efficiently a stagewise multidimensional visual discrimination task [Vyazovska O.V., Navarro V.M., Wasserman E.A., 2018]. We created 16 stimuli from all possible combinations of four binary dimensions. Starting with 1 S+ and 1 S- that differed in all 4 dimensional values, we progressively added S-s sharing 1, 2, and 3 dimensional values with the S+. Pigeons showed robust response to only one of the newly introduced S- stimuli at the beginning of each stage; the order of the chosen dimensions was the same for all pigeons. In the current experiment we presented S+ and 4 S- stimuli that had robust response in the previous experiment: the first differed in all 4 dimensional values from S+, the second with brightness dimension sharing with S+; the third sharing brightness and orientation; the fourth sharing brightness, orientation and size. Then all 16 stimuli were added. Pigeons rejected correctly 6-8 of 11 new added S- stimuli at the beginning of the second stage. A significant inverse correlation between the number of S- stimuli sharing dimension values with S+ in the first stage and the learning dimensional rate at the beginning of the second stage was found.

P1

Spontaneous numerical cognition in chickens, Gallus Gallus Domesticus.

Jasmine Roman, & Alex Wilson and Dr. Sarah Jones (Berea College)

The purpose of this study was to determine if a foraging task could be used to assess numerical cognition in adult Gallus gallus domesticus (Domesticated Chickens). Initially, quantities were chosen to determine how the Object File System and the Approximate Number System play a role in their choices. Researchers ran three experiments where they presented six-week broiler G. domesticus and one-year-old layer hens with various semi-randomized pairs of mealworms in a 3 by 3 ft. enclosure and allowed to consume one of the two sets of mealworms. Binomial analyses were run on the three experiments and no significant data was found. Although the data shows no significant results we are not interpreting this as evidence that G. domesticus do not have quantitative abilities. Instead, we believe that this foraging task was ill-suited to capture the quantitative abilities of farm G. domesticus. The following factors we found impacted the performance of the G. domesticus: having their social needs fulfilled, familiar surfaces, constant supply to water, avoiding heat stress, testing before or shortly after feeding, and a barrier to prevent early approach. Future experiments should attend to these factors to increase likelihood of success when working with G. domesticus.

P2

Effects of Picture Valence on Serial Pattern Learning Performance in Humans

Shannon M. A. Kundery (Hood College)

Comparative work to date has explored humans' and nonhuman animals' sensitivity to sequence structure, usually under conditions attempting to maximize learning. However, conditions in organism's everyday lives may not match these ideal circumstances. Thus, organisms must detect and learn about events' sequencing even when distractions or threats are present. Irrelevant information can decrease sequence learning in both humans and rats (e.g., Hersh, 1974; Kundery & Fountain, 2011; Kundery, De Los Reyes, & Taglang, 2011). Additionally, perception of threat or heightened anxiety can interfere with learning and performance (e.g., Hodges & Spielberger, 1969; Straughan & Dufort, 1969; Mueller, 1976; Mathews & MacLeod, 1986; Johns, Inzlicht, & Schmader, 2008). Tasks involving explicit learning seem to be more susceptible to such disruption (e.g., Ratus, Reber, Manza, & Kushner, 1994; McDowell & Allison, 1995). In two experiments, we investigated college students' pattern learning while they were exposed to emotionally-valenced pictures. Brief exposure to negatively-valenced pictures decreased patterned sequence learning relative to brief presentation of positively-valenced pictures or a control condition in which no pictures were presented. This suggests the process needed for pattern learning was disrupted by the negatively-valenced information and that this process is explicit.

P3

DOGGIE DIPLOMAS: INVESTIGATING THE BEHAVIORAL WELFARE OF DOGS LIVING ON A COLLEGE CAMPUS

Kaitlyn Willgohs, Jenna Williams, Isabella Crisostomo, Katherine Keck, Crystal Young-Erdos, & Lauren Highfill (Eckerd College)

Pets are becoming a more familiar sight on college campuses, and it is clear that companion animals are viewed as an essential element of wellness both by student owners and institutions of higher education. However, as more dogs find their way onto college campuses, it is of vital importance that researchers investigate the well-being of the pets themselves. The current study investigated the difference in anxiety-related behaviors and cortisol levels of dogs living on a college campus (n = 13) versus off-campus dwelling dogs (n = 12). Specifically, the dogs were placed into an unfamiliar room for three minutes and their behaviors were coded within the categories of outward look of fear/anxiety/stress behaviors, information gathering signals, time-increasing signals, action or movement-related behaviors, stereotypic behaviors, and bark spells. Overall, anxious-type behaviors were observed more often for on-campus dogs than off-campus dogs, and a significant difference was found between the two groups for the category of outward look of fear/anxiety/stress behaviors (p = .036). Salivary cortisol levels are currently being analyzed to see if these trends are also observed physiologically. The implications of our findings related to dog welfare and the need for mental stimulation for campus dogs will be discussed.

P4

The Effect of Color Cues on Visual Discrimination of 3D Objects in Goldfish (Carassius auratus)

Janessa Morelli, Jessica Wegman, Kaitlin Gunther, Hunter Barnett, & Caroline M. DeLong (Rochester Institute of Technology)

Fish can visually recognize objects despite differences in orientation under certain conditions. In a series of studies, we examined the ability of goldfish to discriminate between stimuli shown from multiple aspect angles in different rotation planes using a two-alternative forced choice task. After they were trained with stimuli at 0 degrees, they were tested with stimuli at novel aspect angles (90, 180, and 270 degrees). Performance accuracy was very high when they viewed 3D full-color stimuli (green turtle vs. red and yellow frog) or 2D color photos of the same plastic turtles and frogs. In the current study, six goldfish were presented with two black 3D LEGO figures that varied in shape but not color. Five fish failed to discriminate between the stimuli during training sessions. Only one fish advanced to the test phase and successfully discriminated between the stimuli at novel aspect angles when the stimuli were rotated in the picture plane (M = 67%) or depth plane (M = 80%). It appears that many of the fish were relying on color cues in past studies. More experiments with different stimuli are planned to examine whether fish can achieve object constancy without using color cues.

P5

Vocal development in nestling kea parrots (Nestor notabilis)

Amelia Wein, Raoul Schwing (Messerli Research Institute), Takuya Yanagida (University of Vienna), & Ludwig Huber (Messerli Research Institute)

This study investigates vocal development of nestling kea parrots (Nestor notabilis). First, we examine how many structurally distinct call types were present during the nestling period, and the age in which call types occurred. Based on studies with other avian species, we predicted that kea nestlings would have multiple call types, with some present at hatching and others emerging later in the nestling period. Results showed that nestlings have four distinct call types, two present at hatching, and two emerging when the nestlings undergo large physical changes in the second week of life. While two of the call types developed gradually towards more adult-like structures, the other two did not and were apparently only used for communication in the nest. Second, we tested whether nestlings could be discriminated individually based on their calls. All four call types were individually discriminable from hatching until the end of the study, thus providing evidence for vocal signatures. While the function of vocal signatures cannot be ascertained from this study, kea breeding biology rules out explanations based on preventing misdirected parental care. We suggest that vocal signatures may be relevant to the division of parental resources in the nest.

P6

Procrastination: The role of conditioned reinforcement in delaying the initiation of an aversive task

Dalton House, & Thomas Zentall (University of Kentucky)

P7

Procrastination often occurs to avoid immediate initiation of a relatively aversive task. In the present experiment, we tested the hypothesis that pigeons would tend to delay completion of a response requirement because task completion in close proximity to reinforcement would cause it to become a strong conditioned reinforcer. In this task, pigeons chose between two chains (1) walking to a near panel to peck a key, followed by a long walk to peck a terminal key for reinforcement and (2) walking to a far panel to peck a key, followed by a short walk to peck a terminal key for reinforcement. When 10 pecks were required to either the near key or the far key, in keeping with Fantino's Delay Reduction Theory, the pigeons preferred to make the 10 pecks to the far key. This effect may result from the development of a strong conditioner reinforcer that occurs when the event (pecking) comes close to reinforcement. Conditioned reinforcement may also be involved when humans delay initiating tasks until the time is close to the deadline.

Visual Object Categorization in Goldfish (*Carassius auratus*)

Caroline M. DeLong, Evan Morrison, Jessica Wegman, Janessa Morelli, Trisha Rachfal (Rochester Institute of Technology), & Kenneth Tyler Wilcox (University of Notre Dame)

P8

Many non-human animals including monkeys, goats, pigeons, and cichlids have shown the ability to categorize objects. In this study, we examined the ability of goldfish to categorize 3D stimuli. Goldfish may use these categorization skills to aid them in identifying food sources, locating potential mates, and avoiding predators. Seven goldfish were trained to discriminate between two stimuli: a green and grey turtle and a red and yellow frog. Then they were tested with novel turtles and frogs of various colors, shapes, and sizes (e.g., green frog, yellow turtle). Five fish successfully categorized the novel stimuli ($M = 68\%$) and two fish were unsuccessful. A second training phase with two additional stimulus pairs did not result in improved performance. It appears that the successful fish categorized the novel stimuli using shape cues, whereas the unsuccessful fish may have attended to color cues. Many of these subjects had extensive experience discriminating between the green and grey turtle and red and yellow frog presented at various aspect angles in a series of prior studies, which many have influenced which object features they used in the present study.

Primate-Canine Comparisons on the Object Choice Task

Hannah Clark (University of Sussex), Mahmoud Elsherif (University of Birmingham), Zoe Flack (Brighton University), & David A. Leavens (University of Sussex)

P9

Comparative assays of social cognition almost never match sampling, testing protocols, or task preparation across species. We conducted a meta-analysis of 71 studies with nonhuman primates and dogs which employed the Object Choice Task, a frequently used assay of the ability to comprehend deictic gestures, the results of which are widely used as the basis for theories positing human-unique socio-cognitive adaptations. Fully 91% of dogs had pre-experimental histories rich in human interaction, compared with 6% of nonhuman primates ($N = 2534$, $p < .001$) and greater levels of human exposure were linked to increased performance. Of nonhuman primates, 99% were tested with a barrier, in the form of a cage, compared with 1% of dogs ($N = 2534$, $p < .001$). There were also significant differences in the spatial configurations and cue types presented. Such systematic differences in sampling and methodology could account for the so-called species differences in performance between apes and dogs. In two empirical studies, we found barriers in the testing environment resulted in differences in the behavioural responses of 18-month- and 36-month-old children and dogs, and at-chance performance in dogs ($N = 37$, $p = .09$). These findings highlight the necessity of matching testing conditions when comparing across groups.

A unique cyclical hierarchy observed in a herd of African elephants (*Loxodonta africana*) under human care and its implications in a cooperation task

Joy Vincent (Oakland University), Kristina Przystawik (ZooTampa), Kaitlyn Willgohs (Eckerd College), Michael Burns (ZooTampa), & Lauren Highfill (Eckerd College)

P10

This study is the culmination of a two-year exploration of the social dynamics within a herd of African elephants (*Loxodonta africana*) under human care. This study was conducted in conjunction with a cooperation study, in an effort to discover any potential effects participation in the study had on herd dynamics. Behavioral observations of the elephants' interspecific interactions were conducted, with specific regard to their agonistic behaviors. The six main behaviors recorded were displacement, bluff, trunk swing, charge, hit and head slam. These are common behaviors observed in wild populations of elephants, used to maintain set hierarchies and defend resources. This study found low incidence of all observed behaviors, apart from displacement, which is a behavior more in line with de-escalation and hierarchy maintenance, rather than aggression. Elephants are a matriarchal species, forming linear hierarchies within close family groups, consisting of adult females and their juvenile offspring. The patterns of displacement in this study, however, demonstrate a unique cyclical hierarchy structure; the results show a distinct cyclical hierarchy within the herd. The implications of this unique social structure for their management, as well as for the ongoing cooperation study in which the herd is participating will be discussed.

Breed as a Predictive Factor in Feline Personality Traits

Muller, & Melissa (University of Mount Union)

P11

The purpose of this study was to survey cat owners about the potential differences in personality between pure-bred and nonpure-bred cats. Approximately 85.5 million cats live in homes across the United States (ASPCA, 2017). Researchers in Australia recently developed a Six Component Model of feline personality (Bennet, Rutter, Woodhead, & Howell, 2017) and identified six personality traits in cats which they labeled playfulness, nervousness, amiability, dominance, demandingness, and gullibility. The Cat Fanciers Association (2017) states that Persians and Siamese cats are preferred by their owners because they are friendlier and more playful. This study aimed to determine whether the data support that hypothesis. Five hundred fifty-five participants were recruited through social media to complete a survey on cat personality via SurveyMonkey. Owners of purebred Persian and Siamese cats, as well as owners of non-pedigreed cats completed a 35-item inventory based on Bennet, Rutter, Woodhead, & Howell's 2017 paper that identified 6 personality dimensions. Results showed significant differences among the three breeds studied on dimensions of playfulness and amiability (friendliness). Specifically, Persian and Siamese cats scored higher on amiability than non-pedigreed cats, but that Persian cats were less playful than Siamese and non-pedigreed cats.

Pigeons Learn 1-Back Matching: Evidence for Explicit Learning or Long-Delay Implicit Learning

Alexandra Nosarzewska, & Thomas Zentall (University of Kentucky)

P12

A distinction has been made between implicit (unconscious) learning and explicit (declarative rule) learning by humans. Recent theory suggests that delayed reinforcement can eliminate implicit learning but preserve explicit, rule-based learning (Smith & Church, 2018). In the present research, pigeons learned a color matching-to-sample task, however, reinforcement was delayed by 1 trial. That is, the pigeons received feedback for matching on trial N only after responding on trial N+1. When a non-correction procedure was used, three of eight pigeons showed some indication of learning. When a correction procedure was introduced (with up to 5 repeats of the incorrect trial), all pigeons learned the task. Thus, contrary to theory, either pigeons can learn implicitly over significant delays with interference from the current trial or pigeons are capable of explicit learning involving the 1-back rule.

Processes of gestural development in young chimpanzees

K.A. Bard (University of Portsmouth UK), S. Dunbar (University College London UK), V. Maguire-Herring (University of Portsmouth UK), Y. Veira (University at Buffalo - State University of New York), K.G. Hayes (Emory University), & K. McDonald (Oakland Zoo)

P13

Great apes are useful as a model species for investigating gestural development. The prevailing theory is that gestures develop from actions with motoric effects, but through repeated interactions with caregivers, actions are abbreviated and ritualized to become communicative signals. We conducted a responsive care intervention for 16 chimpanzees, such that species-typical gestures developed, with milestones recorded for the first year. Young chimpanzees used gestures for displaying submission, and for initiating and requesting tickle play, comfort/contact, chase play, grooming, and food sharing. We found a consistent and significant developmental pattern in tickle play, grooming, and chase play: engagement when others initiated, followed developmentally by infant-initiations, then requests (sometimes with gestures). Gestures emerged at significantly different

ages across different contexts. Most gestures were not previously effective motor acts but emerged from already communicative actions. Not all gestures were requests. Chimpanzee gestures were co-constructed (e.g., play and grooming) or strengthened (submission) in scaffolded interactions with competent partners. Our new view is that chimpanzee gestures develop from communicative behaviors through interaction and communicate socio-emotional desires, but different processes were evident in some contexts. The assumption that a single process underlies all chimpanzee gestural development is unwarranted.

Can owners predict dog impulsivity?

Jeffrey R. Stevens, Madeline Matthias, & Kylie Hughes (University of Nebraska-Lincoln)

P14

Impulsivity is a critical component of dog behavior with important implications for training and obedience. Brady et al. (2018, *Applied Animal Behaviour Science*, 202: 77-84) developed a test to measure spatial impulsivity in dogs by offering them choices between smaller, closer and larger, more distant food rewards. They found that owner reports of their dog's impulsivity correlated with the distance the dog traveled in the spatial impulsivity task. The aim of our study was to replicate the Brady et al. study to assess how well owners can predict their dogs' impulsivity and which characteristics of dogs and owners are related to a dog's impulsivity. Therefore, we tested dogs in the spatial impulsivity task and had owners complete the Dog Impulsivity Assessment Scale and a survey with questions about the dog's behavior and the owner's behavior and personality. Preliminary results suggest that owners can predict their dogs' impulsivity, but other dog and owner characteristics cannot.

The development of working memory performance in a delayed-search task in detection dogs

Emma Cox, Lucia Lazarowski, Sarah Krichbaum, Jordan Gillespie, Paul Waggoner, & Jeffrey Katz (Auburn University)

P15

Increasing evidence suggests that cognitive processes are involved in working dog performance. In particular, short-term memory is considered critical to tasks performed by detection dogs such as memory for locations and targets searched. We tested candidate detection dog puppies on a delayed-search task in which dogs were required to locate a visually displaced reward after varying delays. The task was modified so that dogs did not have visual access to the hiding locations during the delay, removing the ability to use body orientation or gaze as a cue therefore requiring dogs to rely solely on working memory to solve the task. We tested puppies at three time points between the ages of 3 and 12 months in order to assess the development of canine visuo-spatial working memory, and to determine whether working memory is predictive of detection dog performance. The data indicates that the task is more difficult when dogs are not able to use attention or orientation, with little changes in performance across delay or age. Implications for detector dog success will be discussed. These findings are also part of a larger study examining the relationship between the development of the gut microbiome and early brain and cognitive development.

The perception of the Müller-Lyer illusion in the guppy (*Poecilia reticulata*)

Maria Santacà, & Christian Agrillo (University of Padova)

P16

The Müller-Lyer illusion is a distortion illusion that occurs when the spatial arrangement of inducers influences a line's perceived relative length. To date, this illusion has been reported in several animal species but only in 1 teleost fish (i.e., redbtail splitfin, *Xenotoca eiseni*), although they represent 50% of vertebrate diversity. We investigated the perception of this illusion in another teleost fish that diverged from the redbtail splitfin 65 million years ago: the guppy, *Poecilia reticulata*. The guppies were trained to select the longer between 2 lines; after meeting the learning criterion, illusory trials were presented. Control trials were also arranged to exclude the possibility that guppies' choices relied on potential spatial biases related to the illusory pattern. The guppies' performance indicated that they were susceptible to the Müller-Lyer illusion, perceiving the line with the inwards-pointing arrowheads as longer. The performance in the control trials excluded the possibility that the subjects used the physical differences between the 2 figures as the discriminative cue in the illusory trials. Our study suggests that sensibility to the Müller-Lyer illusion could be widespread across teleost fish and reinforces the idea that the perceptual mechanisms underlying size estimation might be similar across vertebrates.

Effect of rearing environment on the development of spatial cognition in egg-laying hens

Claire Jones, Allison Pullin, Richard Blatchford, Maja Makagon, & Kristina Horback (Center for Animal Welfare Department of Animal Science University of California Davis CA USA)

P17

The American egg industry is transitioning towards cage-free environments for laying hens. Unfortunately, it is unknown whether the visual complexity of the rearing environment may impact adult use of three-dimensional space in aviaries. This study will investigate the ontogeny of distance and depth perception in 480 Dekalb White hens reared in three environments of increasing vertical complexity (perches, ramps, and platforms). Distance perception will be evaluated via a Y-maze task with a 1:3 ratio or a 1:1 ratio difference in escape arm length. Behaviors to be recorded include head orientation, time spent in each arm, and exit choice. Depth perception will be evaluated via performance in a visual cliff test at two depths (15 and 90 cm). Behaviors to be recorded include latency to jump from the perch on the visual cliff to the platform on the deep side, head angle at time of jump, and proportion of time spent on shallow versus deep side. It is predicted that performance in the Y-maze (percent of correct choices) will relate to performance in visual cliff test (latency and quality of jump), and, that general performance will be impacted by the visual complexity of rearing environment.

Discrimination Learning in Archerfish

Bridget Austin, & Michael Brown (Villanova University)

P18

Discrimination learning, an ability common to nonhuman animals, involves learning to respond differentially to different stimuli. However, discrimination learning in nonmammalian, aquatic species has received relatively less attention. Archerfish (*Toxotes* spp) pose a unique opportunity to advance discrimination research due to their unique ballistic hunting technique, which involves shooting targets above the water's surface with a stream of water that comes from their mouth (Schuster et al., 2006). Due to their unique hunting behavior and perceptual abilities, archerfish have recently been used in a range of behavioral studies. A new procedure for the study of visual discrimination performance in archerfish is tested here in two experiments. The first tested a discrimination task, asking the archerfish to discriminate between the image of a cricket (S+) or a blank screen (S-) on a LCD screen above their tank. The second experiment manipulated motion by presenting moving stimuli in a similar format. Performance in both experiments was measured by fish location in a dichotomous choice task. Results revealed that our archerfish were able to discriminate a non-moving stimulus, but the results for moving stimuli are more complicated.

Bottlenose Dolphin Calf Social Development Over the First Two Years of Life

Madison Bradley, Deirdre Yeater (Sacred Heart University), Heather Hill (St. Mary's University), Erika Putman, & Mark Xitco (Navy Marine Mammal Program)

P19

As dolphin calves develop, they are observed spending less time with their mothers and more time engaged in independent activities. In this study, the social development of nine dolphin calves (*Tursiops truncatus*) housed in naturalistic sea pens at the Navy Marine Mammal Program in San Diego, CA were studied over the first two years of life. Focal animal behavioral ethogram data were collected using a 30 second scan sampling technique over multiple 10-minute trials. The predominant swim positions and individual behaviors were observed. The results showed developmental patterns across every three months and between the individual dolphins, in which there was an increase in independent behaviors over time. For every three months, a significant increase was seen in solo swim position and a decrease was seen in infant and echelon positions. These findings are consistent with past research, which has found that there are significant differences in calf behavioral development in swim positions based on calf age. Variation was observed between individuals and may be due to the experience or type of mother, the unique personalities in the calves, or a combination of both.

Socially-applied marks as a potential measure of welfare in bottlenose dolphins

Wendi Fellner (Disney's The Seas/Epcot), Randall S. Wells (Sarasota Dolphin Research Program/Chicago Zoological Society), & M. Andrew Stamper (Disney's The Seas/Epcot)

P20

Appropriate social groupings are central to animal welfare, but determining ideal groupings of gregarious, physically energetic species in managed care settings is not always straightforward. Bottlenose dolphins engage in interactions that leave visible “rake marks” (i.e., epidermal scratches delivered by conspecifics’ teeth). While rakes can be a sign of aggression, too few could be a sign of social isolation as dolphins in the wild are routinely observed with rakes, suggesting that raking is normal for cetaceans. Here we observed the number, location, and depth category of rakes on 39 temporarily-restrained dolphins residing in Sarasota Bay, FL and 3 resident dolphins of The Seas. For Sarasota dolphins, the number of rakes varied across age and sex classes with adult males having the most ($M=35.7$, $SD=16.8$) and female calves having the least ($M=3.5$, $SD=3.3$). Overall, males had significantly more rakes than females ($p=0.0004$), and adult males had more rakes than younger males ($p=0.047$). Longitudinal assessment of Seas dolphins had values that were consistent with free-ranging counterparts. Having a well-grounded reference for normal social activity is important for providing optimal welfare for animals in managed care settings.

Serial Pattern Learning and a Test of Generalization to New Phrasing Cues in a Touchscreen Task for Rats

Katherine H. Dyer, Claire C. Jackman, Jessica L. Sharp, & Stephen B. Fountain (Kent State University)

P21

Pigeons and humans learn to anticipate elements of highly-organized sequences of events presented in circular arrays of spots on a vertical screen (Fountain & Rowan, 1995; Garlick, Fountain, & Blaisdell, 2017). This study assessed whether rats can do the same. Rats learned a 24-element pattern, 123-234-345-456-567-678-781-818, where digits indicate the correct of 8 spots in a circular touchscreen array and reinforcement was electrical brain-stimulation reward. Dashes indicate “phrasing cues” of either 3-sec pauses or responses to a center spot that cued chunk-boundary (CB) elements. The two phrasing cue groups showed the same rate of acquisition. In a transfer test, each group’s phrasing cue was changed to the other group’s cue. After phrasing cue transfer, both groups showed poor performance on CB elements following the new phrasing cue but performance on other items in the pattern was not affected. Therefore, spatial and temporal cues were not functionally equivalent cues for CB elements. Thus, rats can learn serial patterns in a touchscreen array as they can in the spatial array of an octagonal chamber. Given the differences in the touchscreen and octagonal chamber paradigms, future research should explore whether rats develop functionally equivalent cognitive representations of the pattern between paradigms.

Team work makes the string work: Cooperation in the African crested porcupine (*Hystrix cristata*)

Jordyn Truax, Joy Vincent, & Jennifer Vonk (Oakland University)

P22

Cooperation is, as defined in this study, the process by which two or more participants perform two independent actions on an object in order to obtain a reward for all parties. Cooperation would seem, initially, to reduce an individual’s individual fitness so many theories have been proposed to explain its prevalence, such as reciprocal altruism and kin investment. Humans are thought to outperform all other species in the frequency and magnitude of these behaviors. Yet, only through studying a variety of species tested can researchers fully understand the likely selection pressures for cooperation. Few monogamous species have been tested. African crested porcupines are large rodents that pair for life and are good candidates for cooperative behavior although little is known about their social cognition. Here, we tested two crested porcupines, one male and one female, in the loose-sting task. The porcupines were presented with an inaccessible platform baited with food where they were required to simultaneously pull separate ropes to bring the platform within reach.

Puppies and Adult Dogs use Win-Stay-Lose-Shift Strategy

Molly Byrne (Boston College), Emily Bray, Evan MacLean (University of Arizona), & Angie Johnston (Boston College)

P23

When choosing between two potential food hiding locations, dogs often seem to “guess” when they do not receive any cues and are unable to watch the treat hiding process. When “guessing” do dogs use consistent strategies to make choices? In particular, do dogs use a win-stay-lose-shift strategy? Utilizing data from 323 puppies and 326 adult dogs on an 8-trial odor control object-choice task, we first ruled out the possibility that dogs were using odor information, and then investigated whether they used a win-stay-lose-shift strategy. Using a GLMM with age and previous-trial success as predictor variables, and subject as a random intercept, we found a significant effect of previous-trial success on dogs’ shifting behavior ($B = -0.58$, $SE = 0.07$, $p < .001$, $OR = 0.56$, 95% CI: 0.49, 0.64), suggesting that dogs were using a win-stay-lose-shift strategy. Further analysis revealed that this win-stay-lose-shift strategy was primarily driven by dogs’ tendency to shift after a previous loss, as they had a general bias to stay, rather than shift ($t(648) = -8.01$, $p < .001$). Together, these findings suggest that dogs use win-stay-lose-shift, and they are likely to try a different location when they just failed to find a treat.

The Effects of Education at Turpentine Creek Wildlife Refuge: Assessing Change in Visitors' Knowledge and Attitudes Regarding Conservation, Legislation and Wildlife in Captivity

Kate M. Chapman (University of Arkansas), Beckie Moore (Turpentine Creek Wildlife Refuge), & Laura McGehee (University of Arkansas)

P24

Assessment of educational practices is critical for evaluating the impact of zoos and other facilities on visitors. Few studies have focused on education outcomes at refuges and sanctuaries. This study utilized a pretest–posttest design to examine the efficacy of the current educational practices at Turpentine Creek Wildlife Refuge (TCWR). Participants included 95 visitors to TCWR between 18-82. Researchers administered a pre-visit survey, then participants chose to take a guided tour of the refuge or explore a self discovery area. At the end of their visit, participants completed a post-visit survey to assess whether they had a) learned factual information and b) exhibited a shift in attitudes regarding exotic animals in the United States and the wild as a result of their visit. Results suggest participants in both the guided tour condition and the self-discovery condition showed an increase in knowledge and a positive shift in attitudes. While the effect was not significant, the difference between guided tour participants and self-discovery participants did trend in the expected direction for both learning and attitude shifts. Unexpected gender differences also emerged. Overall, these results suggest that TCWR’s education practices are effective in increasing fact-based knowledge and encouraging attitude change in their visitors.

Differential Magnitude of Reinforcement for S1 and S2 Responses Improves Accuracy in Midsession Reversal Task in Pigeons

Peyton Mueller, Megan Halloran, & Thomas Zentall (University of Kentucky)

P25

In the midsession reversal task pigeons are trained on a simultaneous color discrimination where S1 is correct for the first half and S2 is correct for the second half of the session. Optimally, pigeons should choose S1 until trial 41, when it stops being correct, and choose S2 afterward. Instead, pigeons anticipate S2 too early and continue choosing S1 after the reversal. Evidence suggests that they attempt to time the reversal rather than using the feedback from the preceding response. Recently, we have found performance is optimized by generating an asymmetry between S1 and S2. For example, pigeons’ accuracy improves if correct S1 responses are reinforced 100% of the time but correct S2 responses are reinforced 20% of the time. Similarly, accuracy improves if S1 requires 1 peck but S2 requires 10 pecks. In the current experiment, we manipulated the magnitude of reinforcement. For the experimental group, correct responses to S1 were reinforced with five pellets and correct responses to S2 were reinforced with one pellet. For the control group, all correct responses were reinforced with three pellets. There was a significant reduction in anticipatory errors in the experimental group compared to the control, but no increase in perseverative errors.

Towards the development of a Five-Factor behavioral assay for measuring personality in rats (*Rattus norvegicus*)

Olivia Scott (Macalester College)

P26

Personality can be detected in non-human animals by measuring stable patterns of behavior and cognition. The Five-Factor Model of personality has been adapted for animals such as dogs, chimpanzees, and horses. Although specific personality traits have been examined in rats, a comprehensive personality model has not yet been developed. The present research adapts the Five-Factor Model for measuring rat personality, informed by previous research on specific traits, and the natural history of rodents. The five factors proposed here are: Active, Bold, Curious, Easygoing, and Gregarious. Behavioral tests were developed for each of the five factors and administered twice, approximately a week apart, to 10 subjects. Tests were intentionally designed to be non-invasive and minimally stressful, both for ethical concerns and practical concerns of discriminant validity. Each test detected the rat’s choices in various situations to reveal cognitive and behavioral patterns attributable to each factor. Temporal consistency was detected in the Active and Curious tests, and slightly indicated in the Gregarious test. This investigation constituted an initial effort towards introducing a valid and reliable measure of

personality in rats, which could be adapted for various purposes within laboratory settings and elsewhere, including addressing welfare concerns raised by more invasive measures.

Poster Session II - Friday Evening

Categorization of 2D Objects in North American River Otters (*Lontra canadensis*)

Jessica Wegman (Rochester Institute of Technology), Catina Wright (Seneca Park Zoo), Trisha Rachfal, Janessa Morelli, Matthew Altobelli, Tiffani Bragg, Evan Morrison, Kaitlin Gunther, & Caroline DeLong (Rochester Institute of Technology)

P27

Categorization is the ability to group different objects together based on defining features. Otters may use categorization to identify predators, prey, and conspecifics. This study was the first to examine whether North American river otters (*Lontra canadensis*) are capable of categorization. Previously, two otters at the Seneca Park Zoo were trained to discriminate between a circle and an equilateral triangle in a two-alternative forced-choice task. In the present study, otters were presented with novel geometric shapes (e.g., an oval and a hexagon) in Experiment 1 and novel drawings of real-world objects (e.g., a tomato and a tent) in Experiment 2. Each otters' performance was not significantly different for the training vs. test stimuli in Experiment 1 (Heather: M = 84.1% vs. M = 83.3%, Sailor: M = 67.4% vs. M = 66.7%). Both otters performed significantly better than chance. Two otters were able to categorize the novel shapes. Only one otter participated in Experiment 2. The otter's performance was significantly different for the training vs. test stimuli (M = 85.4% vs. M = 50.0%). This otter was not able to categorize the novel drawings into two categories. More tests are planned to further investigate categorization abilities in river otters.

Using Hunt and Toy Drive to Determine Career Success in Working Dogs

Jordan A. Gillespie, Jennifer L. Essler, Alisa Rubinstein, Kaylee Krapp, Ceara Byrne, & Cynthia M. Otto (University of Pennsylvania)

P28

Many studies have evaluated differences and consistencies in the behaviors of various dog breeds throughout early development. These behavioral examinations carry significant importance in working dog training and research as they can be utilized to determine the future potential of young dogs in different careers. This study focuses on a retrospective analysis of a behavioral test adapted by the Penn Vet Working Dog Center that evaluates the environmental soundness and hunt and toy drive of future working dogs as puppies (n=45) throughout training to determine behavioral patterns indicative of dogs that successfully complete training in three different careers: single-purpose scent detection, dual-purpose police K9s, and search and rescue. The test consisted of multiple evaluations performed at 3, 6, 9, and 12 months of age. Stress, toy engagement, and hunting (for toy) behaviors were analyzed. A decision tree model was used to determine various behavioral trends indicative of success in each career.

Preferences for conspecifics in discoid cockroaches (*Blaberus discoidialis*)

Riley Doyle-Odenbach, Sarah Schmale, Stephanie Perrier, Amanda Rose Newton, & Darby Proctor (Florida Institute of Technology)

P29

Cockroaches are one of the most widespread animal lineages on the planet. Despite this, relatively little is known about their behavior or cognitive abilities, particularly when compared to well-studied animals such as rats, pigeons, and primates. Recently, we began using discoid cockroaches (*Blaberus discoidialis*) in place of other animals in our psychology undergraduate curriculum. One advantage of cockroaches over traditional animal models is that undergraduates can conduct meaningful research due to the dearth of information we have about roaches generally and discoid roaches specifically. Here we present the results of a series of experiments primarily carried out by undergraduate students. We were interested in whether roaches would show evidence of individual recognition of other roaches. We conducted a series of choice assessments to determine if the discoid roaches preferred to be alone, with a familiar roach from the same colony, or an unfamiliar roach from a different colony. Roaches preferred to be with other roaches, but did not discriminate between familiar and unfamiliar individuals. This suggests that discoid roaches are social, but indiscriminately so. Furthermore, this work demonstrates that undergraduates can meaningfully contribute to the scientific understanding of these animals.

Cognitive Comparison of Same-Strain Rats from Two Commercial Vendors

Claire C. Jackman, Katherine H. Dyer, Emily A. Miles, Rachael E. Lowe, Jessica L. Sharp, & Stephen B. Fountain (Kent State University)

P30

Previous work in our lab used rat offspring from breeders supplied by Envigo (ENV) in years past and Charles Rivers Laboratories (CRL) more recently. Some studies using ENV rats showed different acquisition rates and performance of serial patterns compared to studies using CRL rats after switching vendors. The current study used both ENV and CRL rats raised by suppliers to directly examine sex and vendor differences in rats' response to the serial multiple choice (SMC) task. Rats trained daily in an octagonal operant chamber to nose-poke a serial pattern, 123-234-345-456-567-678-781-818, where digits represent successive locations of correct responses. The nose-poke receptacles, one per wall, produced an 8-location circular spatial array. After acquisition, a scopolamine (SCOP) challenge was administered to assess this muscarinic antagonist's effect on retention (Chenoweth & Fountain, 2015). The acquisition and SCOP challenge results were compared with previous research which used offspring from CRL breeders. Results showed rats from suppliers learned the serial pattern to a better performance level compared to CRL rats bred in-house. We conclude that future work should use rats from suppliers rather than breeding in-house to reduce individual differences within groups for more consistent data and thus reduce animal use.

Face Processing Regions in Dogs' Brains Using Live Stimuli During Awake-fMRI

Kirsten Gillette, Erin Phillips, Phyllis Guo, Ashley Prichard, Kate Athanassiades (Emory University), Mark Spivak (Comprehensive Pet Therapy), & Gregory Berns (Emory University)

P31

Previous research to localize face areas in dogs' brains has relied on static images or videos. However, most dogs do not naturally engage with two-dimensional images, raising the question of whether dogs perceive such images as representations of real faces and objects. To measure the equivalency of live and two-dimensional representations in the dog's brain, during fMRI we presented dogs two live action stimuli (actors and objects) as well as videos of the same actors and objects. The dogs (N=12) were presented with 20 second long blocks of faces and objects in random order four times per scan run. Three runs consisted of live stimuli and three consisted of video stimuli. For live faces vs. live objects, we found that dogs showed a mean signal change of 1.51% +/- 0.30% in the primary dog face area vs. 0.49% +/- 0.20% for video stimuli (interaction p=0.008). Similarly, the superior temporal sulcus showed a 1.42% +/- 0.42% change in mean signal difference for live stimuli vs. 0.28% +/- .21% for video (interaction p=0.009). These results suggest that using live stimuli to define face processing regions in the dog brain is more effective than using videos.

The role of the rat dorsal posterior parietal cortex in attentional processing

Emma Halter, Carina Alessandro (Providence College), Taylor Wise (Brown University), Victoria Heimer-McGinn (Rodger Williams University), & Victoria Templer (Providence College)

P32

The aim of this study was to determine and perhaps dissociate the contribution of the dorsal Posterior Parietal Cortex (dPPC) to top-down and bottom-up attention. The five choice serial reaction time task (5CSRTT) was used to tap both the goal-driven ability to modulate attention (top-down) and stimulus guided attention (bottom-up). Rats were preoperatively trained to nose-poke in one of five briefly-illuminated ports. Rats then received either sham or neurotoxic lesions to the dPPC. In addition to post-operative testing on the standard 5CSRTT task, probe challenges were presented that were designed to tax relative contributions of top-down vs. bottom-up attention. Lesioned animals showed a deficit in accuracy of choice and a longer latency for correct choice in the first three days of post-operative testing. The loss of this effect in later days might suggest

compensatory cognitive strategy and/or alternate neural circuits. However, an increase in omissions during the later days of testing indicates a possible attentional deficit overall in lesioned rats. The challenges were shown to be equally as difficult for both lesioned and sham animals. The extent to which top-down vs. bottom-up processing relies on the dPPC will be discussed.

Evidence for involvement of the rat dorsal posterior parietal cortex in spatial recognition memory

Robert Vera, Colin Call, Emma Halter (Providence College), Taylor Wise (Brown University), Victoria Heimer-McGinn (Roger Williams University), & Victoria Templer (Providence College)

P33

Attention to the environment and corresponding spatial memory is essential for creation of spatial maps of an animal's environment. The aim of this study was to assess the role of the rat dorsal Posterior Parietal Cortex (dPPC) in spatial object recognition in simple and complex environments, as well as spatial acquisition and long-term retention in the Barnes maze. Rats received either sham or neurotoxic lesions to the dPPC, followed by a period of recovery before behavioral tasks began. Although no group differences in preference for novel objects were seen in simple tasks, sham animals consistently explored novel objects for longer durations and for greater numbers of bouts than lesioned animals. In the complex environment, results indicated possible attentional or memory deficits in the lesioned animals, as seen by a loss of preference for novel objects in the most basic object recognition portion of the experiment. Barnes maze results do not indicate robust differences in memory between groups. However, lesioned animals used significantly fewer direct search strategies for this task than shams, adding to the possibility of spatial memory deficits in PPC lesioned animals.

A comparison of human and rodent performance on the 5:1 Olfactory Discrimination Task using identical odorants.

Chris Evonko, Ashley Kiser, Kayla Vigilante, Nicholas Swain, & David MacQueen (University of North Carolina Wilmington)

P34

With expanded availability of apparatus for controlled presentation of odors, scents are increasingly serving as stimuli for cognitive testing in rodents. Yet, there is limited data regarding the consistency of olfactory abilities between humans and rodents. The present study compared performance of mice and humans on an automated 5:1 odor discrimination task (ODT). Mice were trained in a chamber with a "smell port" through which odors could be presented. Subjects initiated trials by entering the port, and could respond to odors by licking a sensor. Reward was delivered when subjects maintained licking during target odor presentation (5 odors), or stopped licking during non-target (1 odor) presentations. In human testing, participants held a smell port below their nose and responded with a hand-held button. Mice trained to stability produced near perfect performance. Humans underperformed relative to mice regardless of which odor served as the non-target. Accuracy in humans was dependent on non-target assignment, suggesting that these odorants were not equally discriminable. Human participants additionally completed a standardized battery of olfactory function (odor threshold, discrimination, and identification). Relationships between human ODT performance and olfactory function will be discussed.

An underestimated welfare concern in captive wildlife: Influences, risks, and solutions around captivity-induced boredom

Olivia Scott (Macalester College)

P35

The present literature review establishes that the conditions of captivity give rise to an underestimated welfare concern: boredom. Captivity for wild animals introduces unnatural stressors while removing opportunity for animals to engage in species-specific behaviors. Even when sensory stimuli, environmental conditions, and social stressors are addressed, captivity remains inherently monotonous and restrictive. Monotony is clearly linked to boredom in humans, and increasingly in non-human animals, with evidence of highly detrimental consequences when sustained. Monotony is also clearly linked to Abnormal Repetitive Behaviors (ARBs), which can often be a sign of suboptimal welfare. ARBs can be resistant to treatment in some individuals. Theoretically, detecting boredom should enable caretakers to identify in which cases ARBs should be treatable with intervention, as opposed to arising from central nervous system changes. The most highly indicated intervention for preventing and treating ARBs is environmental enrichment. To be effective, enrichment must reduce predictability without inducing stress, encourage naturalistic behaviors and skills, and be tailored to the individual receiving treatment. Drawing the connection between ARBs and boredom opens up new possibilities for increasing welfare for wildlife in captivity.

Fishing for Sound and Movement: Red-Bellied Piranhas Catch a Cue

Amity Jordan, & Jennifer Vonk (Oakland University)

P36

Cues are signals utilized by organisms to engage in behaviors or processes that affect learning and behavior response in individuals in groups. Although there is a growing body of work examining cognition and cue response in various fish species, piranhas have yet to be tested in psychological research. Understanding more how piranhas feed, forage, hunt, and avoid predator threats will allow us to understand how various disruptions may affect their behaviors in response to their changing habitats. It is important to determine whether piranhas prioritize sound or movement during hunting activities because there is a potential that increased environmental stress caused by humans may impact how aquatic predators find their prey. We set out to examine whether carnivorous piranhas, when hunting, prioritize auditory cues over visual cues to find their prey using a competitive cue paradigm in which moving lights were paired with acoustic cues. After the shoal learned to associate a pair of cues with food, the cues were re-paired to determine which cue the shoal would respond to.

Geometry and landmark representation by Clark's nutcrackers is not mediated by hemispheric lateralization

Breanna Cheri, & Debbie M. Kelly (University of Manitoba)

P37

During navigation, animals will often use visuospatial cues provided by the environment, such as geometry and features, to locate a goal. Clark's nutcrackers in particular show flexibility in cue use during spatial tasks. Previous work with pigeons and chicks has suggested differential processing of spatial cues by the two brain hemispheres. Our task investigated hemisphere specific processing of spatial cues by Clark's nutcrackers (*Nucifraga columbiana*). Two groups of birds learned to locate a central goal in either a featureless square arena, or an arena containing a central landmark. Tests were conducted under binocular and monocular viewing conditions to assess the degree of lateralized processing of geometric and featural cues. When tested in an arena that was double the size of the trained environment, birds searched near the center indicating that they were using relative metrics for encoding geometry. When the landmark was present but relocated, nutcrackers showed a stronger reliance on this featural cue over the geometric information from the arena. However, in contrast to previous research with pigeons and chicks, we found no significant differences between viewing conditions suggesting less hemispheric lateralization for processing visuospatial information by nutcrackers. Our results support species-differences among birds for processing of spatial information.

Labeling of Emotional Events in Pigeons and Humans: The Acquisition and Transfer of Visual Labels

Cheyenne Elliott, Madie Westbrook, Kylie Brown, Margarette Alvarado, Kenneth Leising (Texas Christian University), & David Stahlman (University of Mary Washington)

P38

Traditional theories of emotion labeling posit that humans use verbal labels to identify, discriminate, and act upon interoceptive sensations caused by external events. For example, one may learn to say the word "fear" (not "happy" or "sad") to label one's responses (e.g., increased heart rate) to dangerous stimuli. While nonhuman animals are nonverbal, drug discrimination studies have demonstrated that they can differentially respond based on differing drug states. The current study examined whether humans and pigeons learn to select different visual labels following the delivery or omission of a reinforcer, and whether they transferred the use of labels to other discriminative stimuli. The results indicated that, for both pigeons and humans, acquisition and transfer of the visual labels occurred, but only after trials that required labeling were trained in separate sessions from other trials. Additionally, across several experiments, humans showed transfer of the labels only when trials required a single response rather than multiple responses. Tests were conducted with pigeons to determine which cues controlled labeling (e.g., interoceptive state, their behavior, or audiovisual stimuli associated with the events). Pigeons maintained labeling behavior when they could not eat, but showed reduced accuracy when the stimuli accompanying the reinforcing event were removed.

The Effects of Overtraining on Short-Cut Taking in Rats

Isabelle Banke, & Joshua Wolf (Carroll University)

Animals use a variety of search strategies to find food or an opportunity to escape. Under experimental conditions (e.g., during testing the originally trained path is blocked)

P39 animals may attempt to navigate to a previously rewarded location by taking a novel path or a short-cut. The purpose of the current experiment was two-fold. First, we investigated whether rats would take the shorter path during testing if the originally trained path was still available. Second, we wanted to see if extensive training past criterion would cause rats in the overtraining group to take the shorter path less often. Previous research has demonstrated that as the number of training trials increases, search strategies shift from place or directional responding to favor a more stimulus-response based strategy. Rats were trained to navigate a modified two-arm maze to find a Froot Loop(c) and were tested with an available shorter path immediately after reaching criterion or after completing an additional 30 trials after criterion was met. Some rats took the novel path but the amount of training did not influence how often the shorter path was chosen.

Effects of Temporal Delay Type on Human Choice in a Concurrent Chains Procedure

Southern, R. A., Bond, S. R., Edwards, V. M., Jasmer, J. A., Marsh, M. S., Smith, A. L., Stagner, J. P., Bodily, & K. D. (Georgia Southern University)

P40 Stagner & Zentall (2010) found that pigeons chose a lower probability of reinforcement (20%) alternative that was followed by predictive stimuli rather than a higher probability of reinforcement (50%) alternative that was followed by non-predictive stimuli. To investigate the generality of this finding, we adapted this concurrent-chains procedure for use by human participants. Building on our previous research, the current study manipulated the length of delays between the initial and terminal links (e.g., Spetch et al., 1990, McDevitt et al., 1997, Cunningham et al., 2019). The stimuli presented during the delay were manipulated between groups. Choice allocation was analyzed and compared to the generalized matching model. Although there was no change in mean choice preference across blocks, there was an improvement in model fit from block one to block two. This supports the conclusion that obtained reinforcers more accurately account for choice allocation compared to reinforcement predictors.

Effects of Reinforcement Probability on Human Preference in a Concurrent-Chains Procedure

Bond, S. R., Edwards, V. M., Jasmer, J. A., Marsh, M. S., Smith, A. L., Southern, R.A., Stagner, J. P., Bodily, & K. D. (Georgia Southern University)

P41 When given two alternatives that payoff equally, pigeons prefer an alternative that is followed by reinforcement (Roper & Zentall, 1999). We adapted this procedure for human participants to assess if the preference for predictive stimuli generalized across species. The current study investigated the effects of overall reinforcement probability and forced exposure trials on preference for stimuli that predict reinforcement. Analyses showed no effect of block or condition, and no interaction. Choice allocation was submitted to the generalized matching model, revealing that choice allocation was accounted for by obtained reinforcers.

Category Difference Facilitates Oddity Learning in Honeybees (*Apis mellifera*)

Nicole Muszynski (Wabash College University of Hawaii at Manoa), & Patricia Couvillon (University of Hawaii at Manoa)

P42 Performance of honeybees resembles that of vertebrates in a variety of associative learning experiments. Recent work has focused on same/different problems to assess relational learning which is not easily explained by associative principles. Honeybees have successfully solved trial-unique three-stimulus oddity problems with two-color pattern stimuli, although there is room for improvement. The aim of the present experiment was to incorporate a category difference into an oddity problem to facilitate oddity learning. In a preliminary experiment, honeybees easily discriminated solid colors from two-color patterns with new pairs on every trial, a result suggesting category learning. Two groups of honeybees then were trained in four-stimulus trial-unique oddity problems. Group 1 was trained with a category difference among the stimuli on every trial; a solid color was odd on half the trials and a two-color pattern was odd on the others. Group 2 was trained with no category difference; all stimuli were two-color patterns. Both groups showed better-than-chance performance, an indication of the robustness of honeybee oddity learning. However, the proportion of correct choice for Group 1 (category) was significantly greater than that for Group 2 (no category). The results suggest that the presence of a category difference facilitated an oddity discrimination.

Recovery after Extinction in Rats using Olfactory Stimuli

Genevieve Guidone, Sophie Pinneke, Calista Holt, Mark Galizio, & Kate Bruce (University of North Carolina Wilmington)

P43 Psychologists studying animal learning reliably observe recovery of behavior after extinction. Current theoretical models describe this both as “renewal” and as “resurgence.” Renewal emphasizes contextual changes; resurgence studies recovery after a second response is extinguished. We used a modified operant chamber with olfactometers to train 9 rats to center-nosepoke in the context of Odor A under a VI-30s schedule for food reinforcement. Center-nosepoking was then extinguished. In the ABA Renewal condition, extinction occurred in the presence of Odor B; in the AAB Renewal condition, extinction occurred in the presence of Odor A; in the Resurgence condition, extinction occurred while reinforcing the alternative behavior of nose-poking in the right port in the presence of Odor A. Rats were then tested for recovery of center nose-poking in the context of Odor A (ABA Renewal and Resurgence) or Odor B (AAB Renewal). Each rat experienced all three conditions, using different odors, and rats had different testing orders. Surprisingly, rats showed little evidence of renewal and no evidence of resurgence. Thus, we are expanding the current study to explore other variables that are critical to observe resurgence and renewal.

The relationship between behavioral and autonomic measures of fear conditioning in humans

Brittany Fust, Zebulon K. Bell, & Martha Escobar (Oakland University)

P44 Signals of a potentially threatening event can elicit a myriad of autonomic and controlled responses. The present study uses a novel categorization task that allows for assessment of acquisition of a fear conditioned response using concurrent measurement of behavioral (reaction time) and autonomic (gaze and pupil dilation) responses, using human participants and an eyetracker. In order to achieve conditioning, a signal (a picture) was paired with an outcome (a burst of white noise) in one of several probabilistic relationships. Following acquisition of the fear response, the signal was presented in the absence of the potential threat, and extinction of the fear response was assessed. Differences in the time course of acquisition and extinction of the behavioral and autonomic components of fear conditioning will be discussed.

Acute Administration of 7,8 dihydroxyflavone To Attenuate Memory Deficits in a Rat Model of Fetal Alcohol Spectrum Disorder

Jacob Dowell, Bradley Vandecar, Claire Bova, & Martha Escobar (Oakland University)

P45 Alcohol exposure during the gestational period can result in a Fetal Alcohol Spectrum Disorder (FASD), primarily characterized by an array of cognitive, physical, and developmental disabilities. Some of the deficits observed in children with FASD resemble those observed in neurodegenerative disorders in aging individuals, which have been attenuated by infusion of the protein Brain Derived Neurotrophic Factor (BDNF). 7,8 dihydroxyflavone (DHF) is a potent agonist for the BDNF receptor Tyrosine kinase B, supplementing the protein. Our laboratory has observed that chronic administration of small doses (5 mg/kg) of 7,8-DHF to pups exposed to moderate levels of alcohol during gestation can attenuate the otherwise observed spatial memory deficits. The present study used a Y maze to determine whether acute administration of a large dose (30 mg/kg) 7,8-DHF could have the same beneficial effect. Preliminary results suggest that acute administration of 7,8-DHF is not as effective as chronic administration in ameliorating the effects of prenatal exposure of alcohol.

Differential outcomes facilitate acquisition of a visual discrimination with rats

Cokie Nerz, Callie Benavides, Esraa Almulimi, Daniel Alvarez-Torres, Cheyenne Elliott, & Ken Leising (Texas Christian University)

P46 In the laboratory, learning to make different responses (e.g., lever pressing vs. chain pulling) is facilitated by different outcomes (e.g., food vs. water) for each response. The current research aimed to extend this differential outcomes effect (DOE) to rats performing a visual discrimination. Rats were required to nose-poke to initiate the presentation of either a flashing or steady light. Pressing a lever to the left of the feeding niche was reinforced during one visual stimulus (e.g., flashing light), whereas presses to the right lever were reinforced during the other visual stimulus (e.g., solid light). In the experimental group, the rats received a different outcome for each correct response (e.g., flashing light- left lever-sucrose; solid light-right lever-chocolate pellets). In the control group, rats received one outcome (e.g., sucrose) for both responses. During initial training, a response bias was detected in all groups. All groups were retrained and a correction procedure added, which required rats to repeat the trial after an incorrect response. Consistent with previous research using auditory stimuli, rats that received differential outcomes acquired the discrimination faster than rats in the control groups.

Relational Reasoning in Dogs

Erica Kennedy, Spencer Schading, Krista Sawyer, & Sabrina Morton (Frostburg State University)

P47 Relational reasoning is often thought to be a higher cognitive ability seen in limited species. This kind of reasoning was once thought to be linked to language training in non-human primates, but more recent evidence suggests this reasoning ability can be seen in a wider range of species. Little research has been done, however, on the relational reasoning abilities of dogs. The purpose of this study was to present dogs with a relational reasoning problem similar to those presented to non-human primates. In this study, pet dogs from a variety of breeds were presented with two large plastic containers which were used to hide a food reward. Each container was marked with pairs of visual stimuli that either represented “sameness” (two triangles) or “difference” (one square and one circle). The location of the hidden food was determined by a relational rule, with each dog randomly assigned to have “sameness” or “difference” represent the correct choice. Dogs were presented with 20 trials, with different randomized visual stimuli marking the containers hiding the food. Data collection is ongoing, but preliminary analysis suggests that dogs are not sensitive to these visual relational cues in solving this task.

Personality Impacts on Pet Preference

Riley Macgregor, Lindsey Johnson, & Lucas Keefer (University of Southern Mississippi)

P48 Past research has shown personality similarity in pet-owner relationships (Turcsan et al., 2012). We tested whether personality similarity might also impact pet selection, particularly for cats and dogs. Participants (N=957) rated their interest in adopting each of the five cats and dogs based on profiles representing high scores on each positively valenced Big Five trait. Similarity effects were tested by correlating rater traits with evaluations of each profile. Results indicated similarity preferences for all traits (except neuroticism) when considering dog personality preference, but only with openness and agreeableness when considering cat preference. High ratings in neuroticism predicted liking of the emotionally stable (i.e., low neuroticism) pet profiles, a complementarity effect. Results demonstrate notable cross-species and cross-trait differences that speak to the importance of personality traits in pet selection. This information furthers our understanding of the human-pet dynamic and may be helpful in identifying ideal matches for pet adoptions.

Select This or Reject That? Using the Blank Comparison Task to Assess Select and Reject Control in Learning Simple Discriminations

Bobbie Faith Wolff, Ceili Anne Casadei, Mark Galizio, & Kate Bruce (University of North Carolina Wilmington)

P49 To perform a simple discrimination task, animals learn either to “select” the correct stimulus (S+) or “reject” the incorrect stimulus (S-). The Blank Comparison (BLC) Task is a procedure allowing for the assessment of select and reject controlling relations in humans and non-humans. This uses a simple discrimination paradigm that includes an ambiguous stimulus (BLC+/-), response to which is differentially reinforced based on its relation to baseline stimuli (S+ and S-). This task has been used to assess stimulus-controlling relations in humans as well as macaques, but not rodents, which are used in models of comparative cognition. Typically, the task utilizes visual stimuli in a simultaneous presentation procedure, but for rodents, odor stimuli were presented. Rats were trained to remove scented lids from sand filled cups in a two-choice, simultaneous presentation procedure. Then they were trained on the BLC Task, using a blocked training procedure that included select (S+ and BLC-) and reject (BLC+ and S-) trial types. All rats have attained at least 75% accuracy in sessions with both select and reject type trials. The BLC Task provides insight into exclusion learning, and is currently being used in the Odor Span Task, to assess how rats perform this task.

Colour classical conditioning in zebrafish: A novel automated home-tank paradigm

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P50 Classical conditioning is defined as the learning of association between a previously neutral stimulus (the conditioned stimulus) and a reinforcer that has inherent value due to natural predisposition (the unconditioned stimulus). This form of learning has been explored in numerous species from insects to mammals and using different stimulus modalities like auditory and visual cues. Visual cues are particularly appropriate for the diurnal zebrafish, which uses vision as its primary modality. Zebrafish possess four colour photoreceptors, as well as a simple and evolutionarily-conserved brain, making them a good model to study visual learning and memory. Colour-based classical conditioning has already been conducted in zebrafish using methodology that involved human handling. Human handling, however, represents a confound as it induces stress and anxiety, a major problem in zebrafish learning studies. Here, we propose a new method based upon the use of an automated home-tank in which fish are required to associate a particular colour-light emitted by an LED with food reward. The time of coloured light displaying, as well as the quantity of food released are controlled electronically, allowing removal of human interactions during the experiment. Here we report the learning performance of fish in this new system.