Proceedings of the 11th Annual International Conference On Comparative Cognition

Sponsored by the
Comparative Cognition Society*

March 24 to March 27, 2004

Radisson Hotel

Melbourne Beach, Florida

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5:50 Welcome Remarks – Suzanne MacDonald

6:00-7:03 Spatial Learning Processes (Chair, Suzanne MacDonald)

6:00 David R Brodbeck & Jessica M Humber (Sir Wilfred Grenfell College - Memorial University)
1-10
Memory for Space/Colour Compound Stimuli in Pine Siskins (*Carduelis pinus*) - A Field Experiment
Pine Siskins (*Carduelis pinus*), a species of finch that are common throughout northern parts of North America) memory for spatial and local cues was investigated using a field experiment using a cue dissociation method similar to Brodbeck (1994). Three feeders were placed 3 m apart in the field. Each feeder was consistently baited with different amounts of sunflower seeds (200 in the red feeder, 100 in the green and 50 in the yellow) at the start of each (twice daily) one hour recording session. During training sessions, the spatial locations of the feeders remained constant. The birds consistently visited the red feeder the most, followed by the green and yellow. On unbaited test trials one feeder was swapped with another (e.g. red with green). The number of visits to each feeder by the birds was recorded. As expected, the animals searching behaviour was controlled by spatial information.

6:15 Jerome Cohen & Jennifer Vergel DeDios (University of Windsor)
2-10

Retrospective and Prospective Spatial Working Memory in the Hierarchically Baited Radial Maze
Rats perform more poorly in a 16-arm radial maze when four different types of food (cereal puffs, fish pellets, sunflower seeds, and rat pellets)are redundantly cued by different proximally-cued arms at fixed locations than when these food types at randomly vary over arm locations. Following initial training on uninterrupted choice sequences, we interrupted rats in either group after their fourth, or eighth, or twelfth choice. Only the fixed food location group displayed the retrospective/prospective memory split in performance (Cook, Brown, & Riley, 1985). That is, their performance was more disrupted after their eighth than after either their fourth or twelfth choice. Futher experiments with other rats without redundant proximal arm cues suggest that fixed food location rats were attempting to retain two kinds of information (food locations and arm locations sampled) separately in their working memory.

6:30 Kosuke Sawa (Japan Society for the Promotion of Science, UCLA), Kenneth J Leising, Cory Fischer, Aaron P Blaisdell (University of California, Los Angeles)
3-10
Sensory preconditioning of spatial learning using a touch-screen task with pigeons
The integration of spatial maps in pigeons was investigated using a spatial search task presented on a touch-screen equipped computer. In Phase 1 of Pavlovian sensory preconditioning, two visual landmarks (LMs A and B) were presented for 30 s with a consistent spatial relationship without any reinforcement. In Phase 2, pigeons were required to peck at a hidden location (goal) on the screen that bore a consistent spatial relationship to LM A. The distribution of pecks at test suggest that spatial search was guided by a) a B-Goal spatial vector computed from the sum of the B-A and A-Goal vectors, and b) generalization of responding from LM A to LM B. The expression of these processes was influenced by a) whether or not the response field was visually marked, b) the elapsed time between a retraining session and the test session, and c) individual differences between pigeons.

6:45 Kenneth J Leising (University of California, Los Angeles), Kosuke Sawa (Japan Society for the Promotion of Science, UCLA), Raymond Lo (UCLA), Prat Panda (UCLA), & Aaron P Blaisdell (UCLA)
4-5
Spatial Specificity of a Conditioned Inhibitory Landmark in a Touch-Screen Spatial Search Task in Pigeons
A Pavlovian conditioned inhibition procedure with pigeons established two visual landmarks as conditioned inhibitors. Inhibitors X and Y were paired with excitors A and B without reinforcement (i.e., AX-, BY-). On other trials, both excitors were presented together with mixed-grain (AB+) if pigeons pecked at a hidden goal location on the screen. The goal maintained a consistent spatial relationship to Landmark A but not to Landmark B. Spatial control by the inhibitors was assessed in summation tests with an excitatory transfer Landmark C. Inhibitor X was most effective at inhibiting pecks at the goal when the “no goal” location overlapped spatially with the goal location predicted by Landmark C. Inhibitor Y showed less spatial specificity of inhibition. Thus, spatial control by an inhibitory landmark depends on the spatial control by its excitatory associate. Spatial control of inhibition was also influenced by a) whether or not the response field was visually marked, and b) individual differences between pigeons.

Equivalence Learning and the Same/Different Concept (Chair, Jeff Katz)

7:25 Jamie H Brown, Dana J Gant, Tracey A Spinner, & Mary Jo Rattermann (Franklin & Marshall College)
6-5 (Given as Poster)
Identity is Special: Evidence from human adults and 3-year-old children
Using the methodology developed by Wasserman and Young (Wasserman, Fagot & Young, 2001; Young & Wasserman, 2001) a touchscreen Imac was used to present human adults and 3-year-old children with either a display of 2 identical icons or a display of 2 non-identical icons. Subjects received an equal number of identity and non-identity trials, but were only rewarded for touching the screen in the presence of identity (or non-identity, depending upon condition). Also, the children were in either a labeled (“same” and “different”) and an unlabeled condition. As was found in previous research, the adult subjects touched the screen more for identity displays, regardless of whether they were reinforced for responding to identity or non-identity. The children displayed a similar pattern, showing no effect of label. These findings suggest a predisposition in both children and adults to respond based on identity. Further, this predisposition is unaffected by the presence of labels.

7:33 Robert G Cook & Daniel I Brooks (Tufts University)
7-5
Auditory Same/Different Learning in Pigeons
Pigeons were trained in an auditory same/different task using a go/no-go procedure. Stimuli were drawn from 12 synthesized musical sounds varying in timbre and pitch. Same trials consisted of an identical sound played for 2 s and repeated at .5 second intervals. Different trials consisted of all 12 sounds being played in sequence during a trial. After learning the discrimination, further tests revealed their independent sensitivity to both the timbre and pitch dimensions. Tests with novel timbre and pitch values revealed significant discrimination transfer. These results indicate that pigeon relational learning in not limited to the visual modality, but extends to the auditory modality as well.

7:41 Bradley R Sturz, Jeffrey S Katz, Kent D Bodily (Auburn University), & Anthony A Wright (University of Texas Medical School at Houston)
8-5
Same/Different Concept Learning by Pigeons: The Role of Symmetry
Pigeons trained in a simultaneous same/different task to discriminate pairs of pictures as same or different completely transferred to novel stimuli indicating abstract-concept formation. To rule out the possibility that there was some low-level feature of symmetry that might have cued responding, we trained and tested the same pigeons with sequential stimulus presentations. By separating the two stimuli in time, symmetry features would not be simultaneously present. Complete concept learning occurred suggesting that symmetry is not a controlling factor in this discrimination.

7:49 Kristy Lindemann, Colleen Reichmuth Kastak, & Ronald J Schusterman (University of California, Santa Cruz)
9-5
Cross-modal equivalence in a California sea lion
In a classic experiment on stimulus equivalence conducted by Murray Sidman and his colleagues, retarded children demonstrated emergent reading comprehension following training on auditory-visual conditional discriminations. Using a variant of this procedure, we recently showed that California sea lions are also capable of establishing stimulus classes that meet the formal properties of equivalence relations (reflexivity, symmetry, and transitivity). In contrast to Sidman’s original study these classes were comprised of sets of stimuli from a single modality (vision). The aim of our current research with a sea lion is to establish multiple auditory-visual conditional discriminations and then test for emergence of untrained relationships between visual stimuli linked by a common auditory sample. We present preliminary data and a model for investigating cross-modal equivalence in nonhumans.
http://pinnipedlab.ucsc.edu

Snack Break

Learning, Choice, & Reasoning (Chair, Ralph Miller)

8:35 Bill Whitlow (Rutgers University - Camden)
10-10
Associative Analysis of Causal Reasoning
Recent theories of human causal reasoning have focused on problems in medical diagnosis, food poisoning, and forecasting weather and stock markets. However, the domain in which people might be expected to be most expert is social reasoning. This presentation describes studies of social reasoning in which people decide how one person feels about another (likes, dislikes, has no feeling for) based on experiences with ratings of liking/disliking involving a single individual and a group. Comparison of the results with data from conventional causal reasoning paradigms will be made.

9:05 Martin S Shapiro (California State University, Fresno), Corlisa Belt (Oxford University), & Behmer T Spencer (Oxford University)
12-10
Learning in an insect herbivore: How rewards affect color and odor discrimination in a hungry locust.
With the exception of honeybees, there have been few good invertebrate models for associative learning. To establish a new protocol for studying learning in a solitary, herbivorous insect, dessert locust (*Schistocerca gregaria*) were trained in three discrimination experiments (n=12 in each). In experiment 1, colored arms of a two-sided Y-maze provided a large or small amount of wheat for nine choice-trials. In experiment 2, locust discriminated odors, and the wheat rewards were reversed after nine choice-trials for an additional nine choice-trials. For the third experiment, the locust again discriminated odors, but the rewards differed in concentration of protein and carbohydrate. The results of these experiments indicated that in addition to showing good choice performance, the locust also took less time to reach the option with the larger reward. These results demonstrate the sensitivity of this design and are encouraging for the further study of these invertebrates under different conditions.

9:20 Tyson L Platt, Jonathan G Schuster, Elizabeth J Rahn, Francisco Arcediano, & Martha Escobar (Auburn University)
13-5
First- and second-order revaluation in a human causality task
The extended comparator hypothesis (Denniston, Savastano, & Miller, 2001) states that responding to a target cue (T) is determined by the extent to which other cues presented with T during training (i.e., comparator stimuli, C1) predict the outcome. In turn, the effectiveness of C1 as a comparator stimulus depends on the associative status of its own comparator stimulus (i.e., T's second-order comparator, C2). According to the hypothesis, associative changes of C1 have an inverse effect on responding to T, whereas associative changes of C2 have a direct effect on responding to T. Contrary to these predictions, in a human causality experiment we observed that associative inflation and deflation of C1 had a direct effect on responding to T, whereas associative inflation and deflation of C2 had an inverse effect on responding to T. The results are discussed in the framework of both the extended comparator hypothesis and mediated conditioning theories.

9:28 Theresa A Foster & Timothy D Hackenberg (University of Florida)
14-5
Effects Of Response Requirements And Reinforcer Delays On Behavior
In 12-hour sessions, pigeons were exposed to a series of fixed-ratio schedules and reinforcer magnitudes arranging equal unit prices (responses per unit food delivery). Fixed-ratio schedules ranged from 25 to 800 and reinforcer magnitudes (access to grain) ranged from 2 to 8 seconds. Consistent with previous findings, results show a positively decelerating relationship between consumption and unit price, and a bitonic relationship between response output and unit price. Conditions currently underway explore the separate contributions of response requirements and reinforcer delay on reinforcer consumption and responding. To assess effects of reinforcer delay, average obtained ratio-completion times were programmed in place of a response requirement. In later conditions, pigeons will choose between schedules that arrange the same the unit price, but with different cost-benefit components. Separate effects of response requirement and delay will also be assessed under these choice conditions.

Theory of Mind & Metacognition (Chair, Heidi Harley)

9:45 Jennifer M Vonk, James E Reaux, Conni M Castille, & Daniel J Povinelli (University of Louisiana at Lafayette)
15-10
What Human-Enculturated Apes Know about Seeing: Preliminary Results
It has been repeatedly suggested that apes raised with humans exhibit a more robust understanding of mental states than those reared with other apes (Tomasello & Call, 1996). Povinelli and colleagues (Povinelli & Eddy, 1996; Reaux, Theall & Povinelli, 1999) systematically investigated seven peer-reared chimpanzees' understanding of seeing. In conditions in which one experimenter could see them and another could not (e.g., blindfolds over the mouth versus the eyes), these chimpanzees exhibited no initial preference for gesturing to the person who could see them. The sole exception was the back-versus-front condition in which one individual faced the subjects and the other faced away. We tested three human-reared chimpanzees using a subset of these same see/not-see test conditions. The results were strikingly similar to those of the peer-reared animals. Finally, in a novel procedure, these subjects were unable to use their first-person experiences to model the visual experiences of others.

10:00 Megan J Bulloch, Ellen E Furlong, Klaree J Boose, & Sarah T Boysen (Ohio State University)
16-10
Chimpanzees have a theory of mind: Comprehension of others' knowledge states
The ability to discriminate one's knowledge state from others may be unique to humans. Studies with nonhuman primates of this phenomenon, known as Theory of Mind, remain inconclusive. Different findings reported from several laboratories (e.g., Reaux, Theall & Povinelli, 1999; Tomasello, Call & Hare, 2003) raise important questions. We replicated Reaux et al. (1999) with 9 chimpanzees, exploring if chimpanzees recognize that seeing an event creates a different knowledge state for someone not seeing it. Two experimenters stood in front of a chimpanzee, each holding a reward. Subjects requested the food by gesturing to one experimenter. Six experimental conditions included: 1) bucket on head of 1 expter.; none on 2nd; 2) look straight ahead; turned back to subject; 3) look straight ahead; closed eyes; 4) blindfold over eyes; blindfold over mouth; 5) plain mask next to face; face covered by mask; 6) look straight ahead; avert eyes to right.
www.chimpcenter.osu.edu

Thursday Afternoon (12:00 – 6:15)

Ordinality, Magnitude, & Distance (Chair, Michael Brown)

12:00 Herbert Terrace (Columbia University & NY State Psychiatric Institute)
17-20
Cognitive Psychophysics in Rhesus Macaques
Magnitude and distance effects have been obtained from human subjects, both with numerical (Arabic numeral or number of geometrical elements) and arbitrary (letters of the alphabet) stimuli. Here I describe experiments in which magnitude and distance effects were obtained from monkeys trained on numerical and arbitrary lists. Arbitrary lists were composed of photographs; numerical lists of geometric stimuli of various sizes, colors and shapes. Subjects were then given 2-item subset tests consisting of all possible pairs that could be drawn from the arbitrary lists or all possible pairs that could drawn from numerical stimuli containing 1-9 elements. With distance held constant, the reaction time (RT) of the response to the first member of a subset increased linearly with the position of the first member of the subset on the list on which it was trained (magnitude effect). With magnitude held constant, RT decreased as the distance between items increased. Using identical stimuli, similar results were obtained from human subjects.
www.columbia.edu/cu/psychology/primatecognitionlab/index.html

12:25 Stephen B Fountain, Melissa D Muller, & Denise P Smith (Kent State University)
18-10
Multiple Processes in Rat Sequential Learning
Three hypotheses have dominated the sequential learning literature: the sequential memory view, the rule learning view, and the serial position view. Proponents of each have at times argued that a single mechanism can account for learning in sequential tasks. We present evidence that in one sequential learning paradigm rats

monitor and learn from multiple sources of internal and external information concurrently, and doing so recruits multiple dissociable brain systems.
http://www.personal.kent.edu/~sfountai/

12:40 James D Rowan, Daniel C Werner, Amanda R Willey, Elise M Sims, & Eric L Landram (Bridgewater College of Virginia)
19-10
Varying Response Number in an Alternation Learning Task in Rats: Single, Double, Triple and Quadruple Alternation
Numerous studies have demonstrated that rats have great difficulty in learning a double alternation pattern as opposed to a single alternation pattern. This study examined the effect of chunk length on alternation learning. Rats were trained on a 24 element pattern of either a single (121212 etc.), double (11221122 etc.), triple (111222111222 etc.) or quadruple (11112222 etc.) alternation pattern for 5 patterns a day for 40 days. The results seem to contradict previous research in that performance on the double alternation pattern was better than on the single alternation pattern. Errors on the single alternation pattern were the highest when compared to all other groups. As expected, other than the single alternation pattern, rats' errors were highest at the switch points where the rat was required to change responding from one nosepoke receptacle to the other.

12:55 Brett M Gibson (University of New Hampshire), Edward A Wasserman (University of Iowa), & Alan C Kamil (University of Nebraska)
20-10
Pigeons Are Efficient Travelers
We presented four adult pigeons with 3 identical 1cm2 back and white stimuli that were displayed simultaneously on a computer screen; the location of each stimulus was determined randomly prior to each trial. Each pigeon had to peck all three stimuli once in any sequence to receive a food reward. The route the pigeon took to "travel" to all of the stimuli was recorded and compared to all possible routes that could potentially be taken for a given problem. Four and five stimuli were presented on the screen during a second and third experiment, respectively. The routes the pigeons used to "travel" to the stimuli were reliably more efficient then those used by a Monte Carlo simulation given the same problems. Pigeons were significantly less efficient than a nearest neighbor model of performance, however.

Timing Processes (Chair, Russell Church)

1:20 Melissa Bateson (University of Newcastle)
21-10
Temporal averaging in foraging starlings
Animals are universally risk-prone for variance in delay to reward, preferring an option offering a variable delay over one offering a fixed delay equal to the arithmetic mean of the delays in the variable option. A number of different functional and mechanistic models have been proposed to explain this preference. These models differ in the predictions they make regarding the value of the fixed delay at which a subject should become indifferent between a fixed and variable-delay option. I present an experiment on European starlings (*Sturnus vulgaris*) designed to separate these models by identifying this indifference point. The data show that indifference occurs when the fixed delay is close to the harmonic mean of the delays in the variable option. This result rejects the scalar timing theory-based account of choice between delayed rewards.

1:35 Richard Keen, Paulo Guilhardi, & Russell Church (Brown University)
22-10
The Effects of Response Contingency on Timing
The goal of the present study was to examine how the contingency between response and reinforcement affects timing behavior. In appetitive head entry experiments, groups of rats received food contingent on its head being in the food cup (Dwell), its head entering the food cup (Entry), or independently of any response (Classical). These contingencies were either in a fixed interval or random interval procedure. The reinforcement schedule (Fixed or Random) affected the response distribution. Response contingency (Dwell, Entry, or Classical) affected the probability of a response but not the response distribution. The conclusion was that response contingency affects response rate, but not timing.

1:50 Mika LM MacInnis (Brown University)
23-5
The Effect on Behavior of Stimulus Onset, Termination, and Presence
The problem was to determine how the onset, termination, and presence of a stimulus influences behavior. In this experiment, each of 24 rats was trained on three instrumental appetitive head entry procedures in which food was available only at a single time in each procedure, 10, 30, or 110 s following the beginning of the cycle. A stimulus traditionally is a filled interval that provides two time markers, onset and termination. To examine their effects, on each cycle either zero, one, or two discrete events, or a filled stimulus, was presented. The results indicated that the food-to-food interval, the stimulus-onset-to-food interval, and the termination-to-food interval influenced the pattern of response, while the presence or absence of a filled interval did not change the response pattern.

1:58 Paulo Guilhardi (Brown University)
24-5
Predicting Choice on the Basis of Behavior on the Alternatives
The goal was to determine whether choice behavior between alternatives could be predicted from a combination of the behavior to each of the alternatives. Twenty-four rats were trained on two signaled peak intervals (e.g., 15 and 60 s) that were presented at the same or different times. Half were trained with a single lever, and the others were trained with different levers for the two intervals. The peak functions indicated that the rats learned both the times and the combination. A simple quantitative rule based on the alternatives accounted for the choice performance.

2:06 Jonathon D Crystal (University of Georgia)
25-5
Long-interval timing
It is generally believed that intervals below the circadian range of entrainment cannot be timed. The present data document that 16-hour intervals are anticipated. Two mechanisms of anticipation were tested. Timing based on an endogenous oscillator is predicted to be self-sustaining, meaning that multiple cycles of behavior should occur after the termination of periodic, environmental input. In contrast, a pacemaker-accumulator mechanism is not self-sustaining. The present data document that 16-hour intervals are timed after the termination of periodic input (i.e., self-sustaining). The conclusion is that long-interval timing is based on an endogenous, self-sustaining oscillator.

2:14 Rona Russell & Kimberly Kirkpatrick (University of York)
26-5
A demonstration of the instability of temporal bisection
Previous studies have shown that the bisection of two intervals occurs near the geometric mean (with some notable exceptions). Temporal bisection at the geometric mean has been an important factor in distinguishing between different timing theories. We investigated the bisection point of relatively long intervals, Rats were trained to press one lever following a short duration and press a different lever following a long duration; testing was conducted using a maintained generalisation procedure and a range of test stimuli that fell both between the training stimuli and extended beyond them. The results indicated that when rats were trained to discriminate a particular pair of stimuli, different ranges of test stimuli revealed different bisection points. The location of the bisection point also changed over the course of testing. These results will be interpreted within the framework of an adaptation level account.

Social learning (Chair, Clive Wynne)

2:30 Francys Subiaul (Columbia University), Jessica F Cantlon (Duke University), Ralph L Holloway (Columbia University), & Herbert S Terrace (Columbia University & NY State Psychiatric Institute)
27-10
Cognitive Imitation in Rhesus Macaques
Two adult rhesus macaques were trained to execute 4-item lists composed of arbitrary photographs that were presented simultaneously on a touch-sensitive monitor. Random changes in their configuration prevented subjects from learning list as a motor-spatial sequence. Subjects were trained in a chamber with glass walls on adjacent sides. When an opaque partition was placed between the walls, subjects had to learn new lists by trial-and-error (baseline condition). However, when the partition was removed, subjects could see into the adjacent chamber and learn a new list from an expert model (social condition). Lists learned in the social condition, significantly differed from lists learned in baseline ($p < .01$). However, lists learned in a social facilitation or computer feedback control condition did not differ from baseline performance ($p > .20$). These results offer the first evidence that monkeys can acquire serial knowledge vicariously from another monkey.

2:45 Emily D Klein, Nam H Nguyen, & Thomas R. Zentall (University of Kentucky)
28-5
Imitation of a Two-Action Behavioral Sequence by Pigeons
Imitation of a single response has been demonstrated repeatedly in birds. Here we examined the extent to which pigeons would imitate an unfamiliar sequence of two behaviors. The behavioral sequence consisted of a response to a treadle (either pecking or stepping) followed by a pushing response to a screen (to the left or to the right) to gain access to food. Results indicated that, although there were individual differences in the tendency to imitate, the pigeons showed a significant tendency to match the demonstrated sequence of behavior.

2:53 Wendi Fellner (Epcot's Living Seas) & Gordon B Bauer (New College of Florida)
29-5
Synchrony characteristics of neonate bottlenose dolphins change at the onset of nursing
Synchrony among dolphins is a ubiquitous trait that has been described in association with many typical activities, such as traveling, foraging, and social interactions. The synchronous behaviors between a mother and calf are of particular interest as this early experience may lay a foundation for adult synchronous interactions. Nine mother-calf pairs of dolphins were observed for characteristics of synchrony, including proportion of time spent in synchrony, body positioning, and swimming path. Observations were divided into three phases: pre-nursing, novice nursing, and skilled nursing. From pre-nursing to skilled nursing, time spent nursing increased (0% to 5%) as well as time spent with the calf near the mammary area in infant position (2% to 16%). Contrarily, time spent in direct contact with each other decreased (81% to 55%). This change may indicate a shift from direct physical control by the mother to more cooperative synchronous movement mediated by learning.

3:01 Adrienne M Cardwell (The Mirage Dolphin Habitat) & Heidi E Harley (New College of Florida & The Mirage Dolphin Habitat)
30-5
Cooperative Matching-to-Sample by Bottlenose Dolphins
Two dolphins have learned to perform a cooperative matching-to-sample task. First, each blind-folded dolphin learned to perform an echoic 3-alternative matching-to-sample task with great accuracy (>95%). Then the pair was trained to perform the task cooperatively. They were positioned on opposite sides of a 3-object array. At the beginning of each trial, Dolphin Sample submerged and echolocated the sample while Dolphin Choice hauled out of the water and did not experience the sample. After the sample presentation, Dolphin Choice returned to the water and chose an object from the array. Both dolphins were reinforced only when Dolphin Choice chose the alternative that matched the sample. Each dolphin learned to perform both roles. In the most recent seven 18-trial sessions with each dolphin as Dolphin Choice, choice accuracy was 65% for one dolphin, 75% for the other (chance=33%). Mechanisms mediating choice accuracy in the cooperative task are currently under investigation.

Snack Break

Poster Session (3:45 – 6:15) 30 Posters

Stephanie J Babb & Jonathon D Crystal (University of Georgia)
31-P
Spatial memory in rats after 25 hours
We investigated the time course of spatial-memory decay in rats using an eight-arm radial maze. It is well established that performance remains high with retention intervals as long as 4 hours, but declines to chance with a 24-hour retention interval (Beatty & Shavalia, 1980). We reasoned that the chance performance could be due to the similarity of the retention interval and the inter-trial interval (both are 24 hours). Consequently, we used a 48-hour inter-trial interval, and the retention intervals were 1 and 25 hours. The rats were forced to visit four baited arms, followed by a retention interval and then access to all eight arms. Performance (mean +/- SEM) was above chance (45%) after the short (84.5% +/- 2.7%) and long (65% +/- 2.1%) retention intervals. Rat spatial memory apparently lasts at least 25 hours.

Aaron P Blaisdell & Kosuke Sawa (University of California, Los Angeles)
32-P
CS-Reminder induced recovery from overshadowing in an appetitive Pavlovian preparation
A number of experiments using conditioned suppression in rats have demonstrated that the overshadowing deficit can be reversed. For example, post-training exposure to the overshadowed CS prior to testing (i.e., a reminder treatment) and post-training extinction of the overshadowing CS have both been shown to alleviate the overshadowing deficit. These demonstrations suggest that overshadowing is due to a performance deficit rather than an acquisition deficit. However, prior studies using appetitive conditioning or conditioned taste aversion have failed to demonstrate recovery from overshadowing through extinction of the overshadowing CS. This suggests that retrospective revaluation effects, such as recovery from overshadowing, may be specific to conditioned suppression procedures. We report successful recovery from overshadowing of appetitive conditioning through a CS reminder treatment, thereby establishing the generality of retrospective revaluation effects.

Jessica F Cantlon, Kerrie Lewis, & Elizabeth Brannon (Duke University)
33-P
Monkeys Count up and down: Conditional numerical ordering in rhesus monkeys
In previous research rhesus macaques were trained to order numerosities in an ascending or descending direction (e.g., Brannon & Terrace 1998, 2000; Brannon, Cantlon, & Terrace, in prep). These studies demonstrated that monkeys represent ordinal numerical relations but also suggested that monkeys used the first value in a numerical training sequence as a reference point. To further investigate the effects of directional training on the numerical comparative process, we trained macaques to order the numerical values 1-9 in both ascending and descending directions conditional upon a color cue. Accuracy on numerical pairs was comparable when cued to respond in ascending or descending order. Monkeys were subsequently tested with larger numerical values (10-80) under non-differential reinforcement. Results of these experiments offer important insights into the comparative process macaques use to make ordinal numerical judgments and the effects of initial training on performance.

Dana L Church (University of Ottawa)
34-P
How Do Bumblebees Spatially Encode Artificial Flowers in a Laboratory?
Previously, bumblebees were presented a row of artificial flowers in a flight cage, one offering reward (S+). Each bee was trained to obtain nectar from the S+ and then individually tested using empty (i.e., unrewarding) flowers. Chosen flower position and response type (approach, land, or probe) were recorded. Test manipulations

revealed that the presence or absence of ostensible scent marks was inconsistent in predicting choice of, and behaviour on, test flowers, and that memory for absolute position of the S+ was used in choosing flowers. Thus, the S-s were not used as landmarks. The next step was to determine whether the S+ was remembered using egocentric or allocentric cues. Using similar methodology, bees were given the choice of two flowers during testing: one would be chosen if the bee used dead reckoning, and the other if the bee used some external cue(s).

Tara K Clarke, Nicole M Naniche, Caitlyn H Owens, & Charles J Heyser (Franklin and Marshall College)
35-P
Selection of Objects in Exploration Tasks
Object exploration is an increasingly popular experimental paradigm. This task is appealing because there is no explicit need for food or water restriction and several behavioral endpoints can be obtained rapidly including: general activity, reactivity to novelty, and learning (e.g. recognition memory). After our initial use of the novel object exploration task it became clear that the selection of objects is of critical importance and special attention should be given to the species-typical behavior of the organism. The key is that an animal may recognize that some object is novel, indicating that it remembers what objects were present before, but may not explore the object due to differences in affordances among the objects. Results from these initial studies along with the effects of stress on object exploration will be discussed.

Ellen E Furlong, Megan J Bulloch, Klaree J Boose, & Sarah T Boysen (Ohio State University)
36-P
Raking It In: Chimpanzees Recognize The Mechanical Properties Of Tools
There is conflicting evidence as to whether nonhuman primates understand causal relationships, particularly during tool use. Povinelli (2000) described 27 tool tasks that his 7 adolescent chimps typically failed. We recently replicated several tasks, including the flimsy vs. rigid tool task to examine if our 9 chimpanzees (ages 3 û 44 yrs) would choose the appropriate tool based on its physical properties. The chimps were given two rakes (one flimsy and one rigid) to acquire a food reward, but only the rigid tool was functional. All subjects were successful (Overall CR: 75%, $p < .01$). A second study will examine tool use in 2 tasks, requiring a rigid and flimsy tool, respectively. These results suggest that chimpanzees readily grasp the nature of the physical relations between a tool and reward, likely mediated by the same conceptual understanding related to folk physics observed in human infants (Brown, 1990).

Elizabeth V Hallinan, Jeffrey R Stevens, & Marc D Hauser (Harvard University)
37-P
But Wait, There's More! Temporal Discounting In Cotton-Top Tamarins (*Saguinus oedipus*) And Common Marmosets (*Callithrix jacchus*)
Although probably all animals discount future rewards, the extent to which they discount varies across species. The discounting rates of two callitrichid primates, cotton-top tamarins (*Saguinus oedipus*) and common marmosets (*Callithrix jacchus*), were estimated using an adjusting-delay procedure in which subjects chose between a small food reward at fixed delays and a larger food reward at varying delays. For both species, the value of the reward decreased rapidly with increasing delay; however, tamarins discounted at a higher rate than marmosets. The differences in discounting rates between the two species may be attributed to differences in feeding ecology.

Robert R Hampton & Elisabeth A Murray (National Institute of Mental Health)
38-P
Dissociation of Memory Systems by Perirhinal Cortex Removal in Rhesus Monkeys Using a Process Dissociation
Dissociations of memory systems are typically made using different cognitive tests. However, it can be argued that such tests are never pure measures of a single memory system, because multiple systems are always active. In process dissociation procedures (PDP) two memory processes both cooperate and interfere in performance of a single cognitive test, thus permitting quantitative estimates of the contributions of each process (e.g. Hay & Jacoby, 1996). We used PDP to measure the contributions of habit and recognition memory to visual matching-to-sample. To produce habits a subset of images was correct, and rewarded, more frequently than others across days. The results dissociate recognition memory and habit within a single cognitive test, and emphasize the importance of perirhinal cortex for recognition memory. PDP can be applied in monkeys in a way that parallels its use in humans, thereby providing a new tool for investigating the neurobiology of memory in nonhumans.

Megan L Hoffman & Bennett L Schwartz (Florida International University)
39-P
Communication Of Where An Event Occurred By A Gorilla (*Gorilla gorilla* gorilla)
Episodic-like memory for the location where a novel event occurred was examined in an adult male gorilla (*Gorilla gorilla* gorilla). The gorilla witnessed a unique event, performed by an experimenter (e.g. watching an experimenter blow bubbles) at one of three distinct locations surrounding his enclosure. After a 4 to 17 minute retention interval, an experimentally blind tester presented the gorilla with photographs of the three locations, which were mounted on wooden cards, and asked the gorilla where the event occurred. The gorilla communicated his choice by handing a card to the tester. The gorilla identified the location where the event had occurred on 45% of the trials, which was significantly above chance (33%). Results suggest that the gorilla was not responding on the basis of familiarity (that is, by choosing his most recent location in the enclosure), but choosing the location where the novel event occurred.

Erica A Hoy & Dorothy M Fragaszy (University of Georgia)
40-P
Monkeys and Mazes: To what extent do capuchin monkeys (*Cebus apella*) plan their actions when solving two-dimensional detour problems?
Planning was examined in four capuchin monkeys who completed a series of 192 two-dimensional computer mazes. These mazes differed in terms of number of choice points (0-5) and number of "non-obvious" choices (0-3). Non-obvious choices were those in which the incorrect choice appeared to lead more directly to the goal than the correct choice. The number of choices and non-obvious choices varied randomly throughout the testing sequence. Planning abilities were measured in terms of the frequency and type of errors made by subjects while navigating through the mazes. Results of this study were compared to those of a similar study in which three capuchins solved the same computer mazes in order of increasing difficulty. In addition, we investigated the apparent inability of subjects in the present study to inhibit incorrect moves including "dead-ends" and reversals.

Kerry E Jordan & Elizabeth M Brannon (Duke University)
41-P
Cardinal number representation in rhesus macaques
We used a delayed match-to-sample task to test the abstract nature of cardinal number representations in non-human primates. First, three rhesus monkeys learned to match visual arrays of 2 and 8 elements based on number, regardless of continuous dimensions (such as surface area). Secondly, monkeys were tested with samples of 1-9 elements and test stimuli of 2 and 8 elements. The probability that monkeys selected the stimulus with 8 elements systematically increased with sample numerosity. Further experiments tested macaques' abilities to make more precise numerical matches (e.g., match 4 small red circles with 4 large green circles of a different spatial configuration) and the effect of varying sample duration on accuracy. These experiments provide evidence that rhesus macaques possess abstract cardinal number representations, interpolate novel values along an ordinal continuum, and use a ratio comparison rule. Future investigations will test monkeys' abilities to match across modalities based on number.

Juliane Kaminski, Juliane Bräuer, Josep Call, & Michael Tomasello (Max Planck Institute for Evolutionary Anthropology)
42-P
A comparison of the use of causal and communicative cues in an object choice paradigm between dogs (*Canis familiaris*) and chimpanzees (*Pan troglodytes*)

Dogs are outstanding in their ability to use different communicative cues independent from their age or experience with humans. Chimpanzees as our closest relatives to some degree solve different causal problems but fail to use communicative cues in the object choice task. One hypothesis is that understanding causality is a very important skill for undomesticated species whereas using communicative cues is important for domesticated species. A direct comparison of chimpanzee to dogs, could give an answer to this question. In our study we presented dogs and chimpanzees with the same experimental setup testing different kinds of cues. Some of the cues were social and communicative, some of them were social and intentional and some were causal. The results suggest that dogs are significantly better than the chimpanzees in using all the different social cues, whereas the chimpanzees are significantly better than the dogs in using the different causal cues provided.
http://www.eva.mpg.de/psycho/index.html

Nate Kornell & Herbert S Terrace (Columbia University & NY State Psychiatric Institute)
43-P
Information Seeking in Rhesus Macaques
An earlier experiment showed that monkeys can assess the accuracy of their responses on a memory task retrospectively. Here we investigate their ability to evaluate uncertainty prospectively, and to request more information when they are uncertain. Two rhesus macaques were trained in a simultaneous chaining paradigm to touch four arbitrarily selected photographs in a fixed order on a touch sensitive monitor. If a subject didn't remember the correct order, he could request a hint in the form of a border that flashed around the correct item. This "hint" could be requested for any or all items within a given trial. Correct responses were rewarded with a 190 mg banana pellet on trials completed with the benefit of one or more hints, or a highly preferred M&M on trials completed without hints. Subjects requested hints mainly during training on a new list but not after they had learned it well. This shows that monkeys will seek information when they are uncertain about their memories.

Shannon MA Kundey & Laurie R Santos (Yale University)
44-P
What happened where, when? Examining episodic-like memory in Capuchins (*Cebus apella*)
Humans' memory for what, where, and when of personal events is termed episodic memory. Many researchers have questioned whether nonhuman animals share this ability. Without the capacity for language, many have argued, an organism could not possibly represent or reason about events in a similar way to humans. Clayton's recent work with food-storing jays suggests that several features of episodic memory might not be exclusive to humans. However, many have been wary of accepting these claims. Our lab seeks to develop a paradigm to examine episodic-like memory in nonhuman primates (hereafter, primates). Is it reasonable to think that the ability to represent personally significant events emerged only in humans and not our closest primate relatives? Moreover, are there situations in primates' lives where we could reliably observe episodic-like memory, if it exists? Like humans, many primates lead complex lives that require tracking enormous amounts of information (i.e. food sources and social encounters). The complexity of their lives suggests that the capacity to represent episodic-like memories would afford advantages to primates in successfully negotiating their complicated world. This poster highlights our progress in examining episodic-like memory in primates.
http://pantheon.yale.edu/~lrs32/

Katherine A Leighty (University of Georgia)
45-P
Object Recognition from 2D Images in Chimpanzees (*Pan troglodytes*)
Studies show that nonhumans can equate 3D objects and 2D depictions, but have not determined if this is done by representing the object's global form or matching for local details across dimension. I attempt to parse out these alternatives by interactive cross-dimensional search task. In experiment 1, subjects haptically searched a 2D depiction of a 6-door cabinet via a touchscreen. The cabinet was constructed such that local details were equated. Upon revealing the food reward, subjects were presented with the 3D cabinet and their door choices were recorded. In experiment 2, distinctive local details were added above each cabinet door. Subjects did not perform above chance levels in experiment 1. Results from experiment 2 and further experiments will determine the subjects' comprehension of this task as well as the ability to develop a global examining the abilities of 4 adult symbol-using chimpanzees to complete an representation from a 2D image.

Jody L Lewis & Alan C Kamil (University of Nebraska -Lincoln)
46-P
How do nutcrackers minimize interference? Testing the effect of inter-list intervals
Recently, we have demonstrated that Clark's nutcrackers, despite their excellent spatial memory abilities, are subject to proactive and retroactive interference. Previous studies with rats have shown that an increase in the interval between spatial lists can reduce interference effects on recall. In order to determine the effects of inter-list interval on nutcrackers, we are testing memory for lists of spatial locations using a win-stay procedure in an open room. Each bird is tested for recall of two consecutive lists with either a long or short interval between. We expect that a longer (60 minute) interval between lists will lessen the effects of proactive interference compared to a shorter (5 minute) interval.

Kerrie P Lewis, Sarah Jaffe, & Elizabeth M Brannon (Duke University)
47-P
Numerical cognition in prosimian primates
While the study of cognition in monkeys and apes is a broad and burgeoning area of research, there is a great paucity of research addressing cognitive processes in prosimians. Here, we present two investigations conducted at the Duke University Primate Center, examining the quantitative capacities and learning abilities of two species of lemur: ring-tailed lemurs (*Lemur catta*) and mongoose lemurs (*Eulemur mongoz*). Various studies have documented that the food quantity judgments of primates are sensitive to the ratio of the quantities compared (e.g., Beran, 2001; Call, 2000). In accordance with these studies, we present a series of experiments demonstrating that lemurs' food quantity judgments follow Weber's Law. In a second set of experiments, we demonstrate that lemurs can be tested in a touch-screen paradigm and are able to learn 3- and 4-item lists. These studies suggest fundamental similarities in number and list-learning abilities in prosimian and anthropoid apes.

Dustin J Merritt & Herbert S Terrace (Columbia University & NY State Psychiatric Institute)
48-P
An analysis of transitivity in rhesus macaques
The current set of experiments was designed to examine how monkeys organize and represent lists during inferred-order judgment tasks. Two monkeys were trained on a transitive inference task (A>B, C >D, etc.), and were later tested with non-adjacent pairs selected from both within and between lists (B>D, C>E, etc.). Performance was above chance during testing, and further, accuracy and reaction time patterns were consistent with both ends-inward scanning processes (positional and associative), as well as positional comparison processes. To discriminate between these mechanisms, associative interference was created by training adjacent positions with one of two possible items per position, each appearing randomly per trial. The findings suggested that the monkeys used positional information when making order judgments. Current experiments are examining whether the positional information is relative or absolute, and whether accuracy and reaction time patterns shown by monkeys are qualitatively similar to those demonstrated by human subjects.

Christina L Miner (Emory University), James D Rowan (Bridgewater College of Virginia), P. Taylor Johnson (Tufts University), & Shannon MA Kundey (Yale University)
49-P
Rule-Flexibility in Humans and Rats in Serial Pattern Learning: Pattern Dispersal
Studies of serial-pattern learning have revealed that rats and humans are capable of both learning and using rules. However, the literature has failed to adequately address the issue of whether both species are capable of transferring learned rules to novel situations in serial patterns. In an experiment using rats and humans as subjects, half of each species were transferred to a reversed three-chunk pattern interleaved with 8's, and the remaining subjects were transferred to a reversed four-chunk pattern interleaved with 8's. Subjects, both humans and rats, in all groups learned to track their pattern. Additionally, subjects transferred from a three-chunk pattern to a reversed, dispersed three-chunk pattern to a reversed, dispersed three-chunk pattern showed savings in comparison to all other groups. The results support the idea that rats and humans form a flexible representation of a given pattern and are capable of transferring previously learned information to a novel, complex situation.

Tammy D Moscrip (Columbia University), Herbert S Terrace (Columbia University & NY State Psychiatric Institute), Harold A Sackeim (New York State Psychiatric Institute), & Sarah H Lisanby (New York State Psychiatric Institute)
50-P
A Primate Model Of The Cognitive And Electrophysiological Effects Of Electroconvulsive Shock (Ecs) And Magnetic Seizure Therapy (Mst)
Although electroconvulsive shock (ECS) is the most effective treatment for depression, it can produce both anterograde and retrograde amnesia as side effects. Like ECS, magnetic seizure therapy (MST) induces generalized seizures, but, because it is more focused than ECS, it may induce less severe cognitive impairment. We assessed the cognitive effects of ECS and MST in nonhuman primates and also measured the electrophysiology of induced seizures. Rhesus macaques were trained on a cognitive battery composed of tests of long-term, short-term and serial memory. Subjects completed most tasks more rapidly and more accurately following MST than ECS. These differences were greatest on the tasks measuring short-term memory and the recall of 3-item lists. Intracerebral EEG recordings revealed that ECS produced greater global power and induced-voltage than MST, in particular, in the hippocampal region. It appears, therefore, that the frontal and hippocampal areas may be more sensitive to the effects of seizures induced by ECS than by MST.

Tadd B Patton, Scott A Husband, & Toru Shimizu (University of South Florida)
51-P
Seeing Is Not Enough: ZENK Expression for Visual Conspecific Recognition in the Avian Brain
Little is known about the brain structures associated with visual conspecific recognition. In order to isolate such brain regions, we studied distribution patterns of the immediate early gene protein, ZENK, which is believed to be a crucial step in long-term memory formation. Male pigeons were exposed to different visual stimuli (e.g., live females, videotaped females) and then their brain tissues were examined to evaluate ZENK expression. Results showed that several visual and non-visual structures exhibited more ZENK than other regions. Furthermore, although the subjects courted similarly to both live and videotaped females, the live female stimulus triggered more numerous and intensely stained ZENK than the videotaped stimulus. This suggests that the courtship behavior itself was not directly related to the increased ZENK expression. The real-time interactions with a live potential mate, rather than passive visual stimulation, were important for increased ZENK expression in the higher visual areas.
http://chuma.cas.usf.edu/~shimizu

Matthew J Pizzo & Jonathon D Crystal (University of Georgia)
52-P
Evidence for an alternation strategy in a daily time-place task
There has been some controversy over what type of mechanism rats use to solve a daily time-place task. Rats (n=10) were tested twice daily in a T-maze. Food was available at one location in the morning and at the opposite location in the afternoon. After the rats learned to visit each location at the appropriate time, omission tests were conducted to evaluate whether the rats were utilizing time of day or an alternation strategy. Performance on this test was significantly lower than chance. A second manipulation involving a phase advance of the light cycle was conducted to test the alternation strategy and timing with respect to the light cycle. There was no difference between probe and baseline performance. These results suggest that the rats used an alternation strategy in a daily time-place task.

Jesse E Purdy (Southwestern University)
53-P
Empirical and Functional Analyses of Trills in Male Weddell Seals
Thomas and Kuechle (1982) documented that the Weddell seal produces twelve distinct calls that are subdivided into 34 different Call Types. These Calls are categorized on the basis of frequency, duration, repetition rate, and the presence or absence of harmonics and/or auxiliary sounds. The 12 Calls are designated with letters and include T, G, P, E, C, H, K, A, R, Z, L, and M. It appears that only male Weddell seals produce T, R, E, G, and A vocalizations. Calls C, P, K, M, H, and Z are used by both male and female seals. It is not clear whether L sounds are gender specific. In general, males are more vocal than females and Weddell seals are more vocal during the reproductive season (October-December) than at other times of the year. Parijs, Lydersen, and Kovacs (2003) used sophisticated hydroaccoustical arrays to record the trill vocalizations of bearded seals in the Arctic. The authors found significant individual variation in trill vocalizations that correlated with different mating strategies. In essence Parijs, et al., showed that territorial males had significantly longer trill vocalizations. Males using a "roaming" strategy were less successful and their trills were shorter on average than "territorial" males. Given that territorial males appeared to enjoy greater reproductive success, the authors argued that trill duration might indicate male quality in bearded seals. In the present study, we sought to determine if individual variation of trill characteristics existed in male Weddell seals and, if so, could these differences be used by females to predict male quality. We examined trill characteristics of a focal Weddell seal male as it defended its hole against several males and attempted to attract female seals over a period of six weeks. Preliminary analyses of the trill vocalizations suggest that whereas measures of frequency modulation remain fairly constant over the breeding season, the duration of the trills tended to increase over the course of the breeding season. In addition, it appears that trill duration of the resident male was longer on average than the trills of background males. Results are discussed in light of the reproductive strategies of male Weddell seals and their counterparts in the Arctic, the bearded seals.

Carrie R Rosengart & Dorothy M Fragaszy (University of Georgia)
54-P
Motor Priming in a Spatial Memory Task in Capuchin Monkeys (*Cebus apella*)
The A-not-B task has been used to determine if individuals can correctly find an object hidden at a new location (B) after multiple trials where it has been hidden at an original location (A). If motor priming is responsible for impairment of B trial search accuracy, then trials with shorter search latencies should reflect the individual's initial impulse to search at the primed A location, resulting in an error. Six capuchin monkeys were tested to determine the role of motor priming in B trial performance deficits in recall and recognitions tasks, with delays between hiding and the opportunity to retrieve the food reward either 0s or 10s. Latency was measured as the time between search access and the first search attempt. In both recall and recognition tasks, longer delays and shorter search latencies impaired performance indicating that motor priming is partially responsible for errors.

Kathryn A Saulsgiver, Erin McClure, & Clive D Wynne (University of Florida)
55-P
Effects of Amphetamine on Symbolic Matching to Sample of Duration stimuli in pigeons
We studied the effects of 0.75, 1.5, 2.25, and 3.0 mg/kg of d-amphetamine on pigeons' performance on a Symbolic Matching to Sample Duration procedure. The houselight was illuminated for either 2 or 8 s (randomized across trials) followed immediately by red and green illumination of two pecking keys. Responses on the red key were reinforced following 2 s houselight presentations and on the green key after 8 s duration stimuli. Four intervening values were added: 2.6, 3.48, 4.6, and 6.1 s û where responses on red were reinforced for durations under 4 s; and responses on green for durations over 4 s. Comparisons of psychophysical functions obtain before, during and after drug administration were compared. A general flattening of the sigmoid curve occurred under drug administration at higher doses, indicating a disruption in the perception of all durations. Results are interpreted in terms of amphetamine's effects on stimulus control of behavior.

Mark S Schmidt, Jennifer R Warhawk, & Joseph A Garcia (Columbus State University)
56-P
Numerousness Discrimination in Rats
Three experiments were conducted to test rats' ability to acquire conceptual two-choice visual numerousness discriminations. A touch-screen presented stimuli (white dots) and recorded responses. In Experiment 1, three rats were trained on a 3:4 discrimination with trial-unique dot displays (probes) presented on either 20% or 5% of trials. All subjects performed at chance on both training trials and probes. In Experiment 2, four rats were trained on a 3:6 discrimination with probes presented on all trials. All subjects performed at chance. In Experiment 3, four rats were trained on a 2:5 discrimination without probes. All subjects learned this discrimination. Probes were then presented on 25%, followed by 75% of trials. All subjects performed significantly above chance on the probes indicating acquisition of a conceptual numerousness discrimination. Testing continues to determine the nature and limits of this ability in these subjects.

Marcia L Spetch & Alinda Friedman (University of Alberta)
57-P

Do pigeons recognize the correspondence between objects and images of the objects?
Static images of objects or scenes presented on computer monitors are increasingly used to study cognitive processes in pigeons. Nevertheless, evidence that pigeons recognize the correspondence between images and real-life objects or scenes has been mixed. We investigated transfer of object discriminations from real objects to images and vice versa. Pigeons in one group were trained to discriminate between two identically-colored objects that differed in global shape. Pigeons in the other group were trained to discriminate between images of these objects. Following acquisition, pigeons trained with real objects were transferred to pictures and vice versa. Some pigeons were transferred with the same contingencies (positive object stayed positive) and others were transferred with reversed contingencies (positive object became negative and vice versa). Accuracy following transfer was compared for the same and reversed contingencies to determine whether the pigeons recognized the correspondence between the objects viewed directly and those seen in images.

Jeffrey R Stevens & Marc D Hauser (Dept. of Psychology, Harvard University)
58-P
Quantity discrimination in two callitrichid primate species
According to Weber's law, accuracy of discrimination between two amounts should increase with the ratio between their magnitudes. Two New World primate species - cotton-top tamarins (*Saguinus oedipus*) and common marmosets (*Callithrix jacchus*) - were tested in a quantity discrimination task. In this task, the monkeys could choose between two visible rewards (linear arrays of food pellets). As expected, both species chose the larger of the two rewards more frequently as the ratio of their magnitudes increased. Interestingly, marmosets tend to choose the larger reward more frequently than the tamarins, and marmosets appear to have a lower discrimination ratio. Despite similar ecology and social systems, tamarins and marmosets seem to have different quantification abilities.
http://www.wjh.harvard.edu/~mnkylab/

Daniel C Werner, Ashley E. Huddleston, Amanda R. Willey, Thomas W. Crosby, & James D. Rowan (Bridgewater College of Virginia)
59-P
The Effects, or Lack Thereof, of Interference on Double Alternation Learning: Double Alternation Versus Double Response
Rats have great difficulty in learning a double alternation pattern. Some explanations assume that in double alternation interference rapidly builds because of the limited number of stimuli choices (2) and the great number of trials. Traditionally, one way that interference has been lessened is by the use of a larger stimulus set to draw the responses from. In this experiment, rats' performance on a double alternation task is compared to performance on a double response task in which rats were required to make two nosepoke responses in a row and then switch to a nosepoke receptacle to the right in a circular array of 8 nosepoke receptacles. The results indicate that increasing the stimulus set from which the responses are drawn from has no effect on learning. The rats learned to produce a double response pattern in both cases and the groups did not vary in errors nor in the topography of the error profiles.

Patricia A Wilson & Herbert Terrace (Columbia University & NY State Psychiatric Institute)
60-P
Rhesus macaques recognize 4 list items in an unordered delayed-matching-to-successive-sample task
Two rhesus monkeys were trained on a delayed-matching-to-successive-sample task. The sample contained 3-4 arbitrarily chosen photographs. The same 3-4 photographs, along with 1-6 distracters, were presented simultaneously during the test phase of each trial. Subjects were rewarded for selecting all of the sample items in the list, in any order, without responding to any of the distracters. Both subjects were able to retrieve the entire contents of working memory (all 3 or 4 of the sample items) from arrays containing as many as 6 distracters. Accuracy, output order, and reaction time functions were analogous to those obtained in free recall experiments on adult humans. A strong recency effect was observed but there was no evidence of a primacy effect. The absence of a primacy effect, which is also common in children under the age of 5 (Flavell, 1966), may reflect subjects' inability to use a rehearsal strategy.

Angelo Santi & Chris Hope (Wilfrid Laurier University)
61-P
Pigeons' memory for number of light flashes: Effects of intertrial interval and delay interval illumination
Pigeons were trained to discriminate sequences of light flashes (illumination of the feeder) that varied in number but not time (2f/4s and 8f/4s). When the delay interval (DI) was dark, a choose-small bias was observed at DIs longer than the training DI, and a choose-large bias was observed at a DI shorter than the training DI. Differentiating ITI and DI illumination conditions did not attenuate these response biases. When the DI was illuminated, a choose-large bias was observed at DIs longer than the training DI. Increasing the duration of the second flash on small sample trials reduced accuracy to chance levels. Pigeons appeared to code these number samples by timing and summing flash duration rather than by using an event switch.
http://www.wlu.ca/%7Ewwwpsych/asanti/asanti2.htm

Gabriela L Bravo, Kerry McAuliffe, William D Stalhman, Ariel E White, & Roger KR Thompson (Franklin & Marshall College)
95-P
Spontaneous Selective Attention to Stimulus Dimensions by Macaque Monkeys (*M. mulatta*)
Unlike pigeons, (Wasserman et al, 2002) aged rhesus monkeys in a successive implicit discrimination task failed to reliably discriminate between "same & different" relations instantiated by arrays of either 16 identical or 16 non identical icons even after as many as in fifty 48-trial sessions (Flemming, et al., 2003). Were the comparatively poorer performances of the monkeys attributable to the abstract relational dimensions of the 16-icon stimulus arrays (i.e., relative entropy), age related visual deficits, or the response demands & reinforcement contingencies associated with the implicit task? Results from two aged rhesus monkeys tested with the same implicit discrimination procedure, but with discriminative stimuli varying in geometric form, size, and monochromatic color implicate perceptual insensitivity û spontaneous selective inattention - to the abstract dimensions of the multiple icon arrays as the discriminative handicap rather than either the discriminability of individual stimuli or the contingencies & response demands of the discrimination procedure

Fred Stollnitz (National Science Foundation
61A-P
Opportunities for NSF employment, reviewing, and support
The National Science Foundation (www.nsf.gov) supports research and education in comparative cognition, as it does in nearly all fields of science that are not disease-oriented.
Projects that integrate research and education are particularly welcome, as in the new Science of Learning Centers (SLC), Research in Undergraduate Institutions, Faculty Early
Career Development, Research on Learning and Education, Research Experiences for Teachers, Research Experiences for Undergraduates, and Undergraduate Mentoring in
Environmental Biology (defined broadly enough to include comparative cognition!). Research in comparative cognition is supported primarily in the Directorate for Biological
Sciences; single-focus projects are supported in the Animal Behavior Program, while large, multifaceted projects (e.g., SLC, Frontiers in Biological Research) are supported through
NSF-wide or Directorate-wide programs. The Directorate for Education and Human Resources supports projects for teacher enhancement; course, curriculum and laboratory
improvement, and informal education of the general public through zoo or museum exhibits, films or TV programs, etc. Opportunities to serve as a science assistant, as a program
officer, or as a reviewer are available in many NSF programs.

Friday Afternoon (12:30 – 6:30)

Spatial Cues and Spatial Control (Chair, Jon Crystal)

12:30 Michael F Brown & Jason Drott (Villanova University)
62-10
The effects of spatial patterns on spatial search
Rats searched for food hidden on top of vertical poles in a 5 X 5 matrix of poles. On each trial, half of the poles were baited. For all rats, the identity of the baited poles was unpredictable over trials. For some rats, the baited poles always formed a checkerboard spatial pattern. For other rats, the baited poles were chosen randomly on each trial. Differences in the search behavior and performance of these two experimental groups confirm that the checkerboard pattern controlled choices and provide information about the details of spatial pattern learning.

12:45 Debbie M Kelly, Erica Robak,& Alan C Kamil (University of Nebraska-Lincoln)
63-10
Encoding of Geometric and Featural cues in an open environment by Clark's nutcrackers
Many investigations examining the encoding of geometric and featural cues have used a fully enclosed search space (i.e., Cheng, 1986) where the shape of the enclosure provides geometric information and objects within the enclosure provide featural cues. We investigated the encoding of such information by Clark's nutcrackers using an open environment where discrete objects provide not only the featural information, but the rectangular configuration of the objects provides geometric information. Birds were trained to search for a reward at one corner of the array, the orientation of which varied across trials. Birds trained with four unique objects quickly solved the task, whereas after many sessions birds trained with four identical objects were unable to. Transformation tests examined whether birds trained with unique objects had coded the geometric properties of the array (even though this was not necessary to solve the task) and to determine how many of the objects were encoded.

1:00 Rebecca A Singer & Thomas R Zentall (University of Kentucky)
64-5
Effect of Proximal Cues on Cognitive Map Formation in Rats
We tested the ability of rats to form and use a cognitive map. Rats were trained to retrieve food rewards from goal boxes baited at the ends of the same two spatially distinct arms of a three-arm maze. Each arm, but not the goal box, was uniquely textured which allowed the rats to orient themselves within the maze. On test trials, rats were allowed to choose between two novel pathways from the center goal box, one of which led to the goal box that had been baited in training and the other which led to the goal box that had been empty in training. Results showed that the rats chose the novel shortcut that led to the arm that had been baited in training significantly above chance. These results indicate that in the absence of landmarks on test trials, rats were able to navigate using an internal map on their environment.

1:08 Shannon I Skov-Rackette & Sara J Shettleworth (University of Toronto)
65-5
Senseless Spatial Learning
Previous researchers have suggested that animals encode the overall geometry of arrays of objects when exploring them, but they have generally failed to control for a variety of non-geometric cues. Our earlier experiments suggested that while rats do encode some spatial relationships among objects in an array, such as inter object distances, they do not encode the overall shape of the array in the same way as they encode the geometry of enclosures. In the experiments to be described, responses to changes in the geometry of an array were tested by changing spatial relationships among three objects. Disoriented rats encountered a triangular array of objects while searching for randomly scattered food in a large arena that was devoid of landmarks. When the triangle was transformed into its mirror image, the rats did not reexplore, even when the objects were very distinct from one another. However they responded strongly when the identity of one of the objects was changed. Thus rats do not appear to encode sense (left-right relationships) in this situation, and this information may be encoded separately from identification information.

1:16 Sylvain Fiset (Université de Moncton, campus d'Edmundston)
66-5
Use of landmark configurations in domestic dogs
The aim of this experiment was to determine how domestic dogs use a configuration of landmarks to locate a spatial position. The dogs' (N=5) task was to find a buried object (a ball) hidden under a thin layer of woodchips in the middle of four identical landmarks. During training, the entire array of landmarks was moved about in the area from trial to trial. During testing, training and test trials were mixed. On control tests, the ball was removed. On expansion tests, the ball was removed and the size of the landmark array was double along one dimension or along both dimensions. Data revealed that on control tests, domestic dogs searched accurately at the center of the array. On expansion tests, dogs tended to search at locations that were approximately at the correct distance and direction from one or two landmarks. These results are discussed from a comparative perspective.

Mechanisms of Learning (Chair, Bill Whitlow)

1:35 Oskar Pineño & Ralph R. Miller (SUNY-Binghamton)
67-10
Spontaneous Recovery of Responding following Forward and Backward Blocking: The Role of Within-Compound Associations
We provide evidence of spontaneous recovery following both forward and backward blocking in a conditioned suppression preparation with rats. Experiments 1 and 2 found an attenuation of both forward and backward blocking following a retention interval. Experiment 2 showed that recovery of responding to the blocked stimulus cannot be explained by an impaired status of the blocking stimulus after a retention interval. Finally, Experiment 3 found that the within-compound association between the blocking stimulus and the blocked stimulus wanes during a retention interval. Therefore, Experiment 3 suggested that spontaneous recovery following both forward and backward blocking (Experiments 1 and 2) is due to an impaired associative activation of the blocking stimulus during testing with the blocked stimulus. Although no contemporary model of associative learning can explain these results, a modification of Miller and Matzel's (1988) comparator hypothesis is proposed to do so.

1:50 Nestor A Schmajuk & Jose A Larrauri (Duke University)
68-10
Attentional Coding by Dopamine Neurons
We show, through computer simulations, that an existing model of classical conditioning presented by Schmajuk, Lam, and Gray (1996) can replicate experimental results regarding (1) the activity of dopaminergic neurons in the ventral tegmental area of monkeys during conditioning with different probabilities of reinforcement, (2) dopamine release in the nucleus accumbens of rats during the different phases of latent inhibition, and (3) dopamine release in the nucleus accumbens of rats during the different stages of sensory preconditioning. Overall, the results seem to support the view that, in classical conditioning, dopamine codes variables related to attention.
http://psychweb.psych.duke.edu/department/cnlab/Fiorillo1.htm.

2:05 Karen L Roper (Wake Forest University)
69-10

Differences in the differential outcomes effect for reinforcer quality and reinforcer location in rats.
Rats that received qualitatively different outcomes (sweetened condensed milk or pellets) correlated with correct lever position in a tone/no tone conditional discrimination learned at the same rate as a group that was also given these qualitatively different outcomes in distinct spatial positions (differential presentation of the left or right feeder). Learning in both of these groups was faster than when outcomes differed only in terms of outcome location. Superiority of outcome quality on rate of acquisition was evident across two different tests of the quality/position conditions. In a transfer experiment, rats given both features of the outcome correlated with a correct choice were trained either on new samples or the same samples, and given either a partial reversal (only one feature consistent with the prior phase) or a full reversal (neither feature consistent) of these outcomes to further document this effect.

2:20 Kimberly Kirkpatrick & Domhnall Jennings (University of York)
70-5
Temporal predictability modulates the magnitude of the blocking effect in rats
Groups of rats received a blocking treatment in which initial training was given with a 30-s fixed (F) or random (R) duration stimulus that was followed by food delivery. In a subsequent testing phase, the rats then received either a 30-s fixed or random duration novel stimulus in compound with the pretrained stimulus (FF, FR, RF, RR). The rate of head entries into the food cup served as the measure of conditioning. All four conditions demonstrated a retardation in responding to the novel stimulus compared to control groups that received no pre-treatment. However, the magnitude of this retardation varied between conditions. The blocking effect was most robust in the RR group and was weakest in the RF group. The results indicate that temporal predictability modulates the strength of the blocking effect.

Predators, Prey, & Feeding (Chair, David Brodbeck)

2:30 Alan B Bond & Alan C Kamil (University of Nebraska, Lincoln)
71-10
Background heterogeneity and the evolution of polymorphism
We have used operant technology to devise a technique we call virtual ecology. In virtual ecology experiments, blue jays (*Cyanocitta cristata)* search for digital moths whose appearance is determined by a genome. When the probability of successful reproduction is made dependent on avoiding blue jay predation, these digital moths evolve. We can now use these procedures to test a variety of hypotheses about evolution in predator-prey systems. We have recently applied virtual ecology to pattern and scale, a central problem in ecology and evolution, but a notoriously difficult one to study empirically. Different populations of moths evolved under predatory selection by blue jays on resting backgrounds that varied in heterogeneity. The nature of the background affected the evolutionary path taken by the moth populations, demonstrating the importance of heterogeneity in the evolution of prey polymorphism.

2:45 Linda A Parker (Wilfrid Laurier University)
73-5
Is the rat gape the same as the shrew retch?
Rats don't vomit, but shrews do. When infused with a flavor previously paired with a treatment that produces vomiting in shrews, rats gape. anti-emetic drugs interfere with the establishment and the expression of lithium-induced conditioned gaping in rats. The shrew retch, which is topographically similar to the rat gape is displayed just prior to drug-induced vomiting. Is the rat gape a vestigial vomiting response in this non-emetic species?

Snack Break

A Celebration of the Influence of Donald Blough (Chair, Bob Cook)

3:40 Robert Cook (Tufts University)
75-15
The Search for Truth and Beauty
The capacity to attend to and locate relevant information in the varied backgrounds that comprise the world is critical to any foraging animal. The numerous and important contributions of the Bloughs to our understanding of the mechanisms of visual search are reviewed and placed in historical context. The central role of attention in these processes is emphasized. In addition, recent studies from our own lab will be presented examining the global and local factors in the visual search for structured information.

3:55 Russell Church (Brown University)
76-15
Methods and Models in the Study of Animal Cognition
The methods and models adapted and developed by Donald Blough for research with animals continue to have an important influence on animal cognition research. These include the experimental methods of animal psychophysics, the use of computers for all stages of research, simple quantitative functions relating procedural variables to behavioral measures, and quantitative models of psychological processes. An example will be given of these influences on a packet theory of timing. The goal of this theory is to generate times of responses from a large class of conditioning and timing procedures that are difficult to distinguish from those produced by animals tested on the same procedures.

4:10 William A Roberts (University of Western Ontario)
77-15
Donald Blough and The Study of Working Memory in Pigeons
In a classic article, Donald Blough (1959) demonstrated delayed matching-to-sample in pigeons. His paper described a procedure and findings that were the forerunnerof dozens of studies of short-term or working memory in pigeons. I will discuss some of the major findings inspired by Blough's technique, including the forgetting curve, directed forgetting, memory for time and number, and default coding.

4:25 Edward A. Wasserman, Olga F. Lazareva, & Shaun P. Vecera (University of Iowa)
78-15
Object discrimination in pigeons: The roles of global and local cues
Humans can selectively attend to individual objects in cluttered scenes. How might non-mammalian animals segregate a visual scene into multiple candidate objects? To help find out, we trained two pigeons with a DRH/DRL procedure to discriminate a pair of differently shaped and colored objects (e.g., a green oval and a red rectangle) that contained two target spots either on the same object or on each of the two different objects. Both pigeons learned this task, evidencing a strong discrimination between two classes of training stimuli (which varied in the orientation of the objects, the objects' absolute locations, the exact locations of the target spots, and which of the two shapes contained the two target dots on same trials). Follow-up tests disclosed strong control by the color, but not the shape of the objects. Furthermore, a colored region surrounding the dots proved to be critical, but not adequate to support the discrimination, suggesting that the pigeons attended to both local and global properties of the visual stimuli.

4:40 Ronald Weisman (Queen's University), Andrea Friedrich, Dennis Morrell, & Thomas Zentall (University of Kentucky)
79-15
Absolute Pitch: forget about whether music training matters; what matters is whether you are a mammal or a bird.
Absolute pitch perception (AP) refers to the ability to identify, classify, and memorize pitches without use of an external reference pitch. In previously published tests of AP, several species of birds and mammals were trained to sort contiguous tones into 8, 5-tone frequency ranges, based on correlations between responding to tones in each frequency range and reinforcement. Species from two avian orders (songbirds and parrots that learn complex songs and calls) had highly accurate AP in 8-range

discriminations. Two mammalian species (humans and rats) had poor AP; they acquired only a crude discrimination of the lowest and highest of 8 frequency ranges. In the present experiments, pigeons (an avian species with relatively simple unlearned calls) were more similar in their frequency-range discriminations to other avian species than to mammals.

5:10 – 6:10 Master Lecture

Donald Blough (Brown University) From Sensation to Cognition: Adventures in Quantitative Comparative Psychology

80

Banquet – Friday Evening (7:15)

Saturday (10:30 – 6:35)

Business Meeting of the Comparative Cognition Society (10:30 – 11:30)

All welcome to attend. Members of the society may vote.

Group Photo (11:35)

Communication (Chair, Ron Weisman)

11:45 Nicolas Mathevon & Thierry Aubin (Equipe 'Communications Acoustiques' NAMC CNRS)
81-10
Acoustic communication in tropical forest: How does the simple and stereotyped song of the White-browed Warbler transmit information?
An abundant bird of the Brazilian atlantic forest, the White-Browed Warbler *Basileuterus leucoblepharus*, presents a simple and stereotyped territorial song which is particularly sensitive to propagation through dense vegetation. Which information can be supported by this non-sophisticated and fragile signal? By acoustic analysis and playback experiments, we have shown that, for species-specific identification, birds use features resistant to degradation and ignore those sensitive to propagation. Conversely, information about individual identity is supported by acoustic cues susceptible to propagation-induced modifications. By playback experiments with propagated signals, we have shown also that white-browed warblers can assess the emitter distance by relying upon signal degradation. Finally, by modifying the duration of its songs, a bird may send information about its motivational state. Thus, in spite of the simplicity of its acoustic structure and of the propagation problems due to tropical forest, the song of the White-browed Warbler allows an efficient transmission of several important messages: species-specific and individual identities, location and motivation of the emitter.
http://www.cb.u-psud.fr/cb/index.html

12:00 David Mann, Mandy Hill, Brandon Casper (University of South Florida), Debborah E Colbert (Mote Marine Laboratory), Joseph C Gaspard III (University of South Florida), Roger L Reep (University of Florida), & Gordon B Bauer (New College of Florida)
82-10
Auditory Temporal Resolution of the Florida Manatee (*Trichechus manatus* latirostris)
Hearing sensitivities in two Florida manatees were assessed using auditory evoked potential methods. Preliminary results of these tests indicate that the frequency range of detection extends from at least 200 Hz (lowest frequency tested) to 40 kHz. The temporal resolution of the manatee auditory system was also indirectly measured using the Envelope Following Response (EFR) technique. This involves presenting an amplitude-modulated (AM) tone and measuring the effect of changes in the AM rate on the level of the evoked potential. Animals with higher temporal resolution abilities show responses to signals with higher rates of AM. Both manatees could follow rates of AM up to 600 Hz. These results are consistent with the relatively high frequency sensitivity of manatees (which is often directly related to temporal resolution), and they also suggest that manatees may have the ability to use time of arrival cues to localize underwater sound.

12:15 Clementine Vignal (Equipe Communications Acoustiques NAMC CNRS and TSI CNRS), Nicolas Mathevon (Equipe Communications Acoustiques NAMC CNRS), Stephane Ramstein (TSI CNRS), Stephane Mottin (TSI CNRS), & Thierry Aubin (Equipe Communications Acoustiques NAMC eCNRS)
83-5
Audience drives male response to mate's voice in Zebra finches
Behaviours and especially the attitude towards the opposite sex are influenced by social environment. Are male songbirds able to adjust their response to female voices depending on the particular composition of the audience? Using a playback experiment, we show that the vocal response of male Zebra finches to the calls of their regular mate is enhanced only in the presence of a mated pair, and then is significantly modified by the sex and the mating status of the audience, whereas their response to the calls of a familiar female is not.This individual recognition should rely on cognition processes of acoustic signals. An in-vivo and non-invasive neuromethod of investigation of cerebral activation linked to vocal communication remains a challenge: we develop femtosecond white laser transillumination of the intact head of the bird associated with time-resolved spectroscopy to probe variations of cerebral blood volume and haemoglobin saturation during acoustic processing.
http://www.cb.u-psud.fr/cb/index.html

12:23 Julia H Orth (New College of Florida) & Heidi E Harley (New College of Florida and Epcot's The Living Seas of Walt Disney World Resorts)
84-5
Whistle Rates in a Group of Bottlenose Dolphins Over Changes in Composition
Bottlenose dolphins (Tursiops truncatus) are social animals with strong sound reception and production abilities. Aspects of their vocal behavior such as signature whistles and mimicry have been studied in detail. Little is known about their general vocal behavior. We lack information such as normal vocal repertoire or the conditions in which vocalizations are most likely to occur. This study examines whistle production rates of a group of male dolphins across changes in composition. One dolphin was present throughout the study. Whistle rates were analyzed before and after the death of one individual, following the two-staged introduction of another individual, and following the introduction of another individual. Whistles were disproportionately common with more animals, an effect which seems partly attributable to the extensive vocalization of the newly-introduced dolphin. This suggests individual variation in whistle production rate and that the presence of conspecifics excites vocal response.

Comparative and General Process Approaches (Chair, Ed Wasserman)

12:40 Michael Lamport Commons (Harvard Medical School) & Patrice Marie Miller (Salem State College)
85-10
Using Hierarchical Complexity to Determine Developmental Stages in Animals
One difficulty in comparing the highest stages that various animals attain is the traditional tasks used to test human behaviors cannot be directly applied to animals, nor can the tasks for one animal always be applied to another. The Model of Hierarchical Complexity (MHC) can help determine the stages of animal behavior as well as human behavior. It does so by taking the actions and tasks that animals and humans engage in, and putting them into an order based upon how hierarchically complex they are. Stage of performance has the same name and number as the corresponding order of hierarchical complexity of the task it correctly completes. An animal species is characterized by the highest stage of performance observed of any member of that species any amount of training. Animals are observed to engage in actions up the concrete stage of development, which is about what 8 to 10 year old children do.
http://dareassociation.org/

12:55 Patrice Marie Miller (Salem State College and Harvard Medical School), Michael Lamport Commons (Harvard Medical School), & Miriam Chernoff (Harvard Medical School)
86-10
What Archeological Evidence tells us about the Stage of Reasoning of Hominids as they Evolved
We used archeological evidence from a series of Hominids, to estimate what their stage of action would have had to be to develop technology the ways that they did. Tool use and manufacture; and food gathering activities will be examined. Such an examination allows us to understand the developmental stage of various Hominids. To discuss developmental stage of action in Hominids, we introduce basic concepts from the General Hierarchical Complexity Model. That model takes actions and tasks and puts them into an order based upon how hierarchically complex they are. Stage of performance has the same number as the corresponding order of the hierarchical complexity of the task it correctly completes. Hominids are characterized by the highest stage of performance observed of any member of that species. The development stages hominids passed through with evolution were concrete (common to ancestors of homo sapiens and chimpanzees), abstract, formal and systematic.
http://dareassociation.org/

1:10 Chuck Locurto (College of the Holy Cross)
87-10
The structure of early acquisition
We have been studying the structure of individual differences in mouse cognition. Our findings have not always revealed the presence of a robust general factor (i.e., first principal component) as is typically found in human cognition. Instead, we have observed what appears to be a more modular structure. The tasks used in our batteries require a number of sessions to complete. There is a suggestion in the literature that clearer evidence of a general factor may be found if each task is run for only a few trials, thereby capturing early acquisition performance instead of performance following extended training. We have developed a battery in which each task was designed to provide evidence of learning within a few trials. Moreover, each task was distinct in terms of motivation, sensory modality and/or behavior measured, thereby providing a strong test of the presence of a general factor.

1:25 Clive DL Wynne (University of Florida)
88-10
The Perils of Anthropomorphism
In the last decade several researchers in animal cognition have argued that anthropomorphism can serve a constructive role in aiding our understanding of the psychology of other species. I will argue to the contrary: Treating animals as people is not good science. Though old-time behaviorism may have been too constraining, in the reintroduction of anthropomorphism we risk bringing back the dirty bathwater as we rescue the baby. I will consider several recent examples of misplaced anthropomorphism including the claims of a sense of “fairness” in monkeys; “metacognition” (awareness of what one knows and doesn’t know) in monkeys and dolphins, and mirror self-recognition in apes and dolphins. Better progress would be made in understanding animal cognition if we concentrated on investigating the stimulus conditions that control the behaviors under investigation and were less concerned with demonstrating superficial similarity to human states of mind.
http://www.psych.ufl.edu/~wynne/Wynnefairrefusal.pdf
http://www.psych.ufl.edu/~wynne/Wynneperilsanthrop.pdf

Discrimination Learning (Chair, Karen Roper)

1:50 Peter J Urcuioli (Purdue University)
89-10
When discrimination fails (or at least falters)
Pigeons were concurrently trained on four simultaneous discriminations in which left versus right key pecks were reinforced depending on the color displayed on one of two lit keys. As training progressed, choices routinely became less accurate on trials requiring a peck to the (relevant) color cue than on trials requiring a peck to the irrelevant cue. This effect was especially pronounced when color-directed pecks were intermittently reinforced. Indeed, with partial reinforcement, choice accuracy on trials requiring a color-directed peck fell almost to zero for some birds (i.e., birds rarely pecked at the partially reinforced color despite the fact that pecking the alternative stimulus was never reinforced!) By contrast, discrimination performances were maintained at high levels of accuracy on trials requiring a peck to the irrelevant cue even when these pecks were reinforced only 10% of the time. These results appear to be explicable in terms of value transfer.

2:05 Bennett L Schwartz, Megan L Hoffman, & Genevieve P Tessier (Florida International University)
90-10
Delayed match-to-sample in golden-lion tamarins (*Leontopithecus rosalia*)
Delayed match-to-sample tasks have been used in a wide variety of species to assess working memory. In this study, we examined three adult male golden-lion tamarins (*Leontopithecus rosalia*) in a delayed match-to-sample task. An initial sample (a blue square, green circle, or red triangle) was presented. Approximately 10 seconds later, the tamarins choose between the correct answer and a distractor. The correct answer varied across trials semi-randomly. The distractor and the position of the correct and distractor varied across trials. Correct answers were reinforced by allowing the tamarin to extract a blueberry from an opening in the match stimulus. Two of the tamarins failed to learn the task after approximately 200 trials each, but the third improved to above-chance accuracy by 200 trials, with performance leveling out at 65%. Implications and future directions are discussed.
www.fiu.edu/~schwartb/primate.html

2:20 Caroline M DeLong (New College of Florida), Whitlow W Au (Hawaii Institute of Marine Biology), & Herbert L Roitblat (DolphinSearch, Inc.)
91-10
Echo features used by human listeners to discriminate among objects: Insight into dolphin perception and performance
Echolocating dolphins extract object feature information from the acoustic parameters of echoes. However, little is known about which object features are salient to dolphins or how they extract those features. To gain insight into how dolphins might be extracting feature information, human listeners were presented with echoes

from objects used in a dolphin echoic-visual cross-modal matching task. Human participants performed a task similar to the one the dolphin performed, however, echoic samples consisting of 23-echo trains were presented via headphones. The participants performed as well or better than the dolphin (M = 88.0% correct), and reported using a combination of cues to extract object features (e.g., loudness, pitch, timbre). Participants frequently reported using the pattern of changes in the echoes across the echo train to identify the shape and structure of the objects. It is likely that dolphins also use changes across echoes as objects are echolocated.

2:35 Taichi Kusayama & Shigeru Watanabe (Keio University)
92-5
Discrimination of two human facial expressions by Japanese jungle crows
The present experiment examined whether crows discriminate human facial expressions or not. Japanese jungle crows (*Corvus macrorhynchos*) were trained to discriminate between two facial expressions, namely “smile face” and “normal face”, using colour slides. We used an operant chamber with a transparent pecking key. Stimuli were back projected on a screen by a slide projector and the crow could see these stimuli through the pecking key. During one training session, pecking to one facial expression was reinforced by dog foods while pecking to the other one was extinguished. The training continued until they attained both 90% discrimination ratios and 0.9 rho value on two successive sessions. In the test, transfer to facial expressions of novel people was examined. They could discriminate facial expressions of these novel people after being trained with the faces of several people. We also examined the transfer to 3D models and real human faces.

2:43 Kelly A DiGian & Thomas R Zentall (University of Kentucky)
93-5
Stimuli that follow a delay are preferred over those that follow no delay
Clement, Feltus, Kaiser, and Zentall (2000) reported that pigeons prefer discriminative stimuli that require greater effort (more pecks) to obtain over those that require less effort. In the present experiment we asked whether pigeons would prefer stimuli that followed a delay over those that followed no delay. Anticipation of delay was manipulated by signaling its occurrence in the experimental group. Results indicated that delays can produce preferences similar to those produced by effort but only if they are signaled.

2:51 Scott Husband & Toru Shimizu (University of South Florida)
94-5
Common Mechanisms of Cognitive Flexibility in Birds and Mammals
Previous anatomical data suggest that avian medial striatum (MStr) contains a structure comparable to mammalian nucleus accumbens (Acc). Although Acc plays a critical role in attention and goal-directed behavior, it is not directly involved in sensory processes. For instance, lesions to Acc impair reversal learning without affecting sensory discrimination. To determine whether MStr is also functionally equivalent to Acc, we examined MStr lesion effects on simultaneous pattern discrimination and reversal learning sessions in pigeons. Both lesion subjects and controls performed similarly on original discrimination. Furthermore, MStr lesion birds, as well as some sham-lesion controls, had increased errors in reversal sessions compared to non lesion controls. Error patterns indicated that the sham-lesion birds have deficits due to position preference whereas MStr lesion birds had fixation on previous reward contingencies (cognitive rigidity). These results are consistent with the assumption that avian MStr is functionally equivalent to the mammalian Acc. Supported by NSF.
http://chuma.cas.usf.edu/~shimizu

2:59 P. Taylor Johnson & Robert Cook (Tufts University)
96-5
Object Localization in Pictures by Pigeons
Last year, it was reported that pigeons acquired an object perception task n which they were required to locate a target object from an array of objects within a picture. In new experiments to be reported, the pigeons successfully transferred to variations in object location relative to other objects within a test picture. In tests using novel objects, the birds were unsuccessful at identifying new object stimuli, either in the context of old stimuli (1 new object presented with 3 old objects) or all new stimuli (pictures with 4 completely new objects). Other variations on the discrimination task will be presented. Implications on object perception, matching to sample, and visual search will be discussed.

Snack Break

Motion & Rhythm (Chair, Herb Terrace)

3:55 Heidi E Harley (New College of Florida & Epcot's Living Seas), Wendi Fellner (Epcot's Living Seas), & Leslie Larsen-Plott (Epcot's Living Seas)
97-10
Rhythm Production by the Bottlenose Dolphin
Previous work with dolphins suggests that dolphins can discriminate among acoustic rhythms. The current study investigates the dolphin’s ability to produce rhythms. A bottlenose dolphin (*Tursiops truncatus*) uniquely labeled three objects with three rhythms. When presented with an object, the dolphin used its rostrum (bottlenose) to tap out a rhythm on a pneumatically controlled in-air switch connected to a computer’s USB port that controlled tone-generating software. The 14-kHz tones were simultaneously played on an in-air speaker and represented spectrographically on a computer screen. The dolphin was reinforced for playing a series of short tones, a single long tone, or a short and long tone in response to three specific objects. Performance accuracy on the most recent 50 object-labeling trials with each object was 82%, 94%, and 72%. The dolphin is currently learning a fourth object-rhythm pair.

4:10 Angie C Koban & Robert G Cook (Tufts University)
98-5
The Influence of Temporal Characteristics on a Pigeon Motion Discrimination Task
Four pigeons were tested in a directional motion discrimination task. Object stimuli composed of a red cube, tube, cone, and torus. Each was rotated left or right around a central axis in a go/no-go procedure. To examine the nature of the discrimination the number of frames and timing per rotation were systematically varied. The results suggested that pigeons are better able to perceive directional object movement when presented at faster rates, are unable to use object direction if presented too slowly, and need smooth coherent object motion in order to make the discrimination. Implications for using video stimuli to portray motion will be discussed.

4:18 Hiroshi Makino (Chiba University)
99-5
Pigeons’ discrimination of dynamic images of objects rotating in depth
In a go/no-go discrimination procedure, four pigeons were trained to discriminate two objects dynamically rotating in depth. The objects were composed of three identical rectangular solids, but differed in arrangement of them. Two pigeons acquired the discrimination, and then they were exposed to three types of testing. They showed good transfer to static images included in the training stimuli. But they didn’t show transfer to dynamic images of the objects whose angle of projection was changed. And they didnÆt show the kinetic depth effect with dynamic stimuli in which all contour and surface information were eliminated. The results were suggested that the pigeons acquired the discrimination based on two-dimensional cues of the objects.

4:26 Tomokazu Ushitani, Kazuo Fujita, & Akira Sato (Kyoto University)
100-5
Perceptual organization of motion in pigeons

We investigated how pigeons perceptually organize motion of more than one object. We hypothesized that if pigeons organize components sharing a common movement vector to one group, the pigeons would perceive relative motion of the components. We trained pigeons to match a target dot moving vertically to one color and the same dot moving diagonally to another. We presented an accompanying dot moving horizontally near the target. The pigeons were thought to match the diagonal motion to the color for vertical motion and vice versa if they perceived relative motion. The results showed no evidence that pigeons perceived relative motion. However, when a moving frame was substituted for accompanying dots, the pigeons tended to respond to the color corresponding to relative motion. Pigeons may organize a set of moving objects as one object moving relative to the other at least in some stimulus displays.

4:34 Tracy I Martin & Thomas R Zentall (University of Kentucky)
101-5
Effect Of Penalty Time On Acquisition Of Matching To Sample In Pigeons: The Role Of Post Choice Information Processing
The matching-to-sample task is used extensively with pigeons to measure learning. A modification of matching-to-sample, the penalty time procedure, incorporates four seconds, after incorrect choices, during which the discriminative stimuli are maintained. Responses must be withheld during the penalty time to advance to the next trial. Facilitation of matching behavior is found with the penalty time procedure. Penalty time may provide post choice information that is beneficial to future matching behavior and/or penalty time may be aversive to the pigeon and encourage caution in making comparison choices. A penalty time group was compared with a misinformation group in which the sample changed to the non-selected stimulus during the penalty time, which provided misleading post choice information, but maintained penalty aversiveness. The penalty time group learned significantly faster than the misinformation group, which suggests that post choice information may be more important than aversiveness in facilitating a matching-to-sample task.

Categories & Concepts (Chair, Tom Zentall)

4:50 Satoru Ishikawa (Hokkaido University), Hika Kuroshima (Kyoto University), & Kazuo Fujita (Kyoto University)
102-10
Hierarchical Concepts And Abstract Relations In Capuchin Monkeys (*Cebus apella*)
Conceptualization and representation of abstract relations are important considerations in the evolution of cognitive ability in animals. In this study, we confirm the emergence of representation of abstract relations from conceptual behavior in capuchin monkeys (*Cebus apella*). First, we trained monkeys to acquire several concepts having hierarchical relations among them. Then, we investigated their performance toward the relations among visual symbols used in acquiring the concepts. If the monkeys learn spontaneously abstract relations (hierarchy) among concepts during concept acquisition training, they respond appropriately in the test. As a result, three capuchin monkeys acquired four basic and two higher-order concepts simultaneously. Furthermore, the test results of abstract relations of symbols suggest that capuchins are capable of eliciting abstract relations among symbols thorough learning relations among concepts. These results indicate that the ability to represent abstract relations derive from conceptual ability.

5:05 Olga F. Lazareva, Kate L. Freiburger, and Edward A. Wasserman (University of Iowa)
103-10
Pigeons concurrently categorize photographs at both basic and superordinate levels
We studied categorization in pigeons using carefully controlled photographs. Within daily sessions, four pigeons had to classify each of 32 photographs into either its proper basic-level category (cars, chairs, flowers, or people; four-key forced-choice procedure) or its proper superordinate-level category (natural or artificial; two-key forced-choice procedure). The pigeons successfully classified the same stimuli at both levels. Overall, the pigeons learned the basic discrimination faster than the superordinate discrimination; but, this difference was only reliable for artificial stimuli (cars and chairs), not for natural stimuli (flowers and people). The pigeons also exhibited reliable discrimination transfer to novel photographs, attesting to the open-endedness of these basic and superordinate categories. In follow-up experiments, we further examined the differences between natural and artificial stimuli and between basic and superordinate categorization tasks.

5:20 Stephen EG Lea, Andy J Wills, & Catriona ME Ryan (University of Exeter)
104-10
Why is it hard for birds to learn to discriminate artificial polymorphous concepts?
Artificial polymorphous concepts, in which category membership is dependent on m out of n independent features taking positive values, have been widely used as models for natural concepts. They share the property of natural concepts that there is no single, simple, necessary or sufficient condition for category membership. But whereas birds quickly learn to discriminate between sets of stimuli defined in terms of natural concepts, discrimination of artificial polymorphous concepts is frequently slow and incomplete. Chickens were trained in successive discriminations of stimulus sets that resembled 3-out-of-5 artificial polymorphous categories in four ways: stimulus complexity, the need to attend to multiple stimulus dimensions on each trial, the need to remember the valences of multiple features between trials, and the unreliability of the association between reinforcement and each feature. The results suggest that multidimensionality and reinforcement unreliability cause most difficulty when birds are trained to discriminate polymorphous concepts.

5:35 Guillermo C Paz-y-Mino, Alan B Bond, Alan C Kamil (University of Nebraska-Lincoln), & Russell P Balda (Northern Arizona University)
105-10
Inferential and categorical judgment in a highly social bird
Social complexity may have provided an important setting for the evolution of intelligence. In a large stable society it is unlikely that an individual could learn and remember all possible relationships among group members. Instead, selection might have favored the evolution of mechanisms of inference and classification. This role of social complexity has been historically attributed mostly to primates. Here we document how pinyon jays (*Gymnorhinus cyanocephalus*), one of the most highly social North American corvids, use transitive inference to rank the dominance performance of specific individuals in relation to the status of group mates. These findings support the hypothesis that not only primates but other vertebrates exposed to equivalent social and ecological pressures have evolved comparable cognitive traits.
http://bsweb.unl.edu/avcog/

5:50 Lisa K Son (Barnard College), Nate Kornell (Columbia University), Herbert S Terrace (Columbia University & NY State Psychiatric Institute), Danielle Sussan (Barnard College), & Molly E Flaherty (Columbia University)
106-10
Measuring confidence judgments non-verbally by using a betting paradigm
Two rhesus macaque monkeys were trained to make confidence judgments on perceptual and memory tasks by using a betting paradigm. The perceptual tasks required subjects to discriminate the size and number of various stimuli. The memory task required subjects to select a recently viewed photograph that was presented with 8 distractor photographs. Following each response on the perceptual and memory task, subjects were shown two risk icons, one representing a large bet; the other, a low bet. Subjects earned 3 tokens if they chose the high-bet icon following a correct response but lost 3 tokens if they chose that icon following an incorrect response. One token was earned anytime they chose a low-bet icon. The monkeys learned to respond to the bet icons appropriately, improving on each subsequent perceptual task, and on the first day on which they were presented with the memory task. Potential educational applications will be discussed.

6:05 Tammy LB McKenzie, Leanne R Bird, & William A Roberts (The University of Western Ontario)
107-10
What do pigeons learn when forming categories?
During training, pigeons in Group 1 were trained to respond to images of houses (S+) and dogs (S-). Pigeons in Group 2 received the opposite training. Upon testing, novel exemplars of the S+ and S- categories and exemplars from a novel category (flowers) were introduced. During test session one, pigeons from both training situations responded to flowers and dogs in a similar manner and to houses in the opposite manner. Pigeons may have learned more about the houses than the dogs

and pecked at novel stimuli based on a response strategy that they developed during training. Pigeons may have adopted either the strategy “peck at houses and do not peck at all other pictures” or the strategy “do not peck at houses and peck at all other pictures”. Therefore, pigeons may develop exclusion strategies in a concept learning task.

6:20 Eduardo Mercado III (University at Buffalo, SUNY), Itzel Orduna (Rutgers University), & Jeaveen M Nowak (University at Buffalo, SUNY)
108-5
Auditory Classification of Complex Sounds by Rats
Little research has explored the auditory categorization abilities of mammals. To better understand these processes, we tested the abilities of rats to classify multidimensional acoustic stimuli using a classic category learning task developed by Shepard, Hovland, and Jenkins (1961). Rats proved to be able to classify eight sounds as containing either fast or slow frequency modulation, and as exhibiting either ascending or descending frequency modulation. Our results show that when rats are required to classify complex sounds along one of multiple possible dimensions, their ability to do so improves slowly and incrementally, consistent with the predictions of associative models of classification learning.

6:28 – 6:35 Tom Zentall Closing Remarks