19th Annual International Conference On Comparative Cognition

Sponsored by the Comparative Cognition Society

March 7 to March 10, 2012

Radisson Hotel

Melbourne Beach, Florida

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CO3 - 2012 Program Summary

PROGRAM NOTE Five minute talks are designated by a Talk Number with a grey background. They are five minutes in duration followed by two minutes for discussion. Ten minute talks are followed by four minutes for discussion.

Wednesday

3:30 PM Welcome

7:00 PM Opening Remarks (Jon Crystal)

7:05 PM Discrimination Learning (Chair: Jon Crystal)

1

7:05 PM **Near-Win Density in a Pigeon Slot Machine Analogue**

Nathaniel Rice, & Elizabeth Kyonka (West Virginia University)

In slot machine play, near wins are stimuli that approximate winning stimuli but deliver no reinforcer (e.g., two winning symbols and a losing symbol). Pigeons pecked lighted side keys on a fixed ratio 3 schedule. Across 4 trial types, the side key was lighted red or green, or changed from red to green after a specified number of pecks, simulating a slot machine reel. Winning trials involved 3 red presentations. Clear-loss trials involved 3 green presentations. Intermediate, near-win trials involved 2 red presentations before the key turned green. After the fixed ratio was completed, the side key was darkened and the center 'collect' key was lighted white for 5 s. Food was delivered on a winning trial so long as the pigeon pecked the collect key at least once during the 5-s interval. Non-winning trials were not reinforced with food. Throughout several conditions, trial-type density was manipulated and responding on the collect key was recorded. Rates of collect-key pecking were higher for trial types with more red presentations. Differences in rates at different trial-type densities may clarify the discriminative and conditioned reinforcing properties of near wins.

2

7:12 PM **Adaptive Experimentation: Using Genetic Algorithms to Analyze Stimulus Control**

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

During most experiments, a number of stimulus properties are determined by experimenter intuition or convention. Using digitally generated stimuli in a computerized design, however, experiments can be finely tuned to optimize subject performance. In this experiment, adaptive techniques are used to vary multiple aspects of a visual discrimination. Over time, the pigeon's responses to the display cause the stimuli to evolve and cluster into an optimal configuration. The final configuration of the stimuli and the evolution of the display will be discussed.

3

7:19 PM **Gradually increasing duration of incorrect comparison in MTS reduces errors.**

James MacDonall, Peter Sanneman, & Jaime Tanner (Fordham University)

These experiments demonstrate a procedure for reducing errors as pigeons learn identity matching-to-sample using colors. In Experiment 1, a fixed ratio 10 to the sample produced the comparisons and pecks to the matching comparison were reinforced; the intertrial interval was 30 s. In the experimental condition, FR 10 to the sample produced both comparisons but the incorrect comparison disappeared after 0.1 s, and that interval gradually increased over sessions. Two pigeons started in the experimental and two in the control condition. After two sessions of no errors pigeons were moved to the other condition using different colors. Again, after two sessions of no errors pigeons were moved to their initial condition using different colors. Pigeons made fewer errors in experimental conditions (3-50) than in control conditions (53-208). Experiment 2 replicated Experiment 1 but used a 10 s ITI to increase errors in the control condition. There were fewer errors in experimental conditions and a modest increase in errors in control conditions. Experiment 3 used a 5 s ITI and naïve pigeons. Pigeons made fewer errors in experimental conditions (6-96) than in control conditions (97-1052). In each experiment within-subject comparisons showed large differences in errors between conditions.

7:33 PM Choice (Chair: Suzanne MacDonald)

4

7:33 PM **Chimpanzees make equitable offers in an ultimatum game**

Darby Proctor (Georgia State University), Frans de Waal (Emory University), & Sarah Brosnan (Georgia State University)

Is what is fair to a human fair to a chimpanzee? This question has spurred much debate in the literature and has yet to be definitely answered. Here, we use a limited-form ultimatum game to explore whether chimpanzees will make fair or self-interested offers to a partner chimpanzee. The ultimatum game is a traditional human behavioral economic task in which one individual is given some amount of money and asked to split that amount with a partner. The partner can either accept the offer, which results in both individuals leaving with the proposed split, or can reject the offer, in which case neither individual is rewarded. Humans in this task typically offer 40-50% of the reward to their partner, indicating that humans do not act in purely self-interested ways. In the limited-form ultimatum game with chimpanzees, we find that proposers choose the equitable offer significantly more than the offer that is self-interested (more for the proposer than respondent). Thus, it seems likely that humans and chimpanzees share a sense of fairness that was present in our last common ancestor.

5

7:40 PM

Pigeons Prefer Discriminative Stimuli Independently of the Frequency with Which They Signal Reinforcement
Jessica P. Stagner, Jennifer R. Laude, & Thomas R. Zentall (University of Kentucky)
Pigeons prefer an alternative that provides discriminative stimuli (an S+ on 20% of the trials that always predicts reinforcement and an S- on 80% of the trials that never predicts reinforcement) over one that provides nondiscriminative stimuli (one of two stimuli that both predict reinforcement 50% of the time), even though the nondiscriminative stimulus alternative is associated with 2.5 times more food. We hypothesized that pigeons evaluate the conditioned reinforcer associated with each alternative and ignore the conditioned inhibitor (i.e., by judging the stimulus associated with 100% reinforcement relative to the stimulus associated with 50% reinforcement). To test this, we gave pigeons a choice between an alternative associated with an S+ on 20% of the trials and an S- on 80% of the trials (20% reinforcement) versus an alternative associated with an S+ and an S- each on 50% of the trials (50% reinforcement) and found indifference between the two alternatives. Both alternatives were then associated with nondiscriminative stimuli resulting in a strong preference for 50% reinforcement, demonstrating the pigeons' ability to detect the difference between 20% and 50% reinforcement. Thus, pigeons appeared to judge the conditioned reinforcer's predictive value and ignore its frequency as well as the conditioned inhibitor's.

6

7:47 PM

Mid-Session Reversal in Pigeons on Visual and Spatial Discrimination Tasks
Neil McMillan, & William A. Roberts (University of Western Ontario)
We trained pigeons on a red vs. green visual discrimination in which both colors appeared on each sidekey equally often. When the correct key color was reversed half-way through each session, pigeons consistently made anticipatory and perseverative errors. When the duration of the inter-trial interval was manipulated on probe sessions, the resulting shifts in errors supported the hypothesis that pigeons used the interval time from session onset to estimate the expected reversal point, and not the number of trials or reinforcers obtained. These pigeons then were trained with red and green always appearing on the same side (confounded visual/spatial discrimination), and markedly fewer errors were found around the reversal point. When the inter-trial interval was manipulated, no shifts in errors occurred. Pigeons appear to use interval timing as a strategy to predict a mid-session reversal when a visual discrimination is learned but use a win-stay, lose-shift strategy when a visual/spatial discrimination is learned.

7:54 PM Break

7:59 PM Auditory Discrimination (Chair: Marcia Spetch)

7

7:59 PM

Auditory object constancy: Recognition of objects from multiple orientations by human listeners using dolphin echoes
Caroline M. DeLong (Rochester Institute of Technology), Heidi E. Harley (New College of Florida), Amanda L. Heberle (Rochester Institute of Technology), & Whitlow W.L. Au (University of Hawaii)
People recognize objects visually despite changes in object orientation. This ability is called object constancy and has not been well studied in the auditory modality. Dolphins use echolocation for object recognition, and objects ensonified by dolphins produce echoes that vary significantly as a function of orientation (e.g., fish). In this study, human listeners had to classify echoes from three objects ensonified with dolphin signals. The objects varied in material, size, and shape. Object echoes were collected from multiple lateral aspect angles (-30 to +30 degrees, 0 degrees is broadside). In Experiment 1, participants were trained to classify the objects using echoes from -5 to +5 degrees, and then were tested on novel aspect angles. Participants successfully classified objects at all angles (M = 77%). In Experiment 2, 5 groups of participants were trained on 5 different aspect angles and tested on novel angles. Participants trained on angles faraway from broadside could not identify one or more objects at broadside on the test. An analogous study with a dolphin subject is currently underway using the same object echoes. The aim of this comparative approach is to discover the mechanisms underlying auditory object constancy.

8

8:13 PM

Timbre alters how black-capped chickadees but not humans perceive chords
Marisa Hoeschele (University of Alberta), Robert G. Cook (Tufts University), Lauren M. Guillette, & Christopher B. Sturdy (University of Alberta)
We previously trained humans and chickadees to respond to a C major triadic (three-note) chord and not to respond to semitone variations of this chord. Both species showed a similar pattern of responding across chords, but showed subtle differences when transferring this discrimination to a new key (i.e., novel pitches). In the current study we looked at whether changing timbre instead of key would have a similar effect on responding in both species. Timbre is the quality of a sound that differentiates its source (e.g., a flute compared to a clarinet) that is based on the relative powers of frequencies within the spectrum. We found that, while timbre had little effect on how humans responded to the different chords types, timbre had a large influence on the pattern of responding in chickadees. Further, we also presented each species with single notes and dyads (2 note chords) of the training timbre. While humans responded most to dyads that contained 2/3 of the notes from the major chord, chickadees responded more to individual notes. While humans appear to use the fundamental frequency of the component notes, we suspect chickadees are using a different set of spectral features to classify the chords.

9

8:20 PM

Discrimination and generalization of musical consonance/dissonance in humans

Lee M. Vilinsky, Marisa Hoeschele, Ann-Marie Przyslupski, & Christopher B. Sturdy (University of Alberta)

Musical consonance/dissonance is an attribute of sound that, although typically not found in nature, can elicit preferential responding in tasks using musical stimuli. Here, we examine the extent to which humans can use consonance/dissonance as a cue to discriminate and generalize musical intervals (i.e. two notes, played simultaneously) in a go/no-go task. After reinforcement contingencies to the intervals of octave (consonant) and tri-tone (dissonant) were established with response feedback, human subjects successfully generalized to the same intervals composed of different notes. During a subsequent test phase, subjects were presented with novel intervals major seventh (dissonant, one semi-tone below an octave) and perfect fifth (consonant, one semi-tone above a tri-tone) along with training stimuli, without feedback. Thus, the novel intervals that are more similar in pitch height to training intervals are less similar in terms of consonance/dissonance. Stimulus control for novel intervals was governed by consonance/dissonance for subjects initially reinforced for consonance during training and generalization but not for subjects initially reinforced for dissonance. Overall, our findings suggest that individual differences facilitate the use of either consonance/dissonance or pitch height as a cue for discrimination and categorization.

8:27 PM

Song & Communication (Chair: W. David Stahlman)

10

8:27 PM

Geographic song discrimination by black-capped chickadees

Allison H. Hahn, Marisa Hoeschele, Lauren M. Guillette (University of Alberta), Daniel Mennill (University of Windsor), Ken Otter, Thibault Grava (University of Northern British Columbia), & Christopher B. Sturdy (University of Alberta)

The songs of many songbird species consist of complex vocalizations with multiple note types and a varied repertoire. However, the fee-bee song of the black-capped chickadee appears to be a relatively simple acoustic signal, containing only two whistled notes. The structure of the fee-bee song has been considered highly stereotypic across the species' range, with some exceptions in isolated populations. Previous discriminant function analyses using acoustic features of fee-bee songs produced by birds in Ontario and British Columbia suggest that songs can be accurately classified based on the location of origin of the singer. In the current experiment, we examined the perceptual abilities of black-capped chickadees in an operant discrimination task of fee-bee songs produced by birds from these two locations. Using a true category/pseudo category paradigm, we found that birds in the true category had an easier time discriminating songs based on the geographic location of the singer compared to birds discriminating the same songs based on random assignment (pseudo category). This discrimination also transfers to novel songs not heard during initial acquisition. These results suggest that black-capped chickadees perceive differences among songs produced by birds from different locations, which supports the previous statistical classification by discriminant function analysis.

11

8:34 PM

Vocal signaling among male northern elephant seals: behavioral field studies of honesty vs. associative learning

Colleen Reichmuth, Caroline Casey (University of California - Santa Cruz), Isabelle Charrier (Centre Neurosciences Paris Sud), Nicolas Mathevon (Universite Jean Monnet), & Brandon Southall (University of California- Santa Cruz and SEA)

Northern elephant seals (Mirounga angustirostris) are large, highly polygynous mammals that have a breeding system based on the defense of female harems by dominant males. The species provides a unique opportunity for the study of vocal recognition and communication. Acoustic signaling plays an important role in settling otherwise costly interactions between competing males, as stereotyped vocal displays often elicit appropriate behavioral responses from spatially separated individuals without physical contact. We recorded the vocalizations of adult male elephant seals during two breeding seasons to characterize their individual signatures. To determine whether these calls were sufficient to control the behavior of receivers, we conducted a series of playback experiments using calls recorded from individuals of known size, rank, and familiarity. The results show strong and predictable differential phonotaxis and calling behavior based on hierarchical status of the receiver relative to the playback. Call qualities reflecting duration, level, and frequency were evaluated for dependence on body size and rank to determine whether the vocalizations were honest indicators of resource holding potential. The absence of significant correlations supports the notion that these unique signals may not be honest signals but rather serve to convey information about individuals that is managed through associative learning.

12

8:48 PM

Whisper-like Behavior in a Non-human Primate

Rachel Morrison (Biopsychology and Behavioral Neuroscience Subprogram in Psychology The Graduate Center of CUNY), & Diana Reiss (Department of Psychology Hunter College of CUNY Biopsychology and Behavioral Neuroscience Subprogram in Psychology The Graduate Center of CUNY)

In humans, whispering has evolved as a counteractive strategy against eavesdropping. Evidence for whisper-like behavior exists in a few other species, but has not been reported in non-human primates. We discovered evidence of whisper-like behavior in cotton-top tamarins (Saguinus oedipus) in the course of investigating their use of human-directed mobbing calls. We exposed a family of captive cotton-top tamarins to a supervisor who previously elicited a strong mobbing response. Simultaneous audio-video recordings documented the animals' responses in the supervisor's presence and absence. Rather than exhibiting a full mobbing response and producing loud human-directed mobbing calls, the tamarins exhibited a partial mobbing response and produced low amplitude vocalizations that initially eluded our detection. A post hoc analysis was conducted to determine if the tamarins were reducing the amplitude of their vocalizations in the context of exposure to a potential threat. Consistent with whisper-like behavior, the amplitude of the tamarins' vocalizations was significantly reduced only in the presence of the supervisor. Due to its subtle properties, this phenomenon may have eluded detection in this species. Increasing evidence of whisper-like behavior in non-human species, suggests that low amplitude signaling may represent a convergence in a communication strategy amongst highly cooperative species.

8:55 PM

Break

9:00 PM Cognitive Processes I (Chair: Stephen Fountain)

13 9:00 PM

Face Recognition in Orangutans

Catherine F. Talbot (Department of Psychology Georgia State University), Laura Mayo, Tara Stoinski (Zoo Atlanta), & Sarah F. Brosnan (Department of Psychology and Neuroscience Institute Georgia State University)

Faces provide group-living species with information on the age, sex, identity, and emotions of others. In this study, we tested a less gregarious species, the orangutan, to determine if they exhibit similar face recognition skills. Using a match-to-sample paradigm, we first confirmed that orangutans can match two identical photographs of unfamiliar conspecifics. In the second task, subjects matched two different photographs of the same individual from different viewpoints. During testing, probe trials of the experimental question, which were always rewarded, were inserted among training trials. All three subjects successfully transferred to familiar novel stimuli with their first exposure to these individuals ($z=3.1$, $p=0.001$) but not unfamiliar novel stimuli ($z=0.15$, $p=0.878$), despite being trained with the same unfamiliar individuals. Results for all trials (not just initial trials) indicated the same pattern in (Familiar: $z=3.16$, $p=0.001$; Unfamiliar: $z=0.64$, $p=0.520$). Thus orangutans outperformed rhesus monkeys, but not as well as chimpanzees on similar tasks. Further examination is needed of social organization and other social factors which were important in the evolution of face-processing skills.

14 9:07 PM

Clark's nutcrackers (Nucifraga columbiana) use informed, but not uninformed, knowledge states to guide choices during an object-choice task

Dawson Clary, & Debbie M. Kelly (University of Manitoba)

Corvids have been shown to be adept at inferring the intentions of other individuals when tested in ecologically relevant food-caching paradigms. Rarely however, have the social cognition abilities of corvids been tested in contexts outside of food caching, thus the flexibility of their social cognition is yet unknown. The present study utilized the object-choice task to examine whether Clark's nutcrackers are able to discriminate the knowledge states of human experimenters. The nutcrackers were first trained to follow an experimenter's gesture to find a hidden food reward, and subsequently tested with two experimenters: one informed, the other uninformed of the reward's location. The nutcrackers preferentially chose the gesture of the experimenter informed of the hidden food reward's location over the simultaneously presented gesture of the uninformed experimenter. However, if the uninformed experimenter gestured alone, the birds continued to follow the gesture. Overall, these results suggest that nutcrackers are sensitive to when an experimenter is knowledgeable of the food reward's location, yet were not able to use an experimenter's lack of knowledge to guide choice behaviour.

15 9:14 PM

The Behavior of Asian Elephants (Elephas maximus) during mirror exposure

Nicole Daurio (Department of Psychology, Hunter College of CUNY), Joshua M. Plotnik (Department of Experimental Psychology, University of Cambridge), Frans B. M. de Waal (Living Links, Yerkes National Primate Research Center, and Department of Psychology, Emory University), Diana Reiss (Department of Psychology, Hunter College of CUNY)

There is controversy surrounding the topic of mirror-self recognition (MSR) that centers on the use of different methodologies and different criteria used to determine whether an individual shows this ability. Most studies have described mirror-oriented behaviors as exploratory, social, contingency testing, and self-directed. The standard objective test for MSR has been the mark test. Passing rates for the mark test vary greatly within species and between individuals. In a published study, three Asian elephants (Elephas maximus) were exposed to a mirror and tested using standard mark test procedures. Only one elephant passed the mark test. We conducted a subsequent quantitative and qualitative analysis of the behaviors these elephants exhibited during mirror exposure, to determine whether behavioral differences were evident. We categorized behavior as exploratory, social, contingency testing, and self-directed. Our results showed that the individual that passed the mark test spent significantly less time at the mirror over the course of the study. All three elephants showed many behavioral similarities. We conclude that although only one elephant passed the mark test, all three elephants exhibited contingency testing and self-directed behavior at the mirror, evidence for mirror self-recognition.

16 9:21 PM

The Kakariki Model: comparing exploratory learning strategies in parrots and children

Zoe Demery, & Jackie Chappell (University of Birmingham)

The majority of comparative cognition has focussed on establishing what the cognitive capacities of different species are, rather than how animals acquire and structure information, specifically through exploration. We believe exploration is not random; but structured, selective and sensitive to categorical features of the environment. We exploited the neophilic tendencies and distinctive sensorimotor apparatus of parrots and human children by designing a series of comparative experiments. We measured the interaction between parrot visual fields and their bill tip organ to understand a sensory basis for exploration. We then linked this to increasingly complex behavioural tasks involving different novel objects and physical problems, to examine in detail the exploration process in different contexts. Although from quite different ecological niches, we argue kakariki (Cyanoramphus novaezelandiae) and children (4-7 yo) have common strategies. For instance, we found both explore more with functional changes in an object (e.g. weight), than with non-functional changes (e.g. colour). They also focus on certain object properties (e.g. corners or moveable parts) more than others (e.g. smooth surfaces or rigid features), which provide clues about objects' affordances. We discuss the implications of our findings for other animals from a computational, information-processing perspective.

9:28 PM

17

What's all the bias about? Learning effects contribute to cognitive bias in nonhuman primates

Bonnie M. Perdue, Theodore A. Evans, & Michael J. Beran (Language Research Center - Georgia State University)

Cognitive bias refers to the influence of an individual's affective state on cognitive processes. Cognitive bias tasks typically involve training an animal on a conditional discrimination task in which one response results in a more positive outcome than the other. Then the subject is presented with intermediate stimuli and the response indicates whether the subject interprets these ambiguous stimuli as positive or negative. Manipulations of an animal's affective state have been reported to result in changes in the perception of the ambiguous stimuli in a variety of species; however, some recent research suggests that other learning effects may be influencing performance. We trained monkeys on a 40-step psychophysical discrimination task in which opposing responses made at opposite ends of the discrimination spectrum resulted in one (level 1) or four (level 40) pellets. Once at criterion, intermediate levels were introduced. Initially, subjects' classification approximated a true psychophysical discrimination. However, with continued exposure (and no manipulation of affective state), subjects began to classify the majority of intermediate stimuli as less positive. Our findings suggest that learning, independent of affective state, may also result in biased responding, and this potential confound should be considered and controlled for in future studies.

9:30 AM-10:30AM Behavioural Processes Workshop – Meet the Publisher & Editors
Everyone is welcome to attend!

12:00 PM Spatial Cognition (Chair: Russell Church)

12:00 PM

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Rats' encoding and retrieval of spatial and non-spatial features of a missing object in a foraging task.
Corrrine Keshen, & Jerome Cohen (University of Windsor)
After obtaining food from three of four baited objects in a study array rats had to find the remaining fourth baited object in the test array of a trial. For some rats the array configuration, its location within the foraging area, the position and orientation of objects within the array remained fixed over trials during training (stable group) while for others these cues varied over trials (unstable group). Rats' ability to flexibly use these cues to find the missing object in test arrays was assessed in post-acquisition probe tests where these cues were either dissociated from each other or were systematically eliminated. Rats were less able to use each of these cues accurately after being trained under stable than unstable conditions. These results suggest that a missing object's features were simultaneously encoded and retrieved under stable conditions but separately encoded and retrieved under unstable conditions.

12:07 PM

19

The dynamics of visual orientation in foraging rats
Tamara Carolina (Indiana University)
Animals collecting renewable resources are faced with complex spatial problems. In a familiar terrain, most species can return to those resources by using self-motion cues or environmental landmarks. In an effort to understand how rats can exploit visual landmarks, I have analyzed the areas of the visual scene that are salient to them from a sensory perspective, and have tracked the position of the animal's head as a proxy to measure their orientation to regions of their visual panorama, as they learn foraging tasks. Analyses of the head movements indicate scanning at regular locations in the arena, particularly prior to establishing a moving direction. In these experiments, visual scanning in the rats may arise for several relevant reasons, including the increase in visual field (from 320 to 360 degrees), motion parallax, or as an error detection signal.

12:14 PM

20

Pigeons (Columba livia) establish and maintain consistent strategies for efficient route-finding in an open field Traveling Salesman Problem task
Danielle Lubyk (University of Alberta, Department of Psychology), Alejandro Sanabria, Vadim Bulitko (University of Alberta, Department of Computing Science), & Marcia Spetch. (University of Alberta, Department of Psychology.)
The Traveling Salesman Problem (TSP) is a computational task which requires a subject to "visit" multiple locations then return to the starting point via the shortest route. Most studies examining pigeon performance on the TSP have used operant paradigms in which subjects peck at nodes on a screen. The current study tested pigeons in an open field TSP task using a novel design. Pigeons were trained to establish consistent routes among several arrays of goal locations then tested with both easier and more difficult array configurations to determine whether their strategies transferred to novel situations. This procedure was carried out in several stages, which gradually increased the number of goal locations from three to six. In all stages, birds were able to establish consistent routes in training and subsequently transfer their strategies to both the easier and more difficult testing arrays. Birds were more likely to use an advanced Convex Hull strategy when three and four goal locations were present and a more primitive Nearest Neighbor strategy for five and six goals. These results suggest that while pigeons can establish consistent routes and generalize to novel arrays, the strategies employed may become less sophisticated as the number of goals increases.

12:21 PM

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Can zebrafish solve a spatial learning task
Robert Gerlai (University of Toronto Missisauga)
Mammals can solve spatial tasks. Fish, despite the lack of mammalian hippocampal structure in their brain, have also been shown to acquire spatial tasks. However, investigators almost never check whether the "good" spatial learning performance actually reflects acquisition of the dynamic relationships among spatial cues. For example, subjects may solve a spatial task by picking out a salient extra-maze cue from their environment and thus turn the task into a simple CS-US associative paradigm, without the knowledge of the experimenter. The mammalian literature, however, also shows that the ability to focus on a salient "background" cue is practically abolished if the experimenter provides a highly predictive, temporally contiguous and salient associative cue in addition to the spatial cues. We utilized this procedure and investigated whether the excellent spatial learning performance we found in zebrafish indeed reflects spatial learning or whether it may be due to simple two-stimulus, i.e. CS-US associative processes. Here we show that zebrafish can learn a CS-US association, can perform well in a spatial task and, importantly, can learn both the CS-US association and the location-US association at the same time, suggesting that fish are able to learn spatial tasks.

12:35 PM

Vertebrate pollinators: a time-dependent generalized traveling-salesman problem

York Winter (Humboldt Universitaet - Berlin), Magnus Jungsbluth (Universitaet Oldenburg), Johannes Thiele (Universitaet München), & Alexander Hartmann (Universitaet Oldenburg)

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Nectar-feeding animals exploit resource landscapes with flowers at fixed locations but with time-dependent nectar content. Vertebrate flower visitors with cognitive abilities may have evolved behavioral mechanisms to optimize the exploitation of such dynamic resources. We present a theoretical approach for this foraging problem (determining minimum-effort harvesting optima in multiple individual and time-dynamic resource landscapes). We introduce a model for the global optimization problem of nectar harvesting by nectar-feeding flower bats as a generalization of the (multiple) traveling-salesman problem. We numerically studied optimum harvesting using genetic algorithms. We investigated experimentally the resource use by freely visiting flower bats. For this we caught bats in the Costa Rican rainforest and equipped them with RFID tags. Free-ranging bats could then visit fully automated computer controlled artificial flowers with ID readers on a 100 by 100 m experimental area in the rainforest. A bat on visiting an artificial flower was identified in real-time and received a nectar reward according to its individually specific schedule. We found that both temporal and spatial patterns of resource exploitation were in the directions as predicted by the theoretical optimization model. Surprisingly, individual differences in foraging efficiency (kJ per km flight effort) were more than twofold.

12:49 PM

Discrimination Learning of Geometric Angles by Humans Differs as a Function of Angle Size

James F. Reichert, & Debbie M. Kelly (University of Manitoba)

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Geometric angles, such as those found at corners of enclosed spaces, represent one specific type of geometric spatial cue used by human and non-human animals to establish environmental position. The current research examined how adult humans learn to discriminate between different sized angles. During Experiment 1, participants learned to discriminate between two real-world objects shaped as geometric angles; one object projected a 50° angle and the other projected a 75° angle and participants were divided into groups based upon training angle size. During testing each respective training angle was individually paired with one of a series of novel test angles that was either smaller or larger than the training angle. The results showed more absolute encoding of the smaller training angle compared to the larger training angle. During Experiment 2, a third angle (25°) was included during training; participants now learned to discriminate between three angles during training but, during testing, were provided with a choice between their training angle and one of a series of novel test angles. Once again, the resulting response patterns showed smaller angles being associated with absolute learning and larger angles associated with relative, rule-based learning.

1:03 PM

Associative Processes (Chair: Ralph Miller)

1:03 PM

Preventing recovery from CS preexposure

Mario A. Laborda, Cody W. Polack, & Ralph R. Miller (SUNY Binghamton)

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The effects of manipulations known to reduce recovery from CS postexposure (a.k.a. extinction) were evaluated in their effectiveness in reducing recovery from CS preexposure (a.k.a. latent inhibition), in two lick suppression experiments with rats as subjects. In Experiment 1, the effects of massive nonreinforced training and of nonreinforced training in multiple contexts were evaluated in their effectiveness to reduce recovery from CS preexposure, as well as the conjoint effect of these manipulations. In Experiment 2, the effects of spacing the nonreinforced trials and of spacing the nonreinforced sessions were evaluated in their effectiveness to reduce recovery from CS preexposure, as well as the conjoint effect of these manipulations. Our results suggest that, as in the case of CS postexposure, these techniques are effective plots in reducing recovery from CS preexposure.

1:10 PM

Exploring the Temporal Nature of Conditioned Response During the Over-expectation Treatment

Chad M. Ruprecht, Josh E. Wolf, & Kenneth J. Leising (Texas Christian University)

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Over-expectation (ox), in Pavlovian conditioning, is the finding that following a compound phase of two pre-trained, asymptotic elements (e.g., stimulus A + X), less conditioned responding is found during tests of either element in isolation. Numerous studies have bolstered the notion that the temporal relationship between a target stimulus and a US not only strengthen but modulate the nature and magnitude of the conditioned response (Catania, 1970; Roberts 1981).In this experiment, we used a conditioned magazine approach paradigm to evaluate the role of timing in the overexpectation effect. In Phase 1, rats were trained with two elements of separate duration; a long element A (40 sec) and short element X (10 Sec), both of which were simultaneously paired with the delivery of the U.S. In Phase 2, we embedded X either early (onset 10 sec) or late (onset 25 sec) within element A (Leising, Sawa, & Blaisdell, 2007). Subjects showed widespread decrements in conditioned responding during testing with A. The results are discussed in terms of how simple conditioned response measures may provide different information about what is learned than evaluation of the distribution of responses.

1:17 PM

Within-session shifts in reward probability and behavioral variability in pigeons

W. David Stahlman (UCLA), Chad M. Ruprecht, & Kenneth J. Leising (Texas Christian University)

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Recent research has indicated that pigeons use within-session temporal cues to govern decision-making behavior in discrimination tasks (Cook & Rosen, 2010; Rayburn-Reeves, Molet, & Zentall, 2011). Even after extensive training, pigeons make both anticipatory and perseverative errors in a two-choice discrimination task when the reinforced response is reversed midway through training sessions. We were interested to know whether variability in behavior shows a similar topography. We report results from a single experiment in which pigeons were rewarded with grain for pecking to a single disc on a touchscreen. Three pigeons (Group Stable) received alternating daily sessions of trials that were rewarded at either High (13%) or Low (4%) probability; the other three (Group Switch) received alternating sessions where the probability of reinforcement was changed midway through the session (i.e., 13%→4%, 4%→13%). We find little evidence for anticipatory shifts in the variability of pecks, but do find evidence for a delayed adjustment in response variability to the reduction in reward probability.

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1:24 PM

Analogies between forward blocking and proactive cue interference in context dependency

Gonzalo Miguez, Henry X. Cham, & Ralph R. Miller (State University of New York at Binghamton)

Blocking (i.e., A-US pairings in Phase 1 and AX-US pairings in Phase 2) has been one of the signature phenomena in Pavlovian conditioning. Its discovery promoted the development of several associative models, most of which posed blocking as an instance of cue competition phenomena (i.e., a decrease in responding due to training two conditioned stimuli conjointly). In one experiment using rats in a fear conditioning paradigm, we found that forward-blocking can be influenced, due to the nature of the design, by proactive interference (i.e., a decrease in responding without a within-compound association) as well as cue competition. Specifically, we show that renewal of backward-blocking parallels the renewal of retroactive interference, while renewal of forward-blocking parallels that of proactive interference.

28

1:31 PM

Inhibition and Facilitation Using Espinet Pretraining

Cody W. Polack, & Ralph R. Miller (State University of New York at Binghamton)

Espinet pretraining (XB / AB; Espinet, Iraola, Bennett, & Mackintosh, 1995) has been used to create inhibitory relationships between neutral stimuli. Subjects seemingly learn that Stimuli X and A are mutually exclusive in the presence of Stimulus B. Specifically, if Stimulus A is subsequently paired with an aversive stimulus (i.e., footshock), then X will also function as a conditioned inhibitor for that aversive stimulus. Using rats in a barpress preparation, we replicated the finding that many XB /AB discrimination trials result in X-A conditioned inhibition, whereas few discrimination trials do not (Experiment 1). Considering that, given Pavlovian conditioned inhibition treatments (A+ / AX-), one can observe either conditioned inhibition or second-order conditioning depending on the number of training trials, we sought to determine whether a similar distinction would occur using Espinet pretraining. In Experiment 2, we found that giving few Espinet pretraining trials resulted in a facilitative X-footshock relationship. Experiment 3 investigated the role of within-compound associations with Stimulus B in this facilitated responding to X. This series provides further support for the view that, as the number of training trials increases, within-compound associations shift from serving a facilitative role to serving in an inhibitory-like fashion.

29

1:38 PM

MEG study of associative learning using a streamed-trial procedure

Susana Maia (Universidade do Minho), Jeremie Jozefowiez (Université Charles de Gaulle-Lille3), & Gary Green (University of York)

We used magnetoencephalographic recording techniques to investigate brain areas involved in associative learning. Participants were exposed to a variant of Crump et al. (2007)'s streamed trial procedure: They were presented with 100-ms stimuli and had to judge the contingency between a target cue and an outcome, while their brain activity was recorded. The contingency between the cue and the outcome was manipulated by changing the probability between them while keeping constant the probability between a companion cue and the outcome. Behavioral results show that despite the difficulty of the task and the short duration of the stimuli, subjects' ratings were sensitive to the contingencies. Preliminary analysis of the MEG data revealed brain areas specifically sensitive to the manipulation of the contingency between the cue and the outcome.

1:45 PM Break

1:50 PM Memory (Chair: Olga Lazareva)

30

1:50 PM

Effect of generalization gradients, relational disparity, and familiarity in motion-based transposition

Olga Lazareva, Kaitlyn Kandray, & Emily Leiker (Drake University)

Pigeons demonstrate robust relational learning after multiple-pair transposition training (Lazareva, Young, & Wasserman, 2005; Lazareva, Miner, Young, & Wasserman, 2008). These studies, however, employed the stimuli varying along the same dimension (i.e., size), raising concerns about generality of the findings. We trained pigeons to select the faster (or the slower) of the two stimuli moving vertically with different speed. The first group of pigeons was trained to discriminate S1 vs. S2 (where digits denote the speed of movement). The two-pair training group discriminated S1 vs. S2 and S2 vs. S3. Finally, three-pair training group discriminated S1 vs. S2, S2 vs. S3, and S3 vs. S4. As in our earlier studies, we found an overall increase in relational learning from one-pair to two-pair to three-pair training. We also applied our model of relational responding in transposition task that uses the difference in generalized associative strength between the stimuli in the testing pair, the dissimilarity between the testing stimuli, and the Euclidean distance from the training pair to the testing pair as predictors of relational choice in a novel testing pair (Lazareva, Young, & Wasserman, in preparation). The preliminary results of simulations will be presented.

31

2:04 PM

Lateral and Frontal Long-Term Memory in Pigeons (Columba livia)

Matthew S. Murphy & Robert G. Cook (Tufts University)

Birds as laterally-eyed animals have specialized retinal areas for frontal and lateral vision, which have unique perceptual, anatomical, and cognitive properties. The visual fields largely follow different visual pathways in the brain. There is an additional difficulty in transferring information learned in one field to the other. However, prior research has not thoroughly investigated this area and has suggested that there is a separate long-term memory store for lateral and frontal information. Using a behavioral targeting procedure with pigeons, we are able to test visual transfer of pictures between the fields in a variety of ways. We found the first strong evidence of frontal-to-lateral intraocular transfer in pigeons, and further results will be discussed.

32 2:11 PM

Mid-session Reversal Task in Pigeons: Effect of ITI Duration

Jennifer R. Laude, Becky Rayburn-Reeves, & Thomas R. Zentall (University of Kentucky)

Pigeons trained for many sessions on a simple, simultaneous spatial discrimination with one response correct for half of the 80-trial session (left key) and the other response correct for the remainder of the session (right key) anticipate the reversal well before it occurred and perseverate well after it occurred. We tested the hypothesis that one reason for the difficulty that pigeons have with this task is the relatively long (5 s) intertrial interval (ITI) because pigeons need to remember not only whether they were fed on the last trial or not but which alternative they had selected. Thus, the task may be not unlike biconditional matching with a 5 s delay. To test this hypothesis, we manipulated the ITI (1.5, 5, and 10 s) and found that pigeons' accuracy was much improved. They made almost no anticipatory errors and made many fewer perseverative errors. Thus, their inability to develop something close to a "win-stay/lose-shift" strategy appears to be related to a failure of memory rather than a failure to use the information provided by the cues from the preceding trial.

33 2:18 PM

Rhythmic Entrainment in a California Sea Lion (Zalophus californianus)

Peter Cook, Andrew Rouse, Margaret Wilson (University of California Santa Cruz), & Colleen Reichmuth (Institute of Marine Sciences)

Motoric entrainment to an isochronous rhythmic auditory stimulus is a behavioral capability once thought to be unique to humans. Recently, this ability has been identified in a few other species, most notably the sulfur-crested cockatoo (Cacatua galerita eleonora). Because the most convincing demonstrations have come from animals that demonstrate vocal mimicry, it has been theorized that entrainment is an evolutionary byproduct of vocal mimicry and related adaptations in the basal ganglia. Anecdotal evidence suggests that, when present, entrainment may be innate rather than acquired. To further explore whether 1) entrainment to specific auditory tempos can be acquired through explicit training, and 2) whether such an ability would generalize to novel tempos, we are studying rhythmic entrainment in an easily trained but vocally stereotypic mammal: the California sea lion. After more than 20 sessions of operant training, the sea lion subject has learned to reliably synchronize a continuous head bob to two similar auditory stimuli with different rates (80 and 120 beats/minute). This finding confirms that a vocally stereotypic animal can learn to entrain, and will serve as a jumping off point to assess transfer of rhythmic entrainment to novel tempos.

34 2:25 PM

Is it really all noise? Beyond unitary comparisons of visual working memory across species.

John F. Magnotti, Jeffrey S. Katz (Auburn University), L. Caitlin Elmore, & Anthony A. Wright (University of Texas Medical School at Houston)

Current theories of visual working memory (VWM) fall into two broad classes: discrete and continuous. Discrete models suggest that VWM is best viewed as filling a few fixed-resolution slots with whole objects, while continuous models suggest that VWM is best described as the allocation of a continuous resource, with no stipulation on storing whole or parts of objects. We have recently suggested that both human and nonhuman data favor the continuous view, and that the quantitative differences across species are best summarized by the amount of “noise” in the VWM system. The current study was designed to fractionate this single noise parameter into variability at encoding, storage, and retrieval/decision time. Three pigeons were trained in a color change detection task in which we manipulated several factors relevant to both encoding (view time, display eccentricity) and retrieval (color similarity) demands. These results were compared to humans in an analogous task. Results indicate that rather than a single measure of noise (e.g., the slope parameter of an exponential function), comparisons across species are better understood in terms of relative noisiness at each phase (i.e., encoding, storage, retrieval/decision) of the task. Our conclusions generalize to considerations of discrete models of VWM as well.

35 2:32 PM

Operant Analogs of Episodic-Like Memory in Western Scrub Jays

Alan C. Kamil, Amy Ort & Alan B. Bond (University of Nebraska - Lincoln)

We have employed two different operant procedures to test the what-where-when (WWW) memory of Western scrub jays, the species studied by Clayton and Dickinson in their studies of episodic-like memory during cache recovery. In one procedure, intended as a direct simulation of the Clayton & Dickinson methodology, jays were shown a trial-unique sample stimulus followed by either a 2-s or 7-s retention interval. The retention interval was followed by a two-choice test between the sample in the original location and another trial-unique stimulus in a different location. The birds were required to match after one retention interval and nonmatch after the other. The second procedure was modeled on the work of Skov-Rackette et al. with pigeons. We trained jays to respond to what, where, and when tests presented on separate trials in random order. They were then given probe trials during which they were presented with two tests. Results from both procedures demonstrate very good WWW learning and memory but provide no evidence for the integrated WWW memories posited to be characteristic of episodic memory.

36 2:46 PM

Prospective memory in a language-trained chimpanzee

Theodore A. Evans, Jessica Bramlett, Bonnie M. Perdue, & Michael J. Beran (Georgia State University Language Research Center)

Prospective memory is remembering to execute an intended action at an appropriate future time. We assessed this capacity in a language-trained chimpanzee, Panzee. Panzee chose between two food options from her indoor enclosure: the chosen option was distributed in her outdoor yard and the non-chosen option was sealed in an opaque container near the indoor enclosure (not visible from the outdoor yard). She then could access the outdoor enclosure for 30 minutes, which also contained eight face-down lexigram tokens. A naive experimenter remained indoors, available to exchange the food in the container for the appropriate token. Panzee searched the tokens in the yard after foraging for her chosen food in 91% of trials, discontinuing her search when she found the token that matched the food contained indoors in 71% of trials. Panzee remembered to bring a token indoors in 89% of trials (an appropriate token in 67% of trials), and she came indoors without any external prompt 81% of the time. This indicates that Panzee may be using prospective memory to store, retrieve, and execute an intended action at a future time of her choosing within the context of other ongoing activity.

3:00 PM

The Trade-off between Nutrients and Toxins by Educated Predators

Christina Halpin (Newcastle University), John Skelhorn (University of Exeter), & Candy Rowe (Newcastle University)

37

Aposematic insects use conspicuous colours and/or markings to advertise the fact that they are defended in some way. Educated predators are those that have learned about the nutritional value and defence levels of prey in their environment, and are able to make informed decisions about whether or not to eat prey that they encounter. Although we know that the toxin content in aposematic prey is important for the degree to which they are avoided, we don't know how the nutritional content of aposematic prey affects predators' foraging decisions. In an experiment using wild-caught starlings (Sturnus vulgaris) feeding on defended and undefended mealworms (Tenebrio molitor) of different nutritional values, we found that the asymptotic attack rates on defended prey were not absolute, but differed depending on the protein content of the defended prey. Our findings offer an insight into how educated predators integrate information about toxins and nutrients to make adaptive foraging decisions, and how their decision-making can impact on the evolution of aposematism and prey defences.

3:14 PM Snack Break

3:54 PM Serial & Temporal Processing (Chair: York Winter)

3:54 PM

Similarities and Differences in Orangutans' and Human Children's Serial Recall of Lists with Different Content and Spatial Cues

Elizabeth Renner (The George Washington University), Elizabeth Price (Smithsonian National Zoological Park), & Francys Subiaul (The George Washington University)

38

Comparisons between human and non-human primate serial memory have used arbitrarily related items. Here, we explored whether apes and young children spontaneously attend to cues that predict order. We used two paradigms in which pictures appearing on a touch-sensitive screen must be touched in a specific serial order. In the simultaneous chaining paradigm (SCP), three different items (A->B->C) appear in different spatial arrangements from trial to trial. In the spatial sequencing task (SST), three items (A->A->A) appear in the same spatial arrangement from trial to trial (e.g., Top->Bottom->Right). Experiment 1 predicted that spatial cues in the SST would enhance performance compared to the SCP. Results confirmed that both children and apes learned better in the SST than in the SCP. Experiment 2 manipulated the content of pictures in the SCP by size, color, and number, and compared performance to lists of arbitrary pictures. Size cues enhanced performance in children but not in apes, while color cues enhanced performance in one ape but depressed it in children. These results indicate that apes and children are able to use spatial cues to learn a list more rapidly and may be able to use certain content cues to improve serial recall.

4:01 PM

Stimulus Onset and Key-Peck Response as Time Markers for Pigeons

Adam E. Fox, & Elizabeth G. E. Kyonka (West Virginia University)

39

The onset of an external stimulus (e.g., auditory signal) and engagement in a physical response (e.g., nose poke) have been reported as being comparable time markers for rats. The present experiment compared the onset of a key light and a peck to a lit key as time markers in pigeons. Four pigeons pecked in fixed-interval (FI) and response-initiated fixed-interval (RIFI) schedules of food reinforcement. RIFI schedules are tandem fixed-ratio (FR) 1 and FI schedules. Pigeons were exposed to FI- and RIFI-15 s, 30 s, 60 s, 120 s, 240 s schedules of reinforcement. Post-reinforcement pauses were a function of the interval duration for both FI and RIFI schedules. However, post-reinforcement pauses were more variable and included more long pauses in RIFI than in FI conditions. Response rates, temporal discrimination ratios and ogive model parameters indicated that temporal discrimination was greater in FI than in RIFI conditions for all pigeons. External stimuli and physical responses may not serve as equally salient time markers for pigeons, in contrast to previous research with rats.

4:08 PM

When Does Integration of Independent Temporal Maps Take Place?

Ralph R. Miller, Gonzalo Miguez, Henry X. Cham, Cara Burney (SUNY-Binghamton), & Mikael Molet (University of Lille, France)

40

Prior research has demonstrated that when two independent temporal relationships with a common element are sequentially encoded (e.g., A-B followed by B-Outcome), subjects behave as if A and the Outcome have a unique temporal relationship despite that they have never been paired. We will describe a series of experiments conducted to determine when this integration of temporal maps occurs: at the time of acquisition of the second temporal map containing the common element, or at the time of testing. This question was assessed by extinguishing the common (i.e., mediating) element (B) between acquisition of the second temporal relationship and testing. If this manipulation failed to disrupt the temporal relationship between A and the Outcome, this would suggest that temporal integration of the two maps occurred at the time of acquisition of the second temporal relationship. However, using both sensory preconditioning and second-order conditioning procedures, we found that the extinction manipulation disrupted the A-Outcome temporal relationship. Thus, temporal integration appears to have occurred at the time of testing.

4:22 PM **Turning Points: Clocks and Samples are linked in MTS reversals**

41 *Carl Erick Hagmann, & Robert G. Cook (Tufts University)*

We examined temporally controlled switching behavior with matching and oddity conditional discriminations. In four pigeons, we tested the hypotheses that the internal clock controlling a behavioral transition was either linked with samples or independent from them. First they were trained to switch conditional behavior (matching-to-oddity or oddity-to-matching) at the midway point of a session with two stimulus sets. We then trained the birds to shift earlier or later in a session with one set of samples and intermittently tested them with the unshifted samples. Results suggest internal clocks and sample sets are linked.

4:29 PM **Age-related changes in speed and accuracy of rats on a temporal task**

Russell Church, & David Freestone (Brown University)

42 The purpose of this experiment was to identify fundamental age-related behavior in the rat that could be used to investigate the relationship between cognitive and brain aging. Thirty-six male Fischer 344/Brown-Norway rats at ages of 3, 12, 20, and 30 months were trained in standard lever boxes on a 64-s fixed interval of reinforcement schedule in which food was delivered following the first response after 64 s had elapsed. The primary data were the times of lever responses and food delivery; the summary measures of performance reflected the speed of responding and the relative precision of the times of responding. The results showed that there was a decrease in the speed of responding, but an increase in accuracy as a function of age. The response speed was relatively fast and constant between 3 and 12 months, and relatively slow and constant between 20 and 30 months, with a large decrease in speed between 12 and 20 months. There was a similar (but slightly earlier) abrupt change in the age trajectory of the accumulation of amyloid in the brain. The conclusion was that there is a close relationship between some measures of brain aging and some measures of cognitive aging.

4:43 PM Break

4:48 PM Perception & Song (Chair: Anna Wilkinson)

4:48 PM **Underwater hearing in spotted seals**

Jillian M. Vitacco, Colleen Reichmuth, Asila Ghoul (University of California - Santa Cruz), & Brandon L. Southall (SEA Inc. and University of California - Santa Cruz)

43 The characterization of species-typical hearing in arctic seals is important in terms of understanding both their perception of the acoustic environment and their susceptibility to anthropogenic noise. In this study, two 1-year-old male spotted seals (Phoca largha) were tested in a go/no-go procedure using the method of constants to measure their underwater hearing sensitivity. Detection thresholds, defined as the stimulus levels resulting in 50% detection probability, were measured for 10% bandwidth linear frequency-modulated sweeps at frequencies between 0.1 – 72.4 kHz. The resulting audiograms exhibited the typical mammalian U-shape, with a wide range of best sensitivity between 3.2 – 25.6 kHz. Moreover, these audiograms were similar to those previously described for related species, strengthening the notion that functional hearing groups may exist among the true seals. The study of acoustic ecology—including measurements of basic hearing capabilities—is relevant to the protection of vulnerable species, especially animals such as arctic seals that often utilize auditory cues to orient and communicate in relative darkness. This work represents the first reported data concerning hearing in spotted seals and provides the foundation for future studies examining noise-induced temporary threshold shifts and masking effects.

4:55 PM **Effect of lesion of nucleus subpretectalis on visual discrimination in pigeons**

Martin Acerbo (University of Iowa), & Olga Lazareva (Drake University)

44 Our earlier research has shown that nucleus rotundus, a thalamic nucleus processing visual information in pigeons, together with its inhibitory complex, is differentially activated in birds performing figure-ground discrimination, color discrimination, and shape discrimination (Acerbo, McInnerney, et al., in preparation). In this study, we conducted bilateral chemical lesions of nucleus subpretectalis, a major inhibitory nucleus that regulates activity of nucleus rotundus. We trained pigeons to simultaneously perform three visual discriminations (figure-ground, color, and shape) using the same displays. When birds learned to perform all three tasks at high levels of accuracy, we conducted bilateral lesions of n. subpretectalis using ibotenic acid. After a period of recovery, the birds were retrained on the same tasks to evaluate the effect of lesion on maintenance of discriminations. Preliminary results indicate that lesion of nucleus subpretectalis has no effect on color discrimination, and impairs both shape and figure-ground discrimination. These results suggest that figure-ground segregation in avian brain may occur at the level of thalamus, rather than at the cortical level as it does in primates.

5:09 PM **Perception of emergent configurations in capuchin monkeys and pigeons**

Kazuhiro Goto (Kyoto University), Shigeru Watanabe (Keio University), & Kazuo Fujita (Kyoto University)

45 We examined the perceptions of emergent configurations in capuchin monkeys and pigeons using a matching-to-sample task. A target and distractors were presented either solely, within congruent contexts which salient configurations emerge, or within incongruent contexts in which salient configurations do not emerge. We found that congruent contexts facilitated the discrimination for capuchins, whereas it disrupted the discrimination for pigeons. The incongruent contexts disrupted the discrimination for both species. These results suggest that capuchin monkeys perceive emergent configurations when targets and distractors are presented within certain congruent contexts but pigeons do not perceive such emergent configurations.

5:23 PM

Phylogenetic relatedness and immediate early gene expression in black-capped chickadees

Christopher B. Sturdy, Marc T. Avey (University of Alberta), Laurie L. Bloomfield (Algoma University), Julie E. Elie (University of California Berkeley), Todd M. Freeberg, Lauren M. Guillette, Marisa Hoeschele, Homan Lee, Michele Moscicki, (University of Alberta), & Jessica L. Owens (University of Tennessee Knoxville)

46

We assessed immediate early gene (IEG) expression in secondary auditory areas of black-capped chickadees to understand their involvement in vocal recognition of conspecific and heterospecific vocalizations. In Experiment 1, playback stimuli were whole "chick-a-dee" calls produced by black-capped and mountain chickadees (sister species), along with "chick-a-dee" calls produced by closely-related boreal chickadees and calls produced by the more distantly-related gray-crowned rosy-finch. We found no significant differences in the amount of IEG expression in response to the three chickadee calls, but IEG expression was significantly greater to all chickadee species compared to gray-crowned rosy-finch calls and silence controls. In Experiment 2, we tested if acoustic structure was driving the IEG response, regardless of phylogenetic relatedness. We compared the IEG response to D notes from the "chick-a-dee" call to the IEG response elicited by acoustically-similar stimuli from species of varying phylogenetic relatedness to black-capped chickadees. All vocalizations, independent of phylogenetic relatedness, led to significant IEG expression, with the exception of reversed black-capped chickadee D notes. These results, along with previous studies from our lab, suggest that IEG expression in the chickadee brain is not a simple conspecific/heterospecific dichotomy, but rather, is best described as a complex interplay between representation/function and perception/acoustics.

5:37 PM

In the eye of the beholder: visual mate choice lateralization in a songbird

Jennifer Templeton, D. James Mountjoy (Knox College), Simon Griffith, & Sarah Pryke (Macquarie University)

47

Birds choose mates on the basis of color, song, and body size, but little is known about the cognitive mechanisms underlying these mating decisions. Recent reports that immediate early gene expression associated with courtship behavior is lateralized in the left optic tectum of Zebra Finches suggest that visual mate choice itself may be lateralized. To evaluate this hypothesis, we used Gouldian Finches, which exhibit strong, adaptive preferences for mates of their own head-color (red or black). We tested finches in a mate-choice apparatus under each of three eye conditions: left, right, and binocular. We discovered that preference for females of the same head color is so strongly lateralized that if the right eye is unavailable, males are unable to discriminate not only between males and females of the same head color, but between the strikingly different female morphs. Song was consistent with these lateralized mate preferences; black-headed males sang significantly more to black-headed females when using their right eye than when using their left. Thus, beauty is in the right eye of the beholder for these colorful songbirds. This is the first clear demonstration of visual mate choice lateralization in any animal.

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

See Poster Abstracts Starting on Page 23

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

12:00 PM Canine Cognition (Chair: Stephen Lea)

12:00 PM

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Discrete-trials Training Procedure for an Odor Discrimination in Domestic Dogs (Canis lupus familiaris)

Nathaniel J. Hall, & Clive D.L. Wynne (University of Florida)

A dog's nose remains one of the most reliable and accurate tools for detecting odors (Furton and Myers, 2001). The intensive procedure required to train these dogs, however, limits their availability and the ability of scientists to study factors that influence performance. In Experiment 1 we trained a group of 20 naïve dogs on an odor detection task with 24 scheduled trials. In Experiment 2, we assessed if dogs learned an odor cue more rapidly than a visual (black vs. white) cue. Exp 2 also assessed if placing accessible food directly in the target bin and inaccessible food in the non-target bin enhanced discrimination training, compared to a procedure in which the experimenter delivered the food shortly after a correct response. Dogs learned faster on the odor task when food was delivered after a response. When the experimenter delivered food, dogs performed better on the odor task than the visual task. Across dogs, important individual differences were noted. A select group of dogs consistently performed with a high level of accuracy while other dogs performed with greater variability. This procedure may be useful to select dogs that will perform well as odor detectors.

12:07 PM

49

Social play as an attention-seeking behavior in captive canid populations.

Lindsay R. Mehrkam, & Clive D.L. Wynne (University of Florida)

The benefits of environmental enrichment for captive animals are widely documented in the scientific literature. However, few studies have examined the relationship between enrichment and social interactions among conspecifics housed together. We provide empirical support for human interaction as enrichment across several canid species, including wolves, wolfdog hybrids, and coyotes. In addition, we suggest that social play, a behavior observed frequently when human interaction was provided, may partially be an interspecific attention-seeking behavior in socialized canids as a result of extensive experience with human caretakers. As play is considered an indicator of positive welfare, further investigation into the function of play behavior may have applied significance for captive populations of animals.

12:14 PM

50

The effects of social training and other factors on adoption rates of shelter dogs.

Sasha Protopopova, & Clive Wynne (University of Florida)

The aim of the present study was to identify factors that may influence and predict adoption rates. Previous research suggested that friendly and sociable dogs are sought out and are perceived as more adoptable. Therefore, we hypothesized that dogs trained to gaze into potential adopters' eyes will be more attractive and thus more likely to be adopted. In addition, we investigated which other individual factors predicted adoption rates. One hundred and seventy-six dogs were randomly assigned into one of three conditions: training, feeding, or control. In order to determine which factors predict adoption, we tracked the outcomes for each dog in addition to their scores on a weekly sociability test as well as their morphological traits and their mode of intake. These findings suggest that other factors besides behavior may be more important to adopters when considering a dog.

12:21 PM

51

Gestural Communication from the Canine Perspective

Monique Udell (Flagler College), Nicole Dorey, Nathaniel Hall, & Clive Wynne (University of Florida)

What do domestic dogs really understand about human gestural communication? Research has tackled this question by looking at canine responsiveness to human pointing, gaze, and a myriad of other gestures that vary in degree of stimulus complexity, orientation, and movement. In a series of recent studies we have demonstrated that dogs are proficient at behaving in ways that maximize their chances of reinforcement in the presence of human social stimuli, choosing to preferentially beg for food from those looking at them and following a point to a target location. However there is increasing evidence that sensitivity to these stimuli varies based on the environment, population and experience level of canine subjects. The results of several studies will be discussed that shed light on this debate, demonstrating the context specific nature of canine responsiveness to human stimuli.

12:35 PM Tool Use & Problem Solving (Chair: Sara Shettleworth)

12:35 PM

52

Insightful Problem Solving in an Asian Elephant

Preston Foerder (Biopsychology and Behavioral Neuroscience Subprogram in Psychology of the Graduate Center of The City University of New York), Marie Galloway, Tony Barthel, Donald E. Moore III (Smithsonian National Zoological Park Washington D.C.), & Diana Reiss (Department of Psychology of Hunter College of The City University of New York and Biopsychology and Behavioral Neuroscience Subprogram in Psychology of The Graduate Center of The City University of New York)

Spontaneous problem solving without evident trial and error behavior in humans and other animals has been referred to as insight. Surprisingly, elephants, thought to be highly intelligent, have failed to exhibit insightful problem solving in previous cognitive studies. We tested whether three Asian elephants (Elephas maximus) would use sticks or other objects to obtain food placed out-of-reach, overhead. Without prior trial and error behavior, a 7-year-old male Asian elephant showed spontaneous problem solving by moving a large plastic cube and standing on it to acquire the food. In further testing he showed behavioral flexibility, using this technique to reach other items and retrieving the cube from various locations to use as a tool to acquire food. In the cube's absence, he generalized this tool utilization technique to other objects and, when given smaller objects, stacked them in an attempt to reach food. The elephant's overall behavior was consistent with the definition of insightful problem solving. Previous failures to demonstrate this ability in elephants may have resulted not from a lack of cognitive ability but from the presentation of tasks requiring trunk-held sticks as potential tools, thereby interfering with the trunk's use as a sensory organ to locate the targeted food.

12:42 PM **String-pulling performance in two Australian parrot species: do ecological factors matter?**

Anastasia Krasheninnikova, & Ralf Wanker (University of Hamburg Germany)

53

Problem-solving tasks such as string-pulling tasks are often used to analyse the advanced cognitive abilities in animals, as it requires a large number of different motions in a precise order to solve a problem never previously encountered. In birds only corvids and parrots understand the logical structure in the task. However, inconsistent performances across parrot species suggest different socioecological factors driving success in such tests. We presented two closely related Australian parrot species, the Galah (Eolophus roseicapillus), and the cockatiel (Nymphicus hollandicus), with a set of string-pulling and string-choice tasks. While both species forage on the ground, only the Galah uses its feet while foraging which was suggested a requirement for the string pulling problem. The performance of the cockatiels demonstrated that for the fine coordinating motor skills it is not necessary to use the feet during foraging. However, galahs outperformed the cockatiels in 4 out of 5 choice tasks. Performance at the individual level suggests that some birds of both species were able to grasp the logical structure of the tasks, but only Galahs were able to inhibit their preference for a shorter string when it was not connected with the reward. Considerable individual and inter-specific differences are discussed.

12:49 PM Break

12:54 PM Concept Learning (Chair: Christopher Sturdy)

12:54 PM **Effects of spatial configuration in a same/different task with pigeons**

Adam Goodman, Jeff Katz (Auburn University), & Anthony Wright (University of Texas Medical School at Houston)

54

Four pigeons were trained in an abstract-concept same/different (S/D) reversal task in which the sample and test stimuli were aligned vertically (sample item located directly above the test item with a white rectangle to the right) and then subsequently trained with sample aligned midway between choice stimuli (test item and white rectangle). When trained in the S/D task with contingency reversals using a vertically aligned configuration, pigeons display response-location preferences that spike and then diminish for each reversal. These patterns of responding may influence relational learning. We hypothesized that increasing the distance between response locations in our S/D task would reduce these preferences. Performance was assessed for the effects of the two different spatial configurations on spatial preferences during reversal learning. Our findings indicated that although pigeons responded based on relational rules in both conditions, location-preferences subsequent to a reversal diminished more rapidly with the sample midway-aligned configuration than with the vertically aligned configuration. Research in human category learning has shown that increased choice-item spacing decreases choice response times, suggesting that forming distinct categorical representations is easier when responses are correspondingly distinct in physical space. The current findings suggest that the choice-item facilitation extends to non-human abstract-concept learning.

1:01 PM **Is your subject ready? Exploring the correlation between training criteria and cognitive task success using inferential and Bayesian statistics**

Marie Trone, Tammy Greer & Stan Kuczaj (Valencia College University of Southern Mississippi)

55

Many cognitive studies involve subjects becoming proficient at a specific conceptual task through training. These conceptual tasks are designed to provide information about a species' mental capacities in areas such as perceptual discrimination, memory, numerosity, communication, etc. This analysis investigates the correlation between task proficiency during training (i.e. training criteria) and subsequent success during testing under novel conditions, using both inferential and Bayesian statistics. Inferential statistics have been traditionally employed in comparative psychology, although statistical assumptions are often violated given the small sample sizes in such studies. Advances in computing technology facilitate the use of Bayesian statistics, consequently avoiding such violations. Results from this study demonstrate that more stringent training criteria are correlated with greater testing success. Implications from this analysis suggest that some species may have tested negatively for specific cognitive tasks due to insufficient preparation. A true comparison of the mental abilities among various species should take into consideration the training criteria employed in the respective studies.

1:08 PM **Same/Different Discrimination in Bumblebee Colonies**

Michael F. Brown, & Justin M. Sayde (Villanova University)

56

Four colonies of bumblebees (Bombus impatiens) were trained to respond differentially to visual displays consisting of either two identical stimuli or two different stimuli. The stimuli were either two colors (two colonies) or two line orientations (two colonies). Discriminative responses were defined by flying to an area on either the left vs. right side of the stimulus display, with one side being correct during a "same" display and the other correct during a "different" display. A correct choice resulted in access to sucrose solution. Following training, the colonies were tested with the alternative (novel) stimulus set, under conditions of non-differential reinforcement. All four colonies showed transfer of the discrimination in a manner consistent with use of a same/different concept.

1:22 PM **Sequence learning in pigeons: Behavior can reflect an abstract rule**

Dennis Garlick (UCLA), Stephen B. Fountain (Kent State University), & Aaron P. Blaisdell (UCLA)

57

At the 2011 CO3 conference, we reported how, in contrast to rats, pigeons perform better on a violation element than a run element on a sequence learning task. Pigeons were presented with 8 disks arranged in a circular array on a touchscreen. On each trial, two of the disks were illuminated. Correct responding consisted of serial patterns involving run chunks (e.g., 123 234, etc.) Each chunk was also signified by a different color, which served as a phrasing cue. For the Run group, the final chunk of 812 also conformed to the pattern. For the Violation group, the final chunk of 818 violated the pattern. It was found that, unlike rats, pigeons made fewer errors on the final trial in the Violation than the Run condition. This was attributed to pigeons learning a configuration of color and positional cues independent to the sequence. To reconcile this inconsistency, we used a different procedure where, rather than being rewarded after each correct response, the pigeons were only rewarded after each complete chunk. With this new procedure, pigeon results corresponded closely with those found with rats and suggest that pigeons can also be influenced by an underlying abstract structure.

1:29 PM

Discrimination Learning & Numerosity (Chair: Roger Thompson)

1:29 PM

58

Motion Matters: Discrimination of Complex Action Categories by Pigeons

Justin M. Sayde, Muhammad A. Qadri, & Robert G. Cook (Tufts University)

Pigeons are skilled at discriminating noun-based categories, but few studies have examined their ability to distinguish stimuli on the basis of action categories. Previous work in our lab has shown that pigeons can discriminate computer-generated models of animals based on gait (i.e., walking vs. running), but given the cyclic nature of these stimuli, it is possible that they accomplished the task by tending to low-level features inherent in these repetitive movements. The current study employed more intricate motion sequences (i.e., a computer-generated human figure engaging in dance or martial arts) to examine how pigeons process and conceptualize action categories. Using a go/no-go procedure tied to each type of action, pigeons were presented with either a 20-second video of each action or randomly-selected frames. The pigeons reliably discriminated the behaviors within ten sessions, and learning was more pronounced for the dynamic condition compared to the static condition. A different group of pigeons trained in just the static condition failed to learn the discrimination over the same period. These results suggest that the dynamic stimuli contain valuable information that can be used to facilitate the perception of action and contribute to the discrimination of static poses.

1:36 PM

59

Can pigeons and humans transfer information between the local and global level in exemplar- and rule-based discrimination tasks?

Ulrike Aust, & Elisabeth Braunöder (University of Vienna)

Pigeons and humans were presented with an exemplar-based discrimination task (category membership of each picture had to be learned individually) and with a rule-based task (category membership was defined by a perceptual rule). Each subject was trained in one of three presentation modes, namely, with intact pictures (providing both local and global information), with scrambled pictures (impairing global information), or with blurred pictures (impairing local information). While humans readily learned both tasks irrespective of presentation mode, pigeons took much longer to learn blurred than intact or scrambled stimuli, and this was particularly evident in the exemplar-based task. When subsequently presented with the two stimulus versions not shown during training, pigeons showed good transfer only between intact and scrambled pictures, while transfer from and to blurred stimuli was poor in both tasks. Humans readily transferred between any two presentation modes in both tasks. The results confirm the notion of a local preference in pigeons and reveal some limitations in their ability to directly generalize from one processing level to the other. Humans did not show a preference for either level, and transfer between levels was excellent in both tasks.

1:50 PM

60

Quantity estimation in animal collective movement

Eran Shifferman (Konrad Lorenz Institute for Evolution and Cognition Research)

Collective movement (CM) is an instance of collective decision making, in which a group of individuals begins to move for purposes such as foraging or migration. There are many different manifestations of CM across various taxa, and these offer a glimpse at the mechanisms allowing for the coordination and trade-off between knowledge and motivation from both the individual and the group levels. Initiation of CM can be centralized (by a leader) or distributed (any individual can lead) and recruitment can rely on thresholds or it could be more precise and require a certain number of specific followers. In this talk I argue that we can find evidence for an increase in the complexity of the employment of quantity estimation (QE) in the various fashions different species behave in the context of CM. I review field data documenting the contextual use of various QE aptitudes, beginning with the rudimentary utilization of thresholds and culminating in counting. This test case provides yet another example for the socioecological impetus for the evolution of the cognitive attribute of QE.

2:04 PM

61

Evolutionary foundations of numerical abilities: Evidence for similar numerical systems in humans and fish

Christian Agrillo, Maria Elena Miletto Petrazzini, Laura Piffer, & Angelo Bisazza (University of Padova, Italy)

Humans and non-human animals share an approximate system for representing numerosities that has no upper limit and for which accuracy is ratio-dependent. Current evidence indicates that humans possess also a numerical system for small numbers (up to 3-4 items) called 'subitizing', insensitive to numerical ratio. There is, however, growing controversy as to whether two separate number systems are present in other species. We directly compared numerical abilities of fish and humans. Two different methods were adopted with fish: in the former the natural tendency to join the larger shoal was used to investigate their limits of quantity discrimination; in the latter fish were trained to discriminate between sets of dots differing in numerosity. Humans were required to discriminate sets of dots differing in numerosity. The same numerical ratios, both within and beyond the subitizing range, were presented to both species. Interestingly, in both students and fish the performance was ratio-independent for numbers 1–4, while it steadily increased with numerical distance when larger numbers were presented. Our results suggest that two systems underlie quantity discrimination in both humans and fish, implying that the building blocks of uniquely human mathematical abilities may be more ancient than we have previously thought.

2:18 PM Break

2:23 PM Cognitive Processes II & Development (Chair: Angie Koban)

Self-Directed Behavior at a Mirror by a 14-month-old Bottlenose Dolphin

2:23 PM

Diana Reiss (Department of Psychology Hunter College CUNY Biopsychology Behavioral Neuroscience Sub-program in Psychology at The Graduate Center CUNY), & Rachel Morrison (Biopsychology Behavioral Neuroscience Sub-program in Psychology at The Graduate Center)

62

Dolphins, like humans, apes, elephants, and magpies demonstrate mirror self-recognition (MSR). MSR emerges in children between 18-24 months and in chimpanzees between 2.5-4.5 years. We conducted a study with a social group of nine bottlenose dolphins (Tursiops truncatus) at the National Aquarium to determine the age of onset of self-directed behaviors and MSR. A 14-month-old male dolphin was exposed to a two-way mirror within a social context and his responses were videotaped and analyzed. The young dolphin demonstrated a high level of interest in the mirror, measured by his total time spent at the mirror (35.6 min). Throughout the study, little social behavior was observed (f=20, 3%) and the majority of the dolphin's behavior was categorized as self-directed (f=501, 62%) followed by contingency-testing (f=115, 14%), ambiguous (f=98, 12%), and stationing (f=77, 10%). A significant number of behavioral events were exhibited when he was alone at the mirror (f=646, 79%). Dolphins are precocious at birth and exceed human and non-human primates in motor skills and coordination. Our findings suggest, that young dolphins may show advanced cognition at an earlier age with respect to mirror self-directed behavior as compared to humans and chimpanzees.

Testing the limits of optimality: The effect of base rates on pigeons' performance in the Monty Hall dilemma

2:37 PM

Walter Herbranson (Whitman College)

63

Pigeons have previously been shown to respond optimally in a task analogous to the "Monty Hall dilemma" (Herbranson & Schroeder, 2010). On each trial, reinforcement was available for pecking a randomly determined response key from among three options. After an initial choice from among all three keys, birds made a second choice from among two keys, always including the key that had just been pecked and the key that could produce reinforcement. Birds performed optimally by switching keys on virtually all trials. While a bird's initial choice had no influence on the probability of gaining reinforcement, most birds nevertheless adopted a preferred key for their initial choice. Two experiments replicated this procedure, but with the availability of reinforcement unequally distributed across keys. With this asymmetry, the initial choice is no longer irrelevant. The best possible rate of reinforcement is attained by choosing the key with the lowest likelihood of reinforcement and then switching. Pigeons approximated this optimal strategy in both respects. By doing so, they earned close to the maximum possible payoff, despite the fact that the initial choices were necessarily on the key that produced the fewest reinforcers.

The role of attentional control in analogical reasoning for baboons

2:51 PM

Timothy M. Flemming (Georgia Gwinnett College), & Joel Fagot (CNRS)

64

The judgment of relational information and ability to reason analogically has proven difficult for several nonhuman animal species. In recent years, the role of diminished executive control and attention, specifically sustained attention, has been implicated as a contributing factor to these difficulties in maintenance of abstract concepts. The relational matching-to-sample (RMTS) task used commonly to assess ability to reason analogically requires not only the maintenance of abstract relations but also is very highly demanding of attention for monkeys. It may be the case that demonstrations of failure of this task are due to attentional deficits rather than a lack of ability to reason by analogy per se. In the present study, we examined the supposed link between observed behaviors demonstrative of attentional control in individuals from a large social group of baboons and their ability to complete a computerized RMTS task. Those individuals sustaining behavioral activity in one concentrated bout for longer periods of time tended to outperform individuals on an RMTS task which engaged in shorter bouts of focused behavioral activity. These results have implications for attentional control and perhaps even model of ADHD as they affect one's ability to reason analogically.

Joint Attention and Cooperation Develop in Chimpanzee and Human Infants

2:58 PM

K.A. Bard (University of Portsmouth), R. Bakeman (Georgia State University), S.T. Boysen (The Ohio State University), & D.A. Leavens (University of Sussex)

65

Joint attention, triadic engagement with social partners and objects, marks the onset of shared intentionality, and may be a precursor to 'theory of mind'. Tomasello's Shared Intentionality hypothesis proposed an inextricable link between Joint Attention and Cooperation, demarcating a human-unique evolutionary pathway. Here we compare the social cognition of human infants with chimpanzee infants assessed during a standardized test. We found that laboratory-reared, 5- to 12-month-old chimpanzees develop joint attention and exhibit cooperation similar to typically-developing, 5- to 12-month humans. Enriched experiences increased joint attention, cooperation, and cognition in chimpanzee infants. Notably, once emotional engagement was statistically controlled, the spurious correlation between Cooperation and Joint Attention disappeared. Social cognition outcomes, at least in chimpanzees, change as a function of emotionally meaningful social interactions. These data support an alternative Lived Experiences hypothesis, highlighting evolutionary continuity in those developmental processes that underpin the emergence of social cognition.

What's in a Face? Orangutans' and Human Children's Recall of Lists Comprised of Conspecifics and Arbitrary Images

3:12 PM

Francys Subiaul, Elizabeth Renner (The George Washington University), & Elizabeth Price (Smithsonian National Zoological Park)

66

Are images of conspecifics recalled more accurately than arbitrary images in a serial task? Here, we explored that question using the simultaneous chaining paradigm (SCP). In the SCP, pictures appear on a touch-sensitive screen and must be touched in a specific serial order. From trial to trial, pictures randomly change spatial position. In Experiment 1, children and orangutans were presented with pictures of three humans or orangutans, respectively. Neither apes nor children learned lists of conspecifics significantly better than lists of arbitrary pictures. In Experiment 2, orangutans were presented with 2 types of lists. One list comprised arbitrary images that had to be touched in a specific order (as in Experiment 1), the other comprised different photographic representations of the same familiar individual (zookeeper). The goal was to respond to the individuals in the same order while ignoring differences in the photographic representation. There was no evidence of learning from List 1 to 30 for either list type. Results suggest that while certain attention biases improve the recognition of individual faces relative to arbitrary images, these biases may not extend to serial recall.

3:26 PM

Development and application of a new method to investigate cognition in newborn guppies

Maria Elena Miletto Petrazzini, Christian Agrillo, Laura Piffer, Marco Dadda, & Angelo Bisazza (University of Padova, Italy)

67

Assessment of cognitive abilities often involves individual training requiring that subjects are maintained in social isolation for prolonged periods. This raises ethical problems, especially when newborns and young individuals are the target of research. The aim of the current study was designing a procedure to investigate cognition in newborn guppies. To achieve our goal we initially observed the development of social behavior in newborn guppies. Spontaneous shoal choices were observed in two different experiments: newborn guppies spent more time near social companions than near an empty compartment (exp. 1), showing an increasing gregarious tendency from birth for two weeks. However they did not exhibit any preference between social companions and their own mirror image (exp. 2), suggesting the possibility of using mirrors as a substitute of social companions to reduce social isolation of single individuals. We accordingly set up a novel training procedure which included the presence of mirrors in the experimental tank. Newborn guppies were required to discriminate between two geometrical figures (circle vs. triangle) to get a food reward (exp. 3): 9 day–old fish successfully discriminated the two stimuli after 20 trials, thus providing the first evidence of operant conditioning in newborn guppies.

3:33 PM Snack Break

4:33 PM In Honor of Tony Wright (Chair: Jeff Katz)

4:33 PM

Source memory in the rat

Jonathon D. Crystal, & Wesley T. Alford (Indiana University)

68

Source memory includes a representation of the origin–-source-–of information and is related to episodic memory. We developed an animal model of external source monitoring by asking if rats can discriminate self-generated (walking along a runway, encountering food) and experimenter-generated (placement at a food site without walking) events. Placement feeding of chocolate- or chow-flavored food occurred at a randomly selected location on an eight-arm radial maze; chow was encountered at other locations. Chocolate replenished at its study location in a subsequent test if the chocolate event was self-generated but did not replenish if the event was experimenter generated. Rats revisited the chocolate location at a higher rate in replenishment than non-replenishment conditions. A transfer test to a novel room suggests that the rats had not memorized a series of spatial contingencies. Manipulation of the retention interval suggests that memory for source information decays with intact flavor-location information, thereby providing a dissociation between source and other memories. These experiments add to recent evidence that rats have a detailed representation of earlier episodes including the external source, what-where-and-when it occurred, and the ability to answer an unexpected question after incidental encoding.

4:48 PM

Role of the dentate gyrus in mediating interference as measured by a pattern separation process

Raymond Kesner (University of Utah)

69

In order to understand the neural mechanism associated with specific forms of interference, this presentation will concentrate on the role of the dorsal and ventral dentate gyrus subregions of the hippocampus in rats. The computational modelers have suggested that the dentate gyrus can provide a neural mechanism that can operate to reduce interference between highly processed similar spatial, contextual or odor inputs to generate pattern separation functions. This is based on the large number of inputs into granule cells of the dentate gyrus and sparse output to the next subregion the CA3 in combination with a competitive inhibition network associated with the granule cells of the dentate gyrus. Based on episodic memory paradigms, such as matching to sample and recognition memory using novelty detection, it can be shown that the dorsal dentate gyrus plays an important role in mediating spatial and context pattern separation and the ventral dentate gyrus plays an important role in mediating odor pattern separation.

5:03 PM

Perceptual Load in Pigeons and Humans

Jeffrey Katz, John Magnotti, Adam Goodman, Thomas A. Daniel (Auburn University), & Anthony Wright (University of Texas Medical School at Houston)

70

Perceptual load can influence estimates of visual working memory (VWM) capacity as assessed via change detection. Using the same stimuli in a visual search task, as in change detection, one can estimate perceptual load by varying the display size and determining search slopes. For the stimulus types tested (colored circles and white shapes), our results indicate flat search slopes for colors, but increasing search slopes for shapes for pigeons and humans. These results suggest that perceptual load is constant across display size for colors, but increases linearly when shape stimuli are used. Our findings are consistent with increased perceptual load leading to decreased VWM capacity estimates and strengthen previous demonstrations of the similarity of VWM across species.

5:18 PM

When Pigs Fly

Robert Cook (Tufts University)

71

What kinds of information animals process from complex visual stimuli remains a challenging issue in the study of animal cognition. New data on this problem using various timeworn procedures will be presented. Within this context, Tony Wright's contributions to this topic will be highlighted.

5:33 PM **Animal Models of Temporal Lobe Amnesia**

Jocelyne Bachevalier (Emory University)

Our understanding of the nature of the human amnesic syndrome has expanded enormously in the last 60 years. This increased knowledge stems not only from the detailed description of memory disorders in patients with brain lesions and from recent neuroimaging studies in both patients with memory disorders and normal subjects, but also from a growing number of animal models of different species. These animal models have been used to refine our understanding of the specific brain regions involved in human amnesic syndromes and the critical memory processes mediated by each region. Although animals and humans differ greatly in many ways, the basic principles of brain organization and function are homologous. The use of selective methods of lesion production as well as the design of new memory paradigms have enabled neuroscientists to examine in rats and monkeys the contribution of specific structures implicated in human memory in a way that is rarely possible in human studies. This presentation will describe several categories of animal model that have advanced our understanding of the processes underlying normal human memory and in particular, the deficits observed in human amnesia.

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5:48 PM Break

5:55 PM Introduction – Jeff Katz

6:00 PM Master Lecture
Functional Relationships for Investigating Cognitive Processes
Tony Wright (University of Texas Medical School at Houston)

7:30 PM Banquet

Behavioural Processes is pleased to present the Best Graduate Student Talk at the International Conference on Comparative Cognition 2012 and the Best Graduate Student Poster at the International Conference on Comparative Cognition 2012

12:00 PM Business Meeting

1:10 PM Group Photo – Smile ☺

1:30 PM Timing Symposium: Valter Tucci (Chair: Valter Tucci)

1:30 PM **Timing by coincidence detection: What's all the noise about?**
Catalin V. Buhusi (Medical University of South Carolina), & Sorinel Oprisan (College of Charleston)
Interval timing is crucial for fundamental cognitive processes like decision making, rate calculation, and action planning. In the vast majority of species and behavioral and neurophysiological manipulations, interval timing is scale invariant: time-estimation errors are proportional to the estimated duration. Time-scale invariance is considered the fundamental property of interval timing, yet it's origin and mechanisms are unknown, despite its ubiquity. How does such a specific property of supra-second timing emerge from neurons firing in the milliseconds range? Current behavioral models posit that time-scale invariance derives from convenient computations, rules, or coding schemes. In contrast, neurobiological models attempt to explain timing as a property of neurons and circuits. We discuss computational properties of a simple neurobiological building block in which time is coded by the pattern of coincidental activation of its inputs. Results suggest that scalar timing may not be a property of higher-order cognitive processes or computations such as timing or counting, but rather a general property naturally emerging in a massively-connected brain from the intrinsic noise of neurons and circuits. These findings provide the simplest, most general explanation for the ubiquity of time-scale invariance over virtually every species, behavioral, and neurophysiological investigation to date.

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1:45 PM **Circadian Timing and Interval Timing by Mice in a Fully-Automated System**
C.R. Gallistel, Joseph Negron, & Aaron Kheifets (Rutgers University)
Animals locate themselves in space and time. They know where they are, the direction and distance of interesting locations from their location, and the direction and distances between remote locations. They know the time of day, the times of day at which interesting events happen, e.g., meals, and the temporal distances between events, that is, durations. The neurobiological mechanisms by which they locate themselves in space and time may be amenable to investigation by means of forward genetics. The first step in such an investigation is behavioral screening for heritable malfunctions in these mechanisms. For that to be practical, we need highly automated behavioral testing systems that measure the performance of these mechanisms quantitatively. We present results from a fully-automate 24/7, live-in test environment in which we screen simultaneously for the ability to anticipate meal onsets and the ability to time elapsing intervals.

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2:00 PM **Sleep, circadian rhythms and interval timing: a genetic and epigenetic approach**
Valter Tucci, & Glenda Lassi (Department of Neuroscience and Brain Technologies - Istituto Italiano di Tecnologia – Italy)
Molecular genetics and epigenetics play an important role in sleep, circadian rhythms and interval timing. Thus, timing is a functional phenotype that is coded at a behavioral, physiological, genetic and epigenetic level. An integrated investigation of these mechanisms represents a powerful instrument to understand strategies that evolution has developed to timestamp information in daily life. Here we will present evidence that support the use of the mouse in understanding the biology of timing. In particular, by manipulating genetic and epigenetic variables, we were able to alter the ability to process time in mice. In one case we have evidence that circadian and interval timing share some common mechanism. In the second case we present sound evidence that loss of genomic imprinting affects timing and sleep homeostasis. Our results suggest that biallelic genetic expression is beneficial to high-level brain processes, even when evolution has maintained a specific monoallelic expression profile.

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2:15 PM **Unwinding the Molecular Basis of Interval and Circadian Timing**
Warren H. Meck (Duke University)
Studies investigating the interaction between interval and circadian timing implicate common dopaminergic and glutamatergic systems in the modulation of temporal processing. The impact of these systems will be discussed at the behavioral and molecular levels as a function of the obligatory entrainment of rhythmic neuronal ensembles functioning at different time scales – thus providing a potential bridge between interval and circadian timing.

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2:30 PM Break

2:35 PM Memory, Choice & Attention (Chair: Catalin Buhusi)

2:35 PM **Visual Short-Term Memory Compared in Pigeons, Rhesus Monkeys, & Humans**
Caitlin Elmore (The University of Texas Health Science Center at Houston), Wei Ji Ma (Baylor College of Medicine), John Magnotti (Auburn University), Kenneth Leising (Texas Christian University), Antony Passaro (The University of Texas Health Science Center at Houston), Jeffrey Katz (Auburn University), & Anthony A. Wright (The University of Texas Health Science Center at Houston)
The change detection task has been used extensively to study visual short-term memory (VSTM) in human subjects. In this study, we conducted the first comparison of change detection memory between humans, rhesus monkeys, and pigeons. All three species were tested with the same stimuli and nearly identical procedures. Results indicate that VSTM is qualitatively similar between all three species, but quantitatively different. In addition, two popular models of VSTM, the fixed-capacity model and the continuous-resource model, were evaluated using the results obtained from all three species. Converging evidence from all three species indicates that the continuous-resource model provides a more parsimonious account of VSTM.

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2:49 PM **The single-mindedness of the pigeon: Attention to single dimensions in multidimensional stimuli**

Stephen Lea, & Ruth Huckstep (University of Exeter)

78 Pigeons were trained in discriminations between black-on-colour grating stimuli that varied in three stimulus dimensions, spatial frequency, orientation, and background hue. During training, one dimension in each stimulus took either a positive or negative value, while the other two took neutral, mid-point values. Multiple positive and negative stimuli were presented simultaneously, and the pigeons were trained to select the positive stimuli. The positive and negative values were adjusted until the three dimensions were equally salient, i.e. until the pigeons did not systematically respond to the stimuli that were positive on any one dimension before the others. In test sessions, stimuli in which all three stimuli took positive values were mixed with "one-away" stimuli in which two dimensions took their positive values and the other took its negative value. The pigeons tended to respond to such stimuli on the basis of only one of the dimensions. We conclude that although pigeons are capable of attending to many aspects of a stimulus, and of attending selectively to a dimension that gives useful information when others do not, they tend to attend to only a single dimension when many dimensions are giving apparently useful information.

3:03 PM **Attention is neither limited nor evidenced by the absence of stimulus control**

Sheila Chase (Hunter College, City University of New York)

79 Although the "cognitive revolution" has resulted in significant advances in the understanding of animal cognition, underlying mechanisms remain largely obscure. Advances in the neurophysiology of cognition require precise description of the behavior to be accounted for. Treating the pigeon as a psychophysical observer, Chase and Heinemann (1972), have shown that the selective use of information as observed in decreased control by stimuli when part of a compound, overshadowing, reflects optimal use of available information rather than limits in the amount of attention available.

3:17 PM **Object-based Attention in Hill Mynas (Gracula religiosa) and Pigeons (Columba livia)**

Tomokazu Ushitani (Chiba University)

80 Hill mynas and pigeons were compared to determine if task-irrelevant objects controlled attentional processes in these Aves. On each trial, a green circle cue appeared at one end of two rectangles arranged in the horizontal, or vertical parallel. Responding to the cue extinguished it and displayed a yellow circle target that appeared either at the cued location (Valid condition), at the opposite side of the cued rectangle (Within condition), at the near side to the cue on the non-cued rectangle (Between condition), or at the far end of the non-cued rectangle (Far condition). Mynas and pigeons were rewarded for responding to the target, regardless of the arrangement of the rectangles, or the location of the target relative to the cue. Comparing the reaction times of mynas in the Within and Between conditions revealed that mynas responded faster to the target appearing on the cued rectangle than on the non-cued rectangle, suggesting that the attentional process of mynas was object-based. The same comparison with pigeons did not reveal any significant difference between the two conditions. Ecological differences between the two species may have produced divergent characteristics of visual attention within this class Aves.

3:31 PM **Attentive spiders that eat mosquitoes**

Fiona Cross, & Robert Jackson (University of Canterbury)

81 Evarcha culicivora, a jumping spider from East Africa, is an unusual species because it specialises at feeding indirectly on vertebrate blood by choosing blood-carrying mosquitoes as preferred prey. It can identify this prey by vision alone and by odour alone, and it also uses search images (selective attention) for finding this prey. For example, when individuals are primed with the odour of blood-carrying mosquitoes, they find this particular prey by sight significantly more often than when they are primed with a different odour source. This is in spite of the fact that these spiders never encountered a mosquito before the experiment. Our results suggest that E. culicivora's search images are innate rather than acquired by perceptual learning. In our ongoing research on E. culicivora's biology, we are considering the role of selective attention in making complex behaviour possible, even for animals with small nervous systems.

3:45 PM **Contextual Cueing in Visual Search Through Naturalistic Scenes by Primates**

Daniel I. Brooks, Ji Dai, & David L. Sheinberg (Brown University)

82 To investigate the role of attentional guidance during visual search, we trained rhesus monkeys to search through photographic visual scenes and report the identity of a transparent target object by classifying it into one of two arbitrary pseudocategories. In half of the visual scenes (non-predictive condition), targets appeared randomly in one of eight locations. In the other half of the scenes (predictive condition), scene identity cued the location of the target through consistent scene-location pairings. Along with manual reaction time, we also tracked the monkey's eye position in order to examine how the monkey searched through each scene. We also recorded from cells in the posterior parietal cortex that participate in the control of visuospatial attention and eye movements to learn how these areas are involved in visual search through more complex environments. This contextual cueing task allows us to investigate the extent to which these cells reflect the integration of bottom-up information from the presentation of the visual scene with top-down information through the learned association of particular scenes with particular target locations.

3:59 PM Break

4:04 PM Cognitive Processes III (Chair: Jim Reichert)

4:04 PM **Examining evidence for empathic-like abilities in bonobos, Pan paniscus**

Zanna Clay, & Frans de Waal (Emory University)

83

Empathy refers to the capacity to be affected by and share another's emotional state, which may involve perspective taking (de Waal, 2008). Compared to the human literature, comparative studies exploring empathic-like abilities in our closest relatives, non-human primates, have received little attention. Here we explored how bonobos deal with others' distress and the extent to which they show empathic behaviours. We observed semi-free-ranging bonobos in DR Congo, (N = 36; mixed sex/ age). Specifically, we observed consolatory and reconciliatory behaviours occurring during post-conflict interactions using the Post-Conflict/ Matched-Control Method (de Waal & van Roosmalen 1979). Overall, bonobos actively consoled victims, using embracing, touching and sexual contacts. Females consoled more than males, especially towards female victims. The strongest predictor was bystander age, with juveniles more likely to console than adults or adolescents. Consolation became more selective with age, suggesting that empathic-like behaviours are modified by developments in other socio-emotional and cognitive skills, such as distinguishing socially-valuable partners. Reconciliation emerged comparatively later, indicating these two behaviours develop under different trajectories and may involve different underlying mechanisms. Overall, results indicate that bonobos possess empathic-like abilities that, with age, combine with other socio-cognitive skills enabling them to assess relative costs/benefits before providing consolation.

4:18 PM **Transitions in search strategy may be mediated by environmental and task complexity**

Kenneth J. Leising, Chad M. Ruprecht, C. Drew Taylor, & Steven Drawdy (Texas Christian University)

84

Animals make use of many different search strategies to arrive at familiar places and evade predators. Previous research indicates that rats use a place strategy to locate a hidden goal (e.g., a submerged platform) early in training, but shift their strategy with additional trials. The present study aimed to evaluate spatial-search behavior within an apparatus which provides easy access to extramaze cues and many routes to the goal. Rats were trained to approach a fixed goal location (i.e., buried fruit loop) within a 5x5 array. After rats learned to reliably search at the hidden goal, the open field could then be shifted along one axis. Rats employing a place strategy should search more often at a novel location relative to intramaze cues, whereas, rats using a directional strategy should search at the same location. In Experiment 1, probe tests with rats in the shift and control (no shift) conditions revealed a place strategy. In Experiment 2, all subjects were tested in the shift scenario, but one group (Late) was given an additional 18 training sessions. Surprisingly, probe tests from rats in Groups Early and Late again indicate a place strategy.

4:32 PM Social Learning & Metacognition (Chair: Michael Beran)

4:32 PM **Social learning by imitation in bearded dragons (Pogona vitticeps)**

Anna Wilkinson (University of Lincoln), Anna Kis (Eötvös University), & Ludwig Huber (Messerli Research Institute Vienna)

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It is frequently claimed that imitation only occurs in humans and great apes although some argue that other mammals and birds also imitate. In the present study we investigated whether a reptile species, the bearded dragon (Pogona vitticeps), is capable of this type of learning. To this end 12 bearded dragons were tested using a bidirectional control procedure. The experimental group (n=8) observed a video of a demonstrator accessing food by either moving a sliding door leftward or rightward. All of the experimental animals moved the door in the observed direction on their first attempt, all four control animals (who observed the door move but not as the result of the demonstrator's behavior) failed. We therefore show, for the first time, that a reptile species is capable of social learning that cannot be explained by simple mechanisms such as local enhancement or goal emulation. This suggests that learning by imitation is likely to be based on ancient evolutionary mechanisms.

4:46 PM **Unsupervised Learning and Metacognition in Rhesus monkeys using Intuitive Tasks**

Justin J. Couchman (Fredonia State University), Joseph Boomer (University at Buffalo), Michael J. Beran (Georgia State University), & J. David Smith (University at Buffalo)

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Unsupervised learning is learning that does not rely on direct external or objective information about whether specific choices are correct. Humans generally rely on executive processes when there is no one-to-one relationship between specific decisions and outcomes. We asked rhesus monkeys to learn perceptual discrimination tasks without any direct trial-by-trial feedback. Direct feedback was absent even during the initial training phase when they learned the basic objectives of the task. They were presented with a stimulus, two primary responses, and an uncertainty response. They received only summary feedback every six trials (all rewards for correct choices, followed by all penalties). We found that they were able to learn the tasks and escape difficult trials in the face of limited information when the response layout was intuitive (e.g., responding to an icon on the left when the stimulus was on the left). Humans were able to learn comparable intuitive and non-intuitive tasks, though they learned faster in the intuitive task. These results will be discussed in terms of theories about the level of cognitive processing mediating uncertainty responding.

4:53 PM **Executive-Attentional Uncertainty Responses by Rhesus Monkeys (Macaca mulatta)**

Michael Beran (Georgia State University), Mariana Coutinho, Barbara Church, & J. David Smith (University at Buffalo)

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Some animals use an uncertainty response appropriately by declining exactly those trials for which they are most likely to make errors of perception or memory. However, the interpretation of the uncertainty response is still sharply debated. We attempted to clarify this interpretation by imposing cognitive loads upon ongoing discrimination performance. Two monkeys performed a Sparse-Dense discrimination with an uncertainty response available to decline any trials if they chose. Identity or spatial memory tasks were periodically overlain on these ongoing discrimination tasks. Both concurrent tasks disrupted monkeys' uncertainty responses but not their Sparse/Dense discrimination responses. Two other monkeys were given the same Sparse/Dense task but with a Middle response to objectively classify stimuli in the middle region of the continuum. These monkeys showed less or no disruption when faced with concurrent task loads from the memory test, indicating that Middle responses were qualitatively different from uncertainty responses in their susceptibility to disruption. This dissociation suggests that the uncertainty response is a higher-level, decisional response that is particularly dependent on working memory and attentional resources. Therefore, the uncertainty response probably deserves to be interpreted as an elemental behavioral index of metacognition.

5:07 PM Closing Remarks (Jeff Katz)

8:30 PM Poster Session II (8:30 - 11:00)
See Poster Abstracts Starting on Page 31
Poster Presenters: Please set up your posters between 8:00 and 8:30

Posters

Poster Session I - Thursday Evening

Reputation-like Inference in Domestic Dogs (Canis familiaris)

Shannon M.A. Kundey (Hood College), Andres De Los Reyes (University of Maryland at College Park), Justin Delise, Erica Royer, Sabrina Molina, Brittany Monnier, Rebecca German (Hood College), & Patrick Swift (University of Maryland Baltimore County)

P1 Humans frequently interact with strangers without prior direct experience with their behavior. Some think that this may have favored evolution of a cognitive system within the hominoid clade or the primate order to assign reputations based on third-party exchanges. However, nonprimate species' acquisition of skills from experienced individuals, attention to communicative cues, and propensity to infer social rules suggests reputation inference may be more widespread. We utilized dogs' sensitivity to humans' social and communicative cues to explore whether dogs evidenced reputation-like inference for strangers through third-party interactions. Results indicated dogs show reputation-like inference for strangers from indirect exchanges. Further manipulations revealed that dogs continued to evidence this ability despite reduction of specific components of the observed interactions, including reduction of visual social cues (i.e., face-to-face contact between the participants in the interaction) and the nature of the recipient (i.e., living, animate agent versus living, inanimate self-propelled agent). Dogs also continued to demonstrate reputation-like inference when local enhancement was controlled and in a begging paradigm. However, dogs did not evidence reputation-like inference when the observed interaction was inadvertent.

Contributions of associative value and spatial representations to transitive inference performance in rhesus macaques (Macaca mulatta)

Regina Paxton and Robert R. Hampton (Emory University and Yerkes National Primate Research Center)

P2 If Ben is older than Emily and Emily is older than Steve, you can infer that Ben is older than Steve. This prototypically cognitive process of inferring relations between stimuli based on shared relations with other stimuli is called transitive inference. Many species solve laboratory transitive inference tasks in which they are taught pairs of overlapping stimulus discriminations (A+B-, B+C-, etc.) and are then tested on non-adjacent test pairs they have never seen before (e.g. BD). Because stimuli in inference experiments are linearly related, subjects may form a spatial representation of the relationships between the stimuli and use that representation to make choices on test trials. Alternatively, because the relations between stimuli are determined by reinforcement in studies of non-humans (i.e., A is reinforced when paired with B, B is reinforced when paired with C), associative strength may control choice behavior. We experimentally assessed the contributions of spatial representations and associative values to transitive inference performance in monkeys. Our results suggest that choices made by our subjects in transitive inference tests cannot be explained by associative values alone, and may be controlled at least in part by spatial representations of the stimulus order.

Holding familiar information in working memory is cognitively effortful for monkeys

Benjamin M. Basile, & Robert R. Hampton (Emory University)

P3 Imagine a colleague tells you their phone number and then another interrupts to ask you a question. Even this brief interference will likely make you forget the number. This example illustrates the temporary and fragile nature of human working memory, in which information is lost within seconds unless actively maintained. Little is known about the degree to which nonhumans engage in active cognitive control to maintain information in working memory. Here, we present evidence that monkey memory for familiar images, but not unfamiliar images, is impaired by interference presented during the retention interval. Additionally, more cognitively demanding interference produced more impairment. This differential effect of interference on memory for the two types of images was not due to a difference in baseline accuracy, a ceiling effect for the novel set, or the timing of the interference during the retention interval. This suggests that familiar and novel images are remembered differently. Familiar images may be actively retained in memory by a cognitively demanding maintenance process, while memory for novel images may reflect passive familiarity of the stimuli at test. Holding familiar images, but not unfamiliar images, in working memory may be cognitively effortful for monkeys.

Can orangutans and human children use computer-based information to solve a perceptually corresponding problem in the physical domain?

Heidi Marsh, Laura Adams, Catherine Floyd, & Suzanne MacDonald (York University)

P4 Despite the fact that photographic stimuli are used across experimental contexts with both human and non-human subjects, the extent and nature of individuals' perceptual understanding of these stimuli is not well understood. In the present experiments, we tested whether orangutans and children could use photos on a computer screen to solve a perceptually corresponding problem in the physical domain. Further, we tested the cues that aided in this process, by pitting local featural information against spatial position. We found that individuals in both species were able to use the information cross-dimensionally, however, subsets of both species also failed the task. Species differences emerged with respect to ease of acquisition and the cues that participants used to solve the task: Whereas the orangutan relied only on spatial information, most children based their decisions on featural information. The results suggest that the orangutan and possibly the younger children used featural equivalence processing, whereas the older children used complex equivalence processing. The finding that two of the three orangutans and almost a quarter of human children were unable to solve the task underscores the need for further testing in this area, in order to design appropriate experimental paradigms in future research settings.

Rats remember incidentally encoded episodes

Wenyi Zhou, Andrea G. Hohmann, & Jonathon D. Crystal (Indiana University)

P5 Animal models of episodic memory have been criticized as being semantic in nature (i.e., solved based on well-learned rules). When encoding is incidental and a memory test is unexpected, people report details about an event based on episodic memory. We tested the hypothesis that rats can answer an unexpected question after incidental encoding. Rats were initially trained in Task 1 (win-shift search for food) and Task 2 (discriminate food vs. no-food; e.g., turn left/right after food/non-food sample) in a radial maze. When starting on one task, rats likely expected to complete that task. In the probe, rats searched for food in Task 1 (incidentally encoding the presence or absence of food). Subsequently, they were unexpectedly asked to report if they had eaten or not in a Task-2 test. Rats answered the unexpected question "Did you just eat or not?" In a second experiment, we tested the hypothesis that answering an unexpected question requires episodic memory by temporarily inactivating a region that mediates episodic memory (lidocaine infusion in the dorsal hippocampus, CA3 subregion). Hippocampal inactivation eliminated the ability to answer an unexpected question whereas performance in control conditions was not impaired. Rats remember an earlier episode after incidental encoding.

Methods of exploring associative and cognitive processes of spatial pattern learning in pigeons

Julia Schroeder, Dennis Garlick, & Aaron Blaisdell (UCLA)

P6 Spatial pattern learning tasks are useful for exploring cognitive processes. We adapted Brown et al.'s (2010) procedure for humans to a touchscreen computer task to examination spatial pattern learning in pigeons. Pigeons were presented with a 3 x 3 array of white disks on a touchscreen in an operant chamber. Only pecks to target disks are reinforced. Target disks are determined by their spatial location in the array, and do not contain any identifying features. Target disk locations conformed either to a simple pattern (e.g., checker board or cross) or in a disorganized pattern. We can use these configurations to investigate pattern abstraction. Evidence for pattern abstraction would come from various measures. First, pattern abstraction should result in more rapid learning and better accuracy on simple versus disorganized patterns. Second, once learned, a simple pattern should more readily generalize to novel transformations of the array of disks. For instance, increasing the number of elements from a 3 x 3 to a 5 x 5 grid of discs should result in extrapolating a simple pattern to novel elements more readily than of a disorganized pattern. Preliminary data from this procedure will be discussed.

A chimpanzee uses similar acoustic cues as humans when identifying sine-wave, noise-vocoded, and time-reversed speech

Lisa A. Heimbauer, Michael J. Beran, & Michael J. Owren (Georgia State University and the Language Research Center)

P7 When humans identify altered synthetic speech, acoustic cues are difficult to identify. In previous studies sine-wave and noise-vocoded speech were easier to identify when specific spectro-temporal features were present (Remez, Rubin, Pisoni, & Carrell, 1981; Shannon, Zeng, Kamath, Wygonski, & Ekelid, 1995), and time-reversed speech was more intelligible if reversal windows were under 130 ms (Saberi & Perrott, 1999). To determine if a language-trained chimpanzee (Panzee) that identifies synthetic speech (Heimbauer, Beran, & Owren, 2011; unpublished data) would respond similarly, she and 12 humans were tested with words in different versions of these three forms. As hypothesized, Panzee and the humans were more successful identifying sine-wave speech when the first two or all three formant tones were present than when either was absent. Also for both species, noise-vocoded words were easier to identify as the number of noise bands increased from two to five, and time-reversed words were more intelligible when reversal windows were between 25 and 125 ms. Performance suggests Panzee attends to the same features of synthetic speech as humans. Outcomes indicate basic auditory capabilities are involved and possibly were present in latent form in a common hominid ancestor.

Differential effects of spatial separation on visual feature binding by humans and pigeons.

Sho Otaki, Kazuhiro Goto (Kyoto University), & Shigeru Watanabe (Keio University)

P8 We examined the mechanism of visual feature binding in humans and pigeons that are visually dominant vertebrates but differ with regard to their neural substrates of feature processing. In Experiment 1, we examined how humans and pigeons bind color and line orientation. Subjects were trained to search for a target among distractors consisting of a horizontal and a vertical lines. In the feature condition, the target had a uniquely colored line from the distractors. On the other hand, in the binding condition, the target differed from the distractors with regard to the combination of colors and orientations. Both species located the target faster in the feature than binding conditions, suggesting that binding require focal attention in both species. In Experiment 2, we examined effects of spatial separation on visual feature binding. The target and distractors consisted of the two horizontally aligned colored lines. The spatial separation of these two lines had little effect on target localization in humans but hampered it in pigeons. These results may reflect the differences of neural substrates between these species.

Odor Span in Rats: Working or Episodic-like Memory?

Carrie Branch, Brooke April, Mark Galizio, & Kate Bruce (University of North Carolina Wilmington)

P9 Episodic memory, the recollection of personal past experiences, has previously been considered unique to humans. The current study explores episodic-like memory in rats using the odor span task (OST), a procedure originally designed to study working memory. This task can be viewed as an incrementing-non-match-to-sample (INMS) procedure because the animal must remember which odors were previously presented during a given session in order to respond accurately. Using the OST, we have observed accurate recognition of up to 70 stimuli in a single session, a finding inconsistent with a working memory interpretation. To determine whether episodic-like memory might mediate OST performance, we presented target stimuli in a holding cage before the OST procedure. These same stimuli were then introduced at random during the OST session; the question was whether the rats discriminate the context and treat target scents as novel scents (what-where-when memory). Preliminary results suggest the occurrence of such episodic-like memory in the OST procedure under some conditions, however, as time since exposure is extended, rats respond to a previously presented scent as if it is novel. These results suggest that the OST may be a fruitful technique for the study of various memory processes in nonhumans.

Towards a Touchscreen Serial Multiple Choice (SMC) Task for Rats

Karen E. Doyle, Ashley M. Smith (Kent State University), Dennis Garlick, Aaron P. Blaisdell (UCLA), & Stephen B. Fountain (Kent State University)

P10 We examined rat serial pattern learning in a touchscreen serial multiple choice (SMC) task analogous to both our well-developed spatial octagonal chamber procedure and a touchscreen version of the task for pigeons being presented at this year's CO3 conference. Rats were presented with a circular array of 8 white disks on a touchscreen and were reinforced for choosing them in the order, 123-234-345-456-567-678-781-818…, where digits correspond to the clockwise position of the stimulus in the array and dashes indicate pauses that served as "phrasing cues." Reinforcement was delivered either after each correct response to the individual elements of the pattern (group Element) or after the last correct response of each 3-element chunk (group Chunk). Acquisition in the touchscreen SMC task was modest compared to performance typically seen in the octagonal chamber version of the task, but rats did readily learn to nosepoke the disks sequentially for reinforcement. Surprisingly, group Element rats acquired the first element of each chunk ("chunk-boundary elements") significantly faster than rats in group Chunk. We will discuss rats' strategies, their response to manipulations of the task, and the possible advantages that the successful development of a touchscreen task might provide for cross-species comparison research.

Timing of Pavlovian-to-Instrumental Trasfer

Joshua E. Wolf, Chad M. Ruprecht, & Kenneth J. Leising (Texas Christian University)

P11 We used a Pavlovian-to-instrumental transfer (PIT) design to evaluate whether a conditioned stimulus (CS) would elevate instrumental performance commensurate with the pretrained temporal relation between the CS and an unconditioned stimulus (US). The CS-US pairings were achieved via an embedding procedure, in which the US was embedded within the duration of the CS, to avoid problems encountered by previous research. Rats were trained with the onset of the 10-s US (sucrose) occurring either early (5 s) or late (10s) after the onset of a 40 s CS. In a third group, the US was explicitly unpaired. The rats were then trained to press a lever on a random ratio schedule. At test, we measured the frequency of lever pressing during the 40-s prior to the CS and across the duration of the CS. Recent evidence has shown that animals have the ability to integrate temporal information from different phases of training. These results will be discussed in terms of Pavlovian conditioning and timing.

I'll work for you, and you work for me: Oh wait, you might not matter

Audrey Parrish, Sarah Brosnan, & Michael Beran (Georgia State University Language Research Center)

P12 Evidence is limited that animals will work to pay one another rather than themselves, or even work for extended periods with no reward. In the current study, we asked whether capuchin monkeys would engage in a joint computerized task that involved turn taking on trials that only gave rewards to the non-playing partner. Capuchins learned to engage the task to pay their partner and alternate turns across trials – sometimes working for multiple minutes for no immediate reward. To determine whether the capuchins understood this task as partner-dependent, we ran a partner-absent control with the same temporal delays to reward delivery from the partner-present sessions. There was no difference in performance between partner-present and partner-absent sessions. Success in the partner-present sessions may have been dependent upon coordination between individuals, but the capuchins' success was not solely dependent upon viewing this task as a cooperative interaction. Thus, caution is required before concluding that animals are cooperating on jointly-performed tasks, at least when food reward is not contingent on a partner actually being involved in the task. This does not mean capuchins cannot cooperate, but simply that demonstrations of cooperation will require monkeys to deal with more than alternated delayed rewards.

Human Free-Operant Escape/Avoidance Learning in a 3D Virtual Environment

Zachary A. Kilday, & Kent D. Bodily (Georgia Southern University)

P13 The purpose of this study was to develop a virtual-environment analog of a signaled, free-operant avoidance task to investigate escape/avoidance learning in human subjects. Undergraduate students served as participants. The environment consisted of one circular room (15 m diameter) with multiple response locations (buttons). Invisible goals were located randomly throughout the room, and participants were awarded one point for each goal with which they came in contact. Two intervals were used during the experiment: Avoidance (AI; 15 or 25 s) and Escape (EI; max of 30 s). The final 5 s of the AI was signaled by a change in the wall color (CS) which remained on until the AI was reset by a response to the correct button or the EI elapsed. An alarm (US) activated at the start of the EI and continued until a correct response was made or 30 s elapsed. Correct responses began an AI-R (25 s) while allowing the US to expire resulted in an AI-S (15 s). Several aspects of the virtual environment (e.g. instruction set and absence of the alarm) were manipulated between groups to determine their effect on multiple behavioral measures. Results and implications will be discussed.

Stimulus Movement Effect in Pigeons?

Thomas A. Daniel, Jeffrey S. Katz (Auburn University), & Anthony A. Wright (University of Texas Houston Medical School)

P14 Washburn, Hopkins and Rumbaugh (1989) showed that rhesus monkeys performed more accurately in matching-to-sample tasks (delayed and simultaneous) when the sample item was moving versus stationary. This Stimulus Movement Effect is believed to be due to movement enhancing attention to the sample item, increasing discrimination between other the sample and the comparison array. This effect has been replicated in humans, but there is no evidence for this phenomenon in avian species. Pigeons with prior experience in nonmatching-to-sample discrimination were presented a sample item that moved about the viewing area during its presentation. Images moved in straight lines until reaching the edge of the computer monitor when motion was reversed at a 45 degree angle. Manipulations included velocity of the item, area of motion, and fixed response requirements. Initial results indicate that this effect hinders discrimination performance in pigeons, contrary to the results found in humans and monkeys.

Comparison of the auditory brainstem response and psychoacoustic methods to test hearing in Lesser Scaup, a species of diving duck

Sara Therrien, Catherine Carr (University of Maryland), Ronald Therrien, & Alicia Berlin (USGS Patuxent Wildlife Research Center)

P15 There are several methods commonly used to obtain auditory thresholds, including the Auditory Brainstem Response (ABR) and psychoacoustics. The ABR is a scalp-recorded potential resulting from synchronized neural discharge after an acoustic stimulus. In psychoacoustic testing, an animal is trained to behaviorally respond in a particular way to the presence of an acoustic stimulus. In this experiment, Lesser Scaup (Aythya affinis) audiograms were constructed using both methods and thresholds were compared after testing. Both methods resulted in audiograms with a similar U-shape, with a peak of sensitivity in the range of 1000 to 3000 Hz, and sharp roll-off in sensitivity at frequencies above 4000 Hz. However, the psychoacoustic thresholds were up to 30 dB more sensitive than thresholds obtained from the ABR. These results, as well as those from other studies comparing both methods, highlight the usefulness of the ABR as a minimally invasive and time-efficient method for obtaining the general shape of the audiogram and range of peak sensitivity. However, while psychoacoustic methods can involve intensive animal training, they often provide the most sensitive measurement of thresholds.

Effects of Injection Stress on Rat Serial Pattern Learning

Samantha M. Renaud, Laura R. G. Pickens, & Stephen B. Fountain (Kent State University)

P16 Stress can alter behavior and sometimes interact with drug effects. Our research on adult cognitive impairments caused by adolescent nicotine exposure has raised the question whether injection stress affects our task independent of drug exposure. To assess effects of injection stress on serial pattern learning, rats received either twice-daily saline injections or no injections during adolescence on postnatal days 25-59 (P25-59), then trained in our serial multiple choice (SMC) task as adults beginning on P65. Rats learned a 24-element pattern of responses, 123-234-345-456-567-678-781-818, where digits indicate the clockwise positions of correct nosepoke receptacles in an 8-position circular array. Rats trained for 35 days to asymptotic levels of greater than 90% correct on all pattern elements. No significant differences in acquisition were observed for any pattern element. These results indicate that injection stress during adolescence did not affect pattern learning in the SMC task during adulthood. However, it is still an open question whether earlier exposure to injection stress or other forms of stress might cause cognitive impairments in other more sensitive behavioral tasks experienced later. Similarly, it is also possible that earlier exposure to injection stress during drug exposure might potentiate persistent drug-induced cognitive impairments.

Long-term memory for an auditory discrimination in chickadees

Lauren M. Guillette, Marisa Hoeschele, Allison H. Hahn, & Christopher B. Sturdy (University of Alberta)

P17 Long-term memory retention (731 days) in visual discrimination tasks has been shown in pigeons (Vaughan & Greene 1984) and Clark's nutcrackers remember locations of cache sites for 285 days (Balda & Kamil 1992). While few studies have examined the extent of long-term memory retention in the vocal domain, two experiments have demonstrated that retention spans eight months; in a playback experiment, male hooded warblers discriminated between the songs of neighbours and strangers (Godard 1991) and European starlings retained a species-based song discrimination in a go/no-go task (Braaten 2000). In the current study, we demonstrate memory for an auditory discrimination with retention intervals that range from one year to over three years. Previously, black-capped and mountain chickadees were trained to discriminate between their own, and the other species' vocalizations in a go/no-go operant discrimination task. One group of chickadees was trained on this species-based discrimination with entire chick-a-dee calls as stimuli; a second group of chickadees was trained with individual note-types isolated from the chick-a-dee call (Guillette et al. 2010). Recently, these same chickadees were re-trained on the discrimination they learned previously. Most chickadees performed significantly above chance during the first block of training, suggesting long-term memory retention for vocal discriminations.

Follow the Leader II?: The Complexities of Social Influences on Foraging Rats

Teagan A. Bisbing, Justin M. Sayde, & Michael F. Brown (Villanova University)

P18 Last year we presented a study that showed a limited amount of social influence on naïve rats' behavior by the spatial choices of trained, model rats. A follow-up experiment will be presented, in which non-reinforced probe trials were introduced. Although model rats continued to selectively choose locations on the assigned side of the maze, there was no evidence that choices made by the subject rats were affected by the model rats choices. Interestingly, location data indicates that the relative position of the subject rat in the maze was influenced by the model rat in a manner that requires social transmission of information about food locations. Considered together, these results confirm our earlier finding that, while there are limited social influences on subject rats' behaviors, these influences are modulated by other social factors.

The effect of context shift on peak interval behavior and tolerance to alcohol in rats

Alexandra Kulikova, Kendall Williams, Jacqueline Woerner, Marie Saxon, & James Denniston (Appalachian State University)

P19 Thirty-two rats were used to extend previous findings on context-specific drug tolerance and to investigate the effect of a within-session context shift on alcohol tolerance, as indicated by changes in an animal's internal clock mechanisms. Prior studies have shown that alcohol tolerance is context-dependent, as indicated by the changes in animal's motor functioning and body temperature in a non drug-associated context (Siegel & Sdao-Jarvie, 1986). In the present study, a peak-interval task was used to demonstrate the accuracy and precision with which animals time their responses after chronic alcohol self-administration. We hypothesized that animals receiving alcohol in a non-alcohol environment would overestimate elapsed time and make an increased number of premature responses in a novel environment. Preliminary results revealed that both the experimental and the control groups demonstrated similar mean peak response times prior to the shift, but that upon a change in context, the peak curve shifted to the left for the animals that received alcohol. This premature responding after the shift was not observed in control subjects that were not shifted.

Differential sensitivities to dynamic Glass patterns

Jean-François Nankoo, Christopher R. Madan, Marcia L. Spetch, & Douglas R. Wylie (University of Alberta)

P20 Form and motion are thought to be processed independently at the early stages of visual processing in the brain. However, it has been shown that a sequence of independent Glass patterns gives the perception of coherence to incoherent motion. Glass patterns are static stimuli that consist of local signals (dot pairs). These pairs can be integrated spatially by both pigeons and humans to create the perception of a global form. In this study, we used Glass patterns to investigate the influence of low-level form cues on the perception of motion in humans. We identified the signal-to-noise sensitivities of different static Glass patterns and compared these to sensitivities to corresponding patterns of form-driven implied motion (i.e., dynamic Glass patterns) and real motion patterns (i.e., random dot displays). This study furthers our understanding of the mechanisms involved in form and motion perception.

Information content of visual scenes influences systematic search of desert ants (Melophorus bagoti)

Eric L. G. Legge (University of Alberta), Patrick Schultheiss (Macquarie University), Antoine Wystrach (University of Sussex), Marcia L. Spetch (University of Alberta), & Ken Cheng (Macquarie University)

P21 Natural environments often contain many landmarks that can be used together for navigation. In visually rich environments, each location is unambiguously characterised by a unique arrangement of visual landmarks. While central-place foraging insects like bees, wasps, and ants are able to use this visual information to navigate along habitual routes and pinpoint a goal with astonishing accuracy, how this is accomplished is still an active area of investigation. Related to this, we present data from work with the Australian desert ant, Melophorus bagoti where we tested two questions: (1) is the accuracy of searching ants increased in visually complex environments? and (2) Are the characteristics of searches different in a familiar visual environment than an unfamiliar one? Our work suggests that the accuracy of ants' searches depends on the amount of information that can be derived from the visual scenery and that the presence or absence of familiar cues significantly influences ants' searching behaviour.

Spatial Integration and Decision Making in Homing Pigeons

Diana B. Klimas, Verner P. Bingman (Bowling Green State University), & Alex Kacelnik (University of Oxford)

P22 Animals use multiple sources of information when making decisions, particularly in tasks such as foraging and navigation. Past research has shown instances where animals have combined multiple cues to make optimal decisions, as well as other instances in which one type of cue is more heavily weighted, causing decisions to be skewed in some way. However, it seems many cases of cue integration can be explained using Bayesian principles. The current study explores the possibility of spatial integration, using two light cues that signal different shaped reward distributions within a circular arena. Homing pigeons were trained to locate food according to which light cue is presented for a given trial. During probe trials, both light cues were presented to the pigeons, creating a conflict scenario. These including trials that have lights placed such that the reward distributions overlapped on one of the goal locations. Preliminary results indicate that the pigeons may indeed be integrating information, though perhaps not using true Bayesian inferences.

Social monitoring by close calls in meerkats

Stephan A. Reber (University of Vienna), Simon W. Townsend, & Marta B. Manser (University of Zurich)

P23 Social monitoring of the actions, behaviors or even the mental states of others is thought to be a key requirement in order to minimize the costs associated with group living. An important prerequisite for social monitoring is the reliable identification of individual group members. As evidence for individual recognition is still sparse in most species, social monitoring in non-primate mammals has so far received little attention. Recent work on cooperatively breeding meerkats (Suricata suricatta) has demonstrated a capacity for vocal indivdual recognition, but it is currently unclear whether meerkats use individually distinctive vocalizations for social monitoring purposes. In meerkats, the dominant female of the group generally monopolizes reproduction by subjecting subordinate females to high levels of aggression. We simulated the close presence of the dominant female by playing back her close calls to subordinate females during a conflict period and compared it to a non-conflict period. We controlled for sex, status, and context dependent signatures. Only during the conflict period, subjects responded significantly more to the test condition by displaying overt submissive behavior. We argue from our findings that meerkats can monitor their social environment by close calls and that they use this capacity to avoid aggressive intra-group interactions.

Retention functions for temporal and hedonic samples in many-to-one symbolic delayed matching-to-sample in rats.

Shannon Mischler, & Angelo Santi (Wilfrid Laurier University)

P24 Rats were initially trained with either temporal samples or hedonic samples mapped to moving and stationary comparison levers. Delay testing revealed marked retention asymmetries in both groups (i.e., a choose-long effect with temporal samples and a choose-no-food effect with hedonic samples). Next, a second set of samples was added to those initially trained, hedonic for rats trained with temporal samples and temporal for rats trained with hedonic samples. For half of the rats within each group, food and short samples (S-F) were associated with one comparison and no-food and long samples were associated with the alternative comparison (a many-to-one, MTO, mapping). For the remaining rats this mapping was reversed (L-F). All rats continued to exhibit a choose-long bias following temporal samples, however rats trained with the S-F mapping showed a choose-no-food effect while those trained with the L-F mapping showed a choose-food effect. Rats appeared to time hedonic-sample trials and respond to the comparison correct for the long sample at long delays (i.e., the no-food associated comparison in the S-F mapping, and the food associated comparison in the L-F mapping). Rats do not commonly code temporal and hedonic samples associated with the same comparison in MTO mapping.

The Mark Test: A Measure of Motivation or Mirror Self-recognition?

Rebecca Roberts, & Kim Wallen (Emory University and the Yerkes National Primate Research Center)

P25 The mark test is the most common measure of mirror self-recognition (MSR) in nonhumans. This test uses subjects' mirror-guided inspection of surreptitiously placed facial marks as indicating MSR. Failure to inspect the marks is interpreted as lacking both MSR and self-awareness. Passing the mark test requires that subjects both understand mirror contingencies and are motivated to inspect foreign body marks. If either requirement is unmet failing the mark test cannot demonstrate an absence of either MSR or self-awareness. We investigated 12 juvenile rhesus monkeys' motivation to inspect body marks, by measuring inspection of five different marks placed in full view on their arms. The marks varied in likelihood to motivate inspection. For example, a peanut butter mark was predicted to highly motivate inspection, whereas a paint mark would produce little mark inspection motivation. Mark type strongly influenced self-inspection. Monkeys showed little interest in marks typically used in the mark test, even when the marks were in full view and inspection did not require mirror use. We propose that inspection motivation significantly influences mark test performance. This suggests that failure to pass the mark test is uninterpretable and that only positive results indicate whether animals possess MSR.

Shape Discrimination in Goldfish (Carassius auratus)

Susan A. Keenan, Amanda L. Heberle, Ashlynn M. Keller, & Caroline M. DeLong (Rochester Institute of Technology)

P26 The goal of this study was to investigate 2D visual object recognition in goldfish (Carassius auratus). We want to determine visual features goldfish use to discriminate among objects (e.g., length, width, surface area, and diameter). Three goldfish were trained individually in 5 gallon test tanks to eat a mixture of flake food and water from a 1.0 ml syringe. Then the fish were trained to tap a black circle with a 2 cm diameter on a white background to receive the food reward by pressing their mouth to the circle. Stimuli were printed on a laminated piece of paper attached to a piece of corrugated plastic, which was presented underwater. The fish were able to reliably tap the circle within 11-15 sessions. In the first object discrimination test, a 3.1 cm x 1 cm black rectangle (matched for surface area) was presented alongside the circle. The fish successfully chose the circle across 77 sessions (M = 83%). In the second object discrimination test, a 2 cm x 1 cm black rectangle (matched for length) was presented alongside the circle. Currently, the average choice accuracy is 76%. These results are similar to those reported for reef fish.

Urban Rhode Island Coyotes: Environmental effects on movement patterns

Kathryn Kalafut (Brown University), Dr. Numi Mitchell, & Wendy Finn (The Narragansett Bay Coyote Study)

P27 One male and one female coyote were collared on Aquidneck Island, Rhode Island in the February of 2010. The coyotes were fitted with radio transmitting collars that collected a GPS point each hour for an entire year. Current points were broadcast by the collars and collected by researchers via a receiver every week. The GPS points collected were transferred to ArcGIS and Matlab software that allowed researchers to map out the coyotes movements over time as well as identify locations the coyotes frequented. These locations were then physically visited in order to determine the attractant that was present. Researchers often found evidence of hunting such as a deer carcass, or bird feathers. Other attractants included anthropogenic food sources such as compost piles or open garbage bins. Having the coyotes collared for an entire year allowed researchers to follow the change in the coyote's movement patterns during breeding, denning and pup rearing seasons. The movement patterns of the male and female as well as the known environmental changes within their territory will be described.

This too can pass: Capuchin monkeys let lesser rewards pass by to get better rewards

Jessica Bramlett, Theodore Evans, Bonne Perdue, Emilie Menzel, & Mike Beran (Georgia State University - Language Research Center)

P28 Self-control may be defined as foregoing an immediate reward to gain a larger delayed reward. Methods used to test self-control comparatively include intertemporal choice tasks, delay of gratification tasks, and accumulation tasks. To date, capuchin monkeys have shown limited self-control. This study introduced a new self-control task in which an intuitive context that allows for natural responses. Capuchin monkeys (Cebus apella) were given a choice between two food items presented on a mechanized, revolving tray that could be accessed after a shorter or longer delay, depending on their position on the tray. Monkeys could grab the first item or wait for the second, but were only allowed one item. Most monkeys in the study waited for a more highly preferred food item or a larger amount of the same food item when those came later by inhibiting the prepotent response to reach out and take the less preferred foods or smaller amounts of food that passed right in front of them first. These data indicate that the mechanisms necessary for self-control are present in capuchin monkeys, and the methodology can be useful for broader comparative assessments of self-control.

Memory for the order of presentation of images in rhesus monkeys (Macaca mulatta)

Victoria L. Templer, & Robert R. Hampton (Emory University)

P29 One important aspect of episodic memory is the ability to remember the order in which sequences of events occurred. We presented monkeys with lists of 5 images drawn randomly from a pool of 6,000 images. At test, two images were presented and monkeys were rewarded for selecting the image that had appeared earlier in the study list. Monkeys were tested in a series of experiments to distinguish among several cognitive mechanisms proposed to support memory for order. Based on these series of tests, it appears that subjects did not use list position or relative memory strength to select the earlier item. Instead, monkeys used "temporal order", a mechanism that was further characterized by testing whether absolute time or the number of intervening items increased memory for order.

Poster Session II - Saturday Evening

Can horses discriminate between objects based on direction of motion?

Tammy McKenzie (Brandon University)

P30

It has been argued that motion should provide important information to many species and should play a role in the categorization of objects (Loidolt et al., 2006). Horses being prey animals and highly mobile may pay a lot of attentiong to motion within their environment, thus the ability to discrimate based on motion may be beneficial to them. This research examined whether horses can discrimate between objects based on direction of motion. In previous research, horses did not learn to discriminate between a circle moving up and down versus a circle moving left and right. In the present research horses were first given a simple dicrimination task, discriminating a light grey square from a dark grey square, and when successful at this task were progressed to the motion discrimination task. Using a two-key response-choice task, horses were simultaneously presented with a pattern of circles moving continously left and a pattern of circles moving continuously up. Horses did not succesfully complete this task. For horses to be successful, it may be necessary to use real objects rather than objects presented on computer monitors. Another possiblity is that horses may be more senstive to speed rather than direction of motion.

Impact of Social Status on Differential Tool-Use for Honey-Dipping by Capuchin Monkeys (Cebus apella)

Lindsay M. Mahovetz, Cara J. Piccerilli, & Roger K. R. Thompson (Franklin & Marshall College)

P31

Capuchins monkeys (Cebus apella) are facile tool users both in the wild and captivity (Fragaszy, Visalberghi, & Fedigan, 2004), but studies with captive animals have focused on performances of animals tested individually rather than in groups. We investigated tool use by tufted capuchins in both individual and paired test settings to determine whether subordinates either “play dumb” (Drea & Wallen, 1999) when with a dominant partner or alternatively, are prevented from expressing their honey-dipping abilities. In experiment one, individuals – absent a partner - were presented with a functional tool presented either singly or together with two non-functional tools. Eight of nine animals successfully honey-dipped in both conditions but also attempted to retrieve honey with the non-functional tools indicating that they spontaneously perceived the affordances of sticks as extensions of their arms, but had to learn through trial-and-error its functionality for the task. In experiment two, pairs of capuchins were tested in conditions identical to experiment one. Although all animals still attempted to honey-dip, dominant within-pair individuals aggressively monopolized access to the functional tool limiting their partners access to tools indicating that the subordinates, rather than "playing dumb," were actively prevented from expressing their knowledge of the task.

Preference for occupied flowers by bumblebees: should it be learned, is it learned and what is learned?

Catherine Plowright (School of Psychology), Sarah Jellen, & Kelsey Ferguson (University of Ottawa)

P32

The presence of a con-specific bumblebee on a flower can signal the discovery of a source of food; yet the flower is emptier than before and so it is not clear that bumblebees ought to have an unlearned preference for occupied over unoccupied flowers, though one has been reported in the literature. Here, we revisited the issue. A radial-arm maze was used in which a 2D pattern (e.g.a photo of a thistle flower) was mounted at the end of each of 10 corridors. A dead bee (the “occupier”) was pinned to three of the patterns. The first 20 choices were recorded for bumblebee workers having no prior experience outside the colony. Choice proportions did not deviate from chance, though the method was capable of revealing other preferences. Bees given discrimination training (rewarding occupied vs unrewarding unoccupied patterns) were then tested on empty patterns. Not only was a learned preference for occupied flowers obtained, but the learning also transferred to new patterns. The trained bees may well have learned the value of the presence of the occupier, suggesting that some knowledge of the social world had been acquired.

Enclosure size and the use of local and global geometric cues for orientation

Bradley R. Sturz, Martha R. Forloines, & Kent D. Bodily (Georgia Southern University)

P33

Multiple spatial cues are utilized to orient with respect to the environment, but it remains unclear why feature (objects in the environment) and geometric (shape of the environment) cues are differentially influenced by enclosure size and the extent to which local (wall lengths and corner angles) and global (i.e., principal axis of space) geometric cues are influenced by enclosure size. We investigated the extent to which environmental size influenced the use of corner angle (i.e., a local geometric cue) and the principal axis of space (i.e., a global geometric cue) for reorientation. Participants were trained to respond to a location in either a small or large trapezoid-shaped enclosure uniquely specified by both local (i.e., wall lengths and corner angles) and global (i.e., principal axis of space) geometric cues. During testing, we presented both groups with a small and large rectangle (to assess the use of principal axis of space) and a small and large parallelogram (to asses relative use of corner angles and the principal axis of space when in conflict). Enclosure size influenced the relative use of corner angles but not of the principal axis of space.

Differential housing conditions and associative learning: Effect of brief enrichment on lever-pressing performance

Danielle Crethers, & Tadd B. Patton (Augusta State University)

P34 Studies have shown that providing laboratory housed animals with an opportunity to utilize species specific behaviors in a natural context appear to alter the physical and psychological well-being of the animals. The effects of such enrichment have been observed by way of performance improvements on tasks of learning and memory. Despite an increased interest in laboratory animal treatment and living conditions, the importance of specific variables, such as enrichment type and duration remains unclear. The aim of the current study was to examine the effect of minimal enrichment duration on a lever-pressing task which required a differential rate of low responding (DRL). Enriched rats were group housed and provided with several play structures to climb and hide in, while the control rats were housed individually. Both enriched and control rats were trained to lever-press on a fixed ratio schedule of reinforcement then switched to DRL responding. There was no significant difference in the mean ratio of lever-presses to reinforcement between the two groups indicating that enriched and control rats required the same number of trials to learn this simple operant conditioning task. Implications of this finding will be discussed in light of enrichment duration and subject age.

Application of the Big Five to equine personality

Rachel Kristiansen (Sheridan College), & Stan Kuczaj III (The University of Southern Mississippi)

P35 This study was designed to test the validity of a Five Factor Model of personality on horses. A questionnaire was replicated from a previous study, with an added option of don't know to the traditional 5-point Likert scale. Seventeen items of the 60-item scale had don't know responses from raters greater than 10% and were subsequently removed from the study. The remaining items were put through a Principal Components Analysis, which extracted eight factors: Neuroticism, Active, Conscientiousness, Agreeableness, Openness, Social Extraversion, Temperamental, and Disciplined. These components correspond well to the five components extracted in the original study, indicating good reliability of the scale. However, 17 items from the original questionnaire were deemed irrelevant by raters, indicating a threat to validity. Though the remaining items were able to be used in analyses, further studies should examine if these are in fact the most effective items to use in the investigation of equine personality.

Tests of Transitive Inference in Rats using an Automated Olfactometer

Alyse Kaszubski, Brooke April, Carrie Branch, Melissa Deal, Rachel Eure, Christine Hausmann, Andrew Hawkey, Sarah Maggio, Victoria Willetts, Mark Galizio & Kate Bruce (University of North Carolina Wilmington)

P36 Transitive inference (TI) has been demonstrated in a variety of species including rats in which TI emerges when odor stimuli are used (Davis 1992; Dusek & Eichenbaum 1997; Jordan 2009). Rats in these studies were initially trained on four overlapping simple odor discriminations. For example, the following pairs could be trained: AB+, BC+, CD+, and DE+. Choice of D given the presentation of the untrained pair "BD" is said to demonstrate transitive inference. These successful TI studies all involved manual presentation of scented sand or scented lids as stimuli. In the present study a systematic replication of Davis (1992) was conducted using an automated olfactometer apparatus. Despite strong discriminative performances on trained baseline pairs, TI was not consistently observed. Additional stimulus sets were trained to determine whether multiple exemplar training would enhance emergence of TI, but without consistent success. Nonetheless, the efficiency and objectivity of computerized assessment would make this procedure an attractive option. We are exploring procedural variations to determine conditions necessary for the emergence of TI.

Incorporation of Inconsistent vs. Consistent Information in a Serial Pattern Transfer Task with Rats.

Sujala Maharjan, Swechhya Shrestha, Henaa Razzak, Jacy Dodd, Whitney Thomas, & James D. Rowan (Wesleyan College)

P37 This experiment examined whether rats could use a previously learned pattern's structure to learn new information which was consistent or inconsistent with the original structure. Twenty four rats were assigned to one of 2 groups for the pretraining phase of the experiment. One group was trained on an 18 element Runs Pattern composed of 6 chunks of 3 elements (123 234 345 456 567 678). The other was pretrained on an 18 element Trills Pattern also composed of 6 chunks of 3 elements each(121 232 343 454 565 676). After 28 days of pretraining, each group of rats was transfer to one of 2 variations of the pretraining pattern, both containing 2 additional 3 element chunks (6 elements). Runs Group rats were transferred to a pattern with the new 2 chunks being runs or trills. The Trills Group was transfer either to a trills pattern with 2 additional trills or 2 additional runs chunks(all for 7 days). Rats in all groups showed dismal performance in transfer. Interestingly, the rats' error rates for the previously learned portion of the pattern also increased dramatically for the entire week of transfer.

Adaptive foraging decisions by educated predators: Trading off nutrients and toxins

Christina Halpin (Newcastle University), John Skelhorn (University of Exeter), & Candy Rowe (Newcastle University)

P38 Educated predators are those that have learned about the nutritional value and defence levels of prey in their environment, and are able to make informed decisions about whether or not to eat prey that they encounter. Although we know that the toxin content in aposematic prey is important for the degree to which they are avoided, we don't know how the nutritional content of aposematic prey affects predators' foraging decisions. In an experiment using wild-caught starlings (Sturnus vulgaris) feeding on defended and undefended mealworms (Tenebrio molitor) of different nutritional values (small vs. large), we found that the asymptotic attack rates on defended prey were not absolute, but differed depending on the nutritional value of the defended and undefended prey. Our findings offer an insight into how educated predators integrate information about toxins and nutrients to make adaptive foraging decisions, and how their decision-making can impact on the evolution of aposematism and prey defences.

The effect of asymmetrical sample training on retention functions for hedonic samples in rats

Sabrina Simmons, & Angelo Santi (Wilfrid Laurier University)

P39 Rats trained in a delayed matching-to-sample procedure in order to discriminate sample stimuli consisting of the presence of food or the absence of food show more forgetting of the food sample than of the no-food sample. According to the single-code/default strategy, rats code only the food sample and make the response correct for the no-food sample by default when there is no memory of the food sample. The purpose of this study was to examine how asymmetrical training with only one sample prior to two-sample training would affect retention functions for samples of food and no-food. Retention functions were not affected by which sample was trained first. Rats trained in an asymmetrical fashion showed mainly symmetrical retention functions where both food and no-food sample accuracy dropped in a parallel fashion across increasing retention intervals, suggesting that the rats coded both the food and the no-food sample. Transfer tests, in which features of the food and no-food sample were manipulated, confirmed that features of the no-food sample were coded. These results are inconsistent with a single-code default strategy and instead suggest that rats code both the food and the no-food sample when asymmetrical sample training is given.

Picture-Object Correspondence in Bumblebees? I. Bumblebees do not confuse flowers with pictures of flowers.

Emma Thompson, & Catherine Plowright (University of Ottawa)

P40 Laboratory studies of pattern recognition in bees typically use two dimensional patterns intended to represent ecologically relevant objects such as flowers, and yet the question of whether these patterns are perceived and treated as flowers has not been investigated. In bees, research has addressed several topics in cognition (e.g. abstract categorization, timing), but these do not include picture-object correspondence, which has been studied in a variety of species, but not bees. This study is the first in a series of experiments intended to examine picture-object differentiation, transfer and generalization as mechanisms of floral recognition in bumblebees. Twenty bees in each of two groups underwent discrimination training in a 12 arm maze with exposure to artificial flowers and pictures of those flowers. In one group, the flower was rewarding and the picture unrewarding, and in the other group the contingencies were reversed. Following training, preference testing on unrewarding stimuli revealed higher than chance choice proportions in both groups for the stimulus that had been rewarding: flowers and their 2D representations were not confused. Future research will investigate whether bumblebees will, nonetheless, treat the two as similar and show spontaneous transfer of learning from objects to pictures of those objects.

Assessing Stereotypy and Learning in a Dead Reckoning Virtual Environment Task

Connie Clements, & Kent D. Bodily (Georgia Southern University)

P41 Dead reckoning is the ability of an organism to find its way back to a path's origin without the use of landmarks. The triangle-completion task, in which subjects are guided from the origin along two legs of a triangle before being allowed to freely return to the origin, is a standard method for assessing dead reckoning. Stereotypy, the tendency for subjects to equivalent rotation and distance estimates to the origin regardless of triangle itinerary, is a common finding when multiple itineraries are used during testing. However, the reason stereotypy occurs has not been assessed. We hypothesized that stereotypy is due to a lack of sensitivity to differences in triangle itineraries. In the current experiment, the range of difference between 2 sets of 3 triangle itineraries was manipulated across groups. Participants (undergraduate students) were tested in a desktop-computer virtual environment. Feedback regarding return accuracy was provided after each trial, and return distance and rotation errors were analyzed. Results and implications will be discussed.

Assessment of Human Spatial Blocking With Stable and Unstable Landmarks

Martha R. Forloines, Kent D. Bodily, Bradley R. Sturz, & Ari White (Georgia Southern University)

P42 The purpose of the current experiment was to determine whether cue competition (e.g., blocking) occurs in the spatial domain with human participants in a desktop virtual environment. Beigler and Morris (1999) found that spatial blocking occurred in rats when trained to find a hidden goal relative to a stable landmark array. The present study investigated blocking of stable landmarks, which maintained a fixed spatial relationship to the goal location, in the presence of unstable landmarks, the location of which varied with respect to the goal location across trials. In Phase 0 (P0), participants were trained to find a goal in the presence of an array of directionally ambiguous landmarks (L0s). In Phase 1 (P1), a stable disambiguating landmark (L1) was added to the array. In Phase 2 (P2), a second stable landmark (L2) and several unstable landmarks (Ms) were introduced. All landmarks were the same shape, but had unique visual color patterns. On test trials, which were randomly interspersed amongst P2 trials, different combinations of landmarks were presented to determine the extent to which they controlled search. Search area in the presence of L2 and absence of L1 assessed blocking. Results and theoretical implications will be discussed.

Did I Do That?: Investigating Agency and WWW Memory in Rhesus Monkeys and Children

Megan L. Hoffman, Michael J. Beran, Rebecca A. Williamson, & David. A. Washburn (Georgia State University)

P43 Comparative research on episodic memory has typically focused on examining the binding of spatial and temporal information in memory, but less is known about how animals integrate other relevant event features in memory. In the present study, we investigated how rhesus monkeys and 3-4 year old children integrate what, where, and when information along with information about their own role in a past event and their knowledge about the environmental context at encoding. We assessed this by presenting monkeys and children with a computerized memory task; on some trials they had to move a picture to a predetermined location on the computer screen using a joystick and on other trials they had to watch as the picture moved by itself. The event always took place within a particular environmental context (either a brightly lit or dim background display) and was followed by either a short (5s) or long (15s) delay. This was followed by a pair of memory tests, which were randomly selected on each trial. These pairings allowed us to examine how the different types of information (identity, spatial, temporal, agency and context) were integrated in working memory.

Proactive Interference in Rhesus Monkeys

Deepna Devkar, Anthony Wright, Caitlin Elmore (University of Texas Health Science Center at Houston), & Jeff Katz (Auburn University)

P44 Repeating stimuli from trial to trial creates proactive interference. We tested three monkeys for proactive interference in a same/different task. Trial-to-trial stimulus repetitions were minimized by using a large 1024 set of picture stimuli. Proactive interference was tested by placing potentially interfering stimuli as sample stimuli in previous trials, 1, 2, 4, 8 or 16 trials prior to the test where it did not match the test-trial sample. Interference was greatest the closer the interference was to the test and dissipated with distance. Time intervals in the task were manipulated to test proactive interference.

Non-conceptual Hook-tool Use in Groups of Captive St. Kitts Vervet Monkeys (Chlorocebus aethiops)

Kerry M. Dore (University of Wisconsin-Milwaukee), Caitlin J. Hannah, Roland M. Eve, & Roger K. R. Thompson (Franklin Marshall College)

P45 We observed captive vervet monkeys (Chlorocebus aethiops) in St Kitts using their tail to hook and retrieve grass outside their enclosure. Here, we tested their use of hooked and straight reaching tools in groups. Dominant individuals, who monopolized handling of all tools in two groups, retrieved a food cup presented either within a hook-tool or attached to a straight reaching tool. When presented with a choice of two hook-tools or two straight tools, the dominant juvenile in one group, similarly to vervet monkeys tested by Santos et al, (2006), chose the hooked or attached food-cup whereas the dominant adult in the other group chose the first tool she encountered when approaching the testing apparatus. Neither animal learned to capture and retrieve the reward using a hook. Also, unlike capuchins or human infants, they did not use straight sticks to extend the reach of their arm (cf., Thompson & Rattermann, 2001; Flemming et al, 2006). Results suggest that hook-tool use by vervet monkeys is not conceptually mediated but is a simple reach-and-pull retrieval response mediated by the discrimination of perceptual differences between rewards attached, or not attached, to a tool and enclosed, or not enclosed, by partial boundaries.

Dolphins' vocal responses to narrowband and broadband vocalizations produced in multiple contexts

Wendi Fellner (Disney's The Seas), Diana Ward (New College of Florida), & Heidi E. Harley (New College of Florida/Disney's The Seas)

P46 Dolphins process and produce sounds very quickly across a wide frequency range. They are echolocators and vocal mimics, although we know very little about their vocal matching of broadband sounds, a large part of their repertoire. We focused on vocal exchanges and analyzed dolphin vocalizations produced by 4 dolphins in human care. Analyzed vocals were produced in response to our playbacks as well as to their tank mates' naturally occurring productions. Broadband sounds were frequent in all sessions. Fish were provided non-contingently in some playback sessions. Recorded subjects were alone or in pairs. We analyzed their response vocalizations in terms of attribute matching (duration, amplitude, frequency, number, frequency contour, bandwidth, category, fidelity) and social context. To date, we have discovered that dolphins were more likely to match frequency (45%) and amplitude (38%) than number (16%) and duration (12%). Frequency matches occurred with narrowband whistles but also with broadband burst pulse sounds, suggesting that dolphins are sensitive to the frequency bands in burst pulses, an unexpected finding. Analysis of dolphin burst pulse sounds may need to include an analysis of the differential distribution of energy across the frequencies in the sounds.

Demonstration of the independence of one-trial memory and habit using process dissociation procedure in rhesus monkeys

Hsiao-Wei (Vicky) Tu, & Robert R. Hampton (Emory University)

P47 Multiple memory systems are often involved simultaneously to generate a behavioral response, preventing a simple one-to-one mapping between cognitive processes and tasks. Process dissociation procedures (PDPs) have been adopted in both humans and monkeys to quantitatively separate one-trial memory and habit, with the assumption that these two processes make independent contributions to a given task. Violations of this assumption may lead to artificial dissociations. Evidence for independence has been reported in humans, but similar tests have not been conducted with monkeys until now. In a within-subjects design using matching-to-sample, we manipulated one-trial memory by changing delay lengths and encoding conditions while simultaneously testing four levels of habit produced by assigning a subset of images to be the sample, and thus the rewarded target at test, more frequently than others. This bias in the reward probabilities associated with different images had the intended effect of increasing habit scores, but did not affect one-trial memory scores. In contrast, increasing memory delays attenuated one-trial memory scores, while habit scores stayed the same. This behavioral double dissociation clearly shows that one-trial memory and habit can be manipulated independently, validating PDP as a valuable tool for studies of learning and memory in nonhuman animals.

Effects of dog´s sociability upon interspecific communicative responses

Adriana Jakovcevic, Gabriela Barrera, Angel Elgier, & Alba Mustaca Mariana Bentosela (Laboratorio de Psicología Experimental y Aplicada (PSEA) Instituto de Investigaciones Médicas (IDIM) CONICET)

P48 Dogs have developed extraordinary interspecific communication skills. Recently, individual differences in communication skills related to breed or training levels have been found in dogs. In this work we studied whether a relationship exists between sociability levels of the dogs and learning interspecific communicative responses. We evaluated adult dogs in a sociability test consisting in the encounter with an unknown human. From these results, animals were divided in two groups: High Sociability (HS) and Low Sociability (LS). In study 1, the dogs were exposed to a conflictive situation where there was food in sight but out of reach. During three trials the gaze response towards the human face was reinforced, followed by three trials of extinction. The study 2 consisted of an object-choice task in which dogs must find hidden food following the direction of the head and the look of a person to the right place. Results showed that HS has longer gaze duration during extinction, compared with LS. In addition, the HS successfully followed the human gaze and find hidden food, resulting in a performance significantly above the chance level, unlike LS whose performance was at chance. In conclusion, the results herein presented suggest that sociability modulates interspecific communication.

Effect of bilateral hippocampal lesion on transitive inference task in pigeons

Kaitlyn Kandray (Drake University), Martin Acerbo (University of Iowa), & Olga Lazareva (Drake University)

P49 We trained pigeons to discriminate four pairs of overlapping visual stimuli: A+ B-, B+ C-, C+ D-, and D+ E-. Because our prior research found no effect of the orderability of the primary stimuli on pigeons' behavior (Lazareva & Wasserman, 2006), we used non-orderable color stimuli in this experiment. We also controlled reinforcement history of stimuli B and D comprising a critical testing pair BD by using massed presentation of the pair D+ E- that produced richer reinforcement history for the stimulus D. After the first test involving the critical pair BD as well as other possible testing pairs, we performed a bilateral lesion of hippocampus by aspiration, and conducted the second test after a period of recovery. Preliminary results showed that in this task some, but not all, of the birds consistently select stimulus D over B during first test, suggesting a strong influence of reinforcement history on the choice in the novel pair. Moreover, the hippocampal ablation in these birds appear to lead to either chance performance in pair BD or a slight preference of the stimulus B over stimulus D, suggesting that the effect of reinforcement history may have been associated with hippocampus.

A literature review: Investigating the fundamentals of inter- and intra-specific cognition and communication between humans and animals for application into the development of human-robot interactions in a team setting.
Melyssa Allen (University of Central Florida), Patricia Morrow, Jonathan Streater (University of Central Florida Cognitive Sciences Laboratory), Florian Jentsch (University of Central Florida Team Performance Lab and Department of Psychology), & Stephen Fiore (University of Central Florida Cognitive Sciences Laboratory and Department of Philosophy)

P50 The ways in which humans and animals interact is complex, but is set on the general foundation of body language, gesture, and verbal communication. Explorations into the complexities of human-animal interactions (HAI) in a team setting have led to inquiries of whether these models could be applied to human-robot interactions (HRI). In this paper we apply an interdisciplinary perspective to integrate research from animal cognition and metacognition, natural and acquired modes of human communication, animal specializations in communication, and studies of how humans interact with robotic animals. Intra-species communication within groups of animals will also be investigated to potentially apply to the robots themselves when working in a team setting. We conclude with a set of guidelines outlining how research can assess the efficacy of methods of communication from HAI in application to efficient HRI teams.

Can Pigeons Learn to Choose Optimally by Watching Other Pigeons?
Carter W. Daniels, Jessica P. Stagner, & Thomas R. Zentall (University of Kentucky)

P51 We asked to what extent suboptimal choice by pigeons (gambling-like behavior in which pigeons choose a lower probability of reinforcement with discriminative stimuli over a higher probability of reinforcement without discriminative stimuli) is influenced by observation of another pigeon choosing sub-optimally versus choosing optimally. Observer pigeons were given a choice between (1) an alternative that provided them with a stimulus that predicted food 100% of the time on 20% of the trials or 0% of the time on 80% of the trials (20% reinforcement), or (2) an alternative that provided them with food 50% of the time irrespective of the stimulus. One group (Observe Suboptimal) observed a demonstrator that chose the suboptimal alternative; the other group (Observe Optimal) observed a demonstrator that chose the optimal alternative. Choice by the experimental subjects in the two groups did not differ significantly but both groups initially chose more optimally than control subjects that did not observe a conspecific. However, with additional experience with the task, all subjects chose suboptimally. The results suggest that exposure to a conspecific (pecking for food) prior to performance might affect the observers' attention or motivation and make it initially more sensitive to the overall probabilities of reinforcement.

Hemispheric Control of Visuospatial Attention in the Social Corvid, Black-billed Magpie (Pica hudsonia)
Amanda Cheys, & Debbie M. Kelly (University of Manitoba)

P52 Cerebral lateralization, the superior control of neural functions by one hemisphere, is known to be ubiquitous amongst vertebrate species. Lateralization of the brain regions responsible for visuospatial attention may lead to a preference to attend to one side of visual space. It is uncertain why the directionality of these biases occur at a population level. However, it has been suggested to be the result of social living, where aligning the directionality of biases may promote group cohesion. When social avian species (e.g. domestic chicks and pigeons) have been tested, visuospatial attention is lateralized at the population level. This study examined whether black-billed magpies (Pica hudsonia), a social corvid, also show population-level lateralization of visuospatial attention. Magpies were tested using the standardized test developed for chicks and pigeons. Each magpie was presented with a matrix of seeds which they selected by entering their heads into the testing arena, while their body was constrained. The order and location of seeds selected were measured to determine whether the birds displayed a visuospatial bias. The presence of a population-level bias would support the social living theory; whereas, no bias would suggest other ecological factors may be influencing cerebral lateralization.

Rhesus monkeys selectively seek information when ignorant in a computerized foraging task
Gabriel R. Schroeder (Emory University), Benjamin M. Basile (Emory University), & Robert R. Hampton (Department of Psychology and Yerkes National Primate Research Center)

P53 Metacognition, or one's knowledge concerning one's own cognitive processes, is a construct based on studies of humans and is usually tested via verbal report, making it hard to test in nonhumans. In the current study we operationalized metacognition as the ability to use the presence or absence of memory to guide information seeking. We presented twelve rhesus monkeys (Macaca mulatta) with a computerized information-seeking task, designed after Call and Carpenter's (2001) manual tubes task. Monkeys were trained to remember and then select the location of a hidden stimulus. After a delay, they were simultaneously presented with the memory test, and the option to seek more information. We manipulated memory by presenting the stimulus at the beginning of half the trials and omitting the stimulus on the other half. Monkeys chose to take the test more often when knowledgeable, and sought information more often when ignorant. Probe trials using other manipulations of memory also affected information-seeking behavior. These results suggest that monkeys can discriminate between knowing and not knowing, and are able to use this information to guide their behavior.

Pseudoconcept Learning in Pigeons

Andrea M. Thompkins, Thomas A. Daniel, Jeffrey S. Katz (Auburn University), & Anthony A. Wright (University of Texas Health Science Center at Houston)

P54 Katz & Wright (2006) found that set-size expansion plays an influential role in the ability of pigeons to utilize an abstract same/different concept. As stimulus training set size was gradually increased from 8 to 1024 items, the results showed a transition from item-specific learning to relational processing and full abstract-concept learning. In the present study, we explored this transition by training a group of pigeons in a pseudo same/different discrimination version of Katz & Wright (2006). Pseudo stimulus pairs consisted of arbitrarily assigned images that did not adhere to their assigned same/different discrimination. Comparisons are made between Katz & Wright (2006) and the current study at each subsequent expansion. Results show overall longer acquisition and no transfer to novel items in the pseudo group indicating that these pigeons only learned the task via item-specific rules.

Transfer From Structured to Unstructured Patterns Effect on Serial Pattern Learning in Rats.

Aditi Dey, Megan Franken, Haley Ward, Ashly Annecchiarico, Soniya Bastola, & James D. Rowan (Wesleyan College)

P55 This experiment examined whether rats would extrapolate a previously learned rule when transferred to a pattern where they were not corrected for rule-inconsistent responses. Eight Rats were assigned to one of 2 groups for the pretraining phase of the experiment. One group was trained on an 18 element Runs Pattern composed of 6 chunks of 3 elements(123 234 345 456 567 678). The other was pretrained on an 18 element Trills Pattern also composed of 6 chunks of 3 elements(121 232 343 454 565 676). After 28 days of pretraining, the rats in the Runs Group and Trills Group were transferred to a pattern with 24 elements. The first 18 elements were the original pattern while the responses on the 6 remaining were always rewarded. All rats were trained on the transfer patters for 7 additional days. Rats in both the Perfect Runs and Perfect Trills transfer groups quickly adopted a "perseveration strategy" where they would repeat the response at a nosepoke receptacle until the original portion of the pattern started again. None of the 8 rats showed pattern extrapolation.

Elephant Cognition

Kristen Kolar, & Penny Bernstein (Kent State University at Stark)

P56 Though animal behavior has been an area of interest for several decades, Animal Cognition is a concept that has only recently begun to gain attention as a credible area of study. In order to perpetuate the momentum of the interest in comparative cognition, research must be continuous, reliable, and discussed. Such research is not always possible, particularly with species that are difficult to maintain in a research facility. Therefore, this study is a meta analysis of previously conducted research on the cognitive capabilities of Loxodonta africana (African elephants) and Elephas maximus (Asiatic elephants). Extensive review of relevant literature was conducted and individual results of several cognitive tasks are discussed. Evidence of problem solving, tool use, self-awareness, and cooperation is presented empirically. Due to the high black market value of the ivory tusks of the elephant, this species is at risk for extinction. Producing empirical evidence of cognitive abilities may help raise awareness and interest in the future of this species.

Do pigeons (Columba livia) perceive Kanizsa-type illusory surfaces?

Yurika Komatsu, & Tomokazu Ushitani (Chiba University)

P57 We examined whether pigeons perceive Kanizsa-type illusory surfaces, in which humans perceive a surface brighter than the background when four pacman-like shapes have their open mouths directed toward the center of the pattern. During the training, brightness of two simultaneously presented patches, each surrounded by four pacmen was manipulated. Two pigeons were rewarded for choosing the brighter patch ("bright" group), whereas the other two pigeons were rewarded for choosing darker patch ("dark" group). The pacmen were arranged so as not to construct the illusory surface during the training. On the test probe trials, one pacmen were arranged to construct the illusory surface and the pigeons were rewarded regardless of their choice. If the pigeons perceive an illusory surface, it would be expected that pigeons in the "bright" group would choose the illusory pattern, whereas pigeons in the "dark" group would avoid it. However, pigeons in both groups frequently chose the illusory pattern. A subsequent test using a non-illusory, but a novel pattern did not reveal such a preference for that pattern. Thus, these results suggest that the illusory pattern may induce a distinctive perception in pigeons, similar to humans and that pigeons develop a preference for the pattern through the non-differentially rewarded trials.

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Notes

The Francis Crick Memorial Conference:
"Consciousness in Human and Non-Human Animals"
JULY 7th, 2012, University of Cambridge, UK

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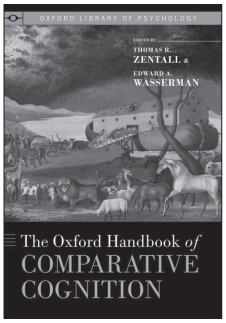

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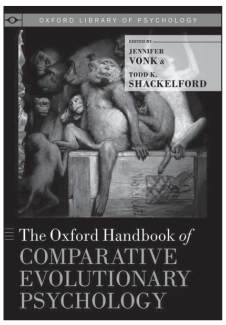

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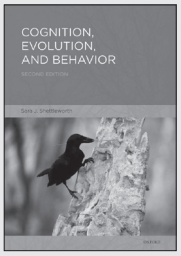

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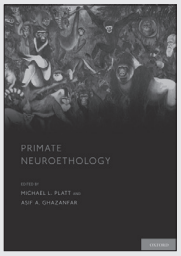

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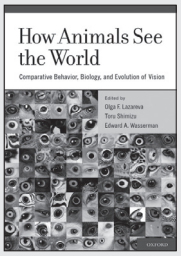

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