Posters

Poster Session I - Thursday Evening

Reputation-like Inference in Domestic Dogs (Canis familiaris)

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

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

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

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

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

Holding familiar information in working memory is cognitively effortful for monkeys

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

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

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

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

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

Rats remember incidentally encoded episodes

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Timing of Pavlovian-to-Instrumental Trasfer

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

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

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

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

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

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

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

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

Stimulus Movement Effect in Pigeons?

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

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

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

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

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

Effects of Injection Stress on Rat Serial Pattern Learning

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

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

Long-term memory for an auditory discrimination in chickadees

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

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

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

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

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

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

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

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

Differential sensitivities to dynamic Glass patterns

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

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

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

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

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

Spatial Integration and Decision Making in Homing Pigeons

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

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

Social monitoring by close calls in meerkats

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

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

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

Shannon Mischler, & Angelo Santi (Wilfrid Laurier University)

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

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

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

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

Shape Discrimination in Goldfish (Carassius auratus)

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

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

Urban Rhode Island Coyotes: Environmental effects on movement patterns

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

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

Information Seeking in the Rat

William A. Roberts, & Chelsea R. Kirk (University of Western Ontario)

P28 Metacognition is awareness of what one does and does not know. Students given a choice between studying material they have learned well and material they have learned poorly prefer to study the less mastered material (Metcalfe, 2009). Recent studies suggest that primates also know about the state of their own knowledge and will seek unknown information to complete a task (Call & Carpenter, 2001; Hampton et al., 2004). We used a radial arm maze to look for metacognition-like behavior in rats. Each maze arm had a bulb mounted on it to serve as a signal light. Rats were trained to go to whichever arm was lit on a trial for reward. They then were trained to press a bar in the maze hub that led to immediate food reward and turned on a light in one randomly chosen arm of the maze. Once the rats learned to press the bar, the reward for bar pressing was discontinued. We report on the rats' readiness to press the bar for information about the location of reward under conditions that varied the degree of information and the motivation to obtain information.

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

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

P29 Self-control may be defined as foregoing an immediate reward to gain a larger delayed reward. Methods used to test self-control comparatively include intertemporal choice tasks, delay of gratification tasks, and accumulation tasks. To date, capuchin monkeys have shown limited self-control. This study introduced a new self-control task in which an intuitive context that allows for natural responses. Capuchin monkeys (Cebus apella) were given a choice between two food items presented on a mechanized, revolving tray that could be accessed after a shorter or longer delay, depending on their position on the tray. Monkeys could grab the first item or wait for the second, but were only allowed one item. Most monkeys in the study waited for a more highly preferred food item or a larger amount of the same food item when those came later by inhibiting the prepotent response to reach out and take the less preferred foods or smaller amounts of food that passed right in front of them first. These data indicate that the mechanisms necessary for self-control are present in capuchin monkeys, and the methodology can be useful for broader comparative assessments of self-control.

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

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

P30 One important aspect of episodic memory is the ability to remember the order in which sequences of events occurred. We presented monkeys with lists of 5 images drawn randomly from a pool of 6,000 images. At test, two images were presented and monkeys were rewarded for selecting the image that had appeared earlier in the study list. Monkeys were tested in a series of experiments to distinguish among several cognitive mechanisms proposed to support memory for order. Based on these series of tests, it appears that subjects did not use list position or relative memory strength to select the earlier item. Instead, monkeys used "temporal order", a mechanism that was further characterized by testing whether absolute time or the number of intervening items increased memory for order.

Poster Session II - Saturday Evening

Can horses discriminate between objects based on direction of motion?

Tammy McKenzie (Brandon University)

P31 It has been argued that motion should provide important information to many species and should play a role in the categorization of objects (Loidolt et al., 2006). Horses being prey animals and highly mobile may pay a lot of attentiong to motion within their environment, thus the ability to discrimate based on motion may be beneficial to them. This research examined whether horses can discrimate between objects based on direction of motion. In previous research, horses did not learn to discriminate between a circle moving up and down versus a circle moving left and right. In the present research horses were first given a simple dicrimination task, discriminating a light grey square from a dark grey square, and when successful at this task were progressed to the motion discrimination task. Using a two-key response-choice task, horses were simultaneously presented with a pattern of circles moving continously left and a pattern of circles moving continuously up. Horses did not succesfully complete this task. For horses to be successful, it may be necessary to use real objects rather than objects presented on computer monitors. Another possiblity is that horses may be more senstive to speed rather than direction of motion.

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

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

P32 Capuchins monkeys (Cebus apella) are facile tool users both in the wild and captivity (Fragaszy, Visalberghi, & Fedigan, 2004), but studies with captive animals have focused on performances of animals tested individually rather than in groups. We investigated tool use by tufted capuchins in both individual and paired test settings to determine whether subordinates either "play dumb" (Drea & Wallen, 1999) when with a dominant partner or alternatively, are prevented from expressing their honey-dipping abilities. In experiment one, individuals – absent a partner - were presented with a functional tool presented either singly or together with two non-functional tools. Eight of nine animals successfully honey-dipped in both conditions but also attempted to retrieve honey with the non-functional tools indicating that they spontaneously perceived the affordances of sticks as extensions of their arms, but had to learn through trial-and-error its functionality for the task. In experiment two, pairs of capuchins were tested in conditions identical to experiment one. Although all animals still attempted to honey-dip, dominant within-pair individuals aggressively monopolized access to the functional tool limiting their partners access to tools indicating that the subordinates, rather than

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

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

P33 The presence of a con-specific bumblebee on a flower can signal the discovery of a source of food; yet the flower is emptier than before and so it is not clear that bumblebees ought to have an unlearned preference for occupied over unoccupied flowers, though one has been reported in the literature. Here, we revisited the issue. A radial-arm maze was used in which a 2D pattern (e.g.a photo of a thistle flower) was mounted at the end of each of 10 corridors. A dead bee (the "occupier") was pinned to three of the patterns. The first 20 choices were recorded for bumblebee workers having no prior experience outside the colony. Choice proportions did not deviate from chance, though the method was capable of revealing other preferences. Bees given discrimination training (rewarding occupied vs unrewarding unoccupied patterns) were then tested on empty patterns. Not only was a learned preference for occupied flowers obtained, but the learning also transferred to new patterns. The trained bees may well have learned the value of the presence of the occupier, suggesting that some knowledge of the social world had been acquired.

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

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

P34 Multiple spatial cues are utilized to orient with respect to the environment, but it remains unclear why feature (objects in the environment) and geometric (shape of the environment) cues are differentially influenced by enclosure size and the extent to which local (wall lengths and corner angles) and global (i.e., principal axis of space) geometric cues are influenced by enclosure size. We investigated the extent to which environmental size influenced the use of corner angle (i.e., a local geometric cue) and the principal axis of space (i.e., a global geometric cue) for reorientation. Participants were trained to respond to a location in either a small or large trapezoid-shaped enclosure uniquely specified by both local (i.e., wall lengths and corner angles) and global (i.e., principal axis of space) geometric cues. During testing, we presented both groups with a small and large rectangle (to assess the use of principal axis of space) and a small and large parallelogram (to asses relative use of corner angles and the principal axis of space when in conflict). Enclosure size influenced the relative use of corner angles but not of the principal axis of space.

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

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

P35 Studies have shown that providing laboratory housed animals with an opportunity to utilize species specific behaviors in a natural context appear to alter the physical and psychological well-being of the animals. The effects of such enrichment have been observed by way of performance improvements on tasks of learning and memory. Despite an increased interest in laboratory animal treatment and living conditions, the importance of specific variables, such as enrichment type and duration remains unclear. The aim of the current study was to examine the effect of minimal enrichment duration on a lever-pressing task which required a differential rate of low responding (DRL). Enriched rats were group housed and provided with several play structures to climb and hide in, while the control rats were housed individually. Both enriched and control rats were trained to lever-press on a fixed ratio schedule of reinforcement then switched to DRL responding. There was no significant difference in the mean ratio of lever-presses to reinforcement between the two groups indicating that enriched and control rats required the same number of trials to learn this simple operant conditioning task. Implications of this finding will be discussed in light of enrichment duration and subject age.

Application of the Big Five to equine personality

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

P36 This study was designed to test the validity of a Five Factor Model of personality on horses. A questionnaire was replicated from a previous study, with an added option of don't know to the traditional 5-point Likert scale. Seventeen items of the 60-item scale had don't know responses from raters greater than 10% and were subsequently removed from the study. The remaining items were put through a Principal Components Analysis, which extracted eight factors: Neuroticism, Active, Conscientiousness, Agreeableness, Openness, Social Extraversion, Temperamental, and Disciplined. These components correspond well to the five components extracted in the original study, indicating good reliability of the scale. However, 17 items from the original questionnaire were deemed irrelevant by raters, indicating a threat to validity. Though the remaining items were able to be used in analyses, further studies should examine if these are in fact the most effective items to use in the investigation of equine personality.

Tests of Transitive Inference in Rats using an Automated Olfactometer

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

P37 Transitive inference (TI) has been demonstrated in a variety of species including rats in which TI emerges when odor stimuli are used (Davis 1992; Dusek & Eichenbaum 1997; Jordan 2009). Rats in these studies were initially trained on four overlapping simple odor discriminations. For example, the following pairs could be trained: AB+, BC+, CD+, and DE+. Choice of D given the presentation of the untrained pair "BD" is said to demonstrate transitive inference. These successful TI studies all involved manual presentation of scented sand or scented lids as stimuli. In the present study a systematic replication of Davis (1992) was conducted using an automated olfactometer apparatus. Despite strong discriminative performances on trained baseline pairs, TI was not consistently observed. Additional stimulus sets were trained to determine whether multiple exemplar training would enhance emergence of TI, but without consistent success. Nonetheless, the efficiency and objectivity of computerized assessment would make this procedure an attractive option. We are exploring procedural variations to determine conditions necessary for the emergence of TI.

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

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

P38 This experiment examined whether rats could use a previously learned pattern's structure to learn new information which was consistent or inconsistent with the original structure. Twenty four rats were assigned to one of 2 groups for the pretraining phase of the experiment. One group was trained on an 18 element Runs Pattern composed of 6 chunks of 3 elements (123 234 345 456 567 678). The other was pretrained on an 18 element Trills Pattern also composed of 6 chunks of 3 elements each(121 232 343 454 565 676). After 28 days of pretraining, each group of rats was transfer to one of 2 variations of the pretraining pattern, both containing 2 additional 3 element chunks (6 elements). Runs Group rats were transferred to a pattern with the new 2 chunks being runs or trills. The Trills Group was transfer either to a trills pattern with 2 additional trills or 2 additional runs chunks(all for 7 days). Rats in all groups showed dismal performance in transfer. Interestingly, the rats' error rates for the previously learned portion of the pattern also increased dramatically for the entire week of transfer.

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

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

P39 Educated predators are those that have learned about the nutritional value and defence levels of prey in their environment, and are able to make informed decisions about whether or not to eat prey that they encounter. Although we know that the toxin content in aposematic prey is important for the degree to which they are avoided, we don't know how the nutritional content of aposematic prey affects predators' foraging decisions. In an experiment using wild-caught starlings (Sturnus vulgaris) feeding on defended and undefended mealworms (Tenebrio molitor) of different nutritional values (small vs. large), we found that the asymptotic attack rates on defended prey were not absolute, but differed depending on the nutritional value of the defended and undefended prey. Our findings offer an insight into how educated predators integrate information about toxins and nutrients to make adaptive foraging decisions, and how their decision-making can impact on the evolution of aposematism and prey defences.

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

Sabrina Simmons, & Angelo Santi (Wilfrid Laurier University)

P40 Rats trained in a delayed matching-to-sample procedure in order to discriminate sample stimuli consisting of the presence of food or the absence of food show more forgetting of the food sample than of the no-food sample. According to the single-code/default strategy, rats code only the food sample and make the response correct for the no-food sample by default when there is no memory of the food sample. The purpose of this study was to examine how asymmetrical training with only one sample prior to two-sample training would affect retention functions for samples of food and no-food. Retention functions were not affected by which sample was trained first. Rats trained in an asymmetrical fashion showed mainly symmetrical retention functions where both food and no-food sample accuracy dropped in a parallel fashion across increasing retention intervals, suggesting that the rats coded both the food and the no-food sample. Transfer tests, in which features of the food and no-food sample were manipulated, confirmed that features of the no-food sample were coded. These results are inconsistent with a single-code default strategy and instead suggest that rats code both the food and the no-food sample when asymmetrical sample training is given.

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

Emma Thompson, & Catherine Plowright (University of Ottawa)

P41 Laboratory studies of pattern recognition in bees typically use two dimensional patterns intended to represent ecologically relevant objects such as flowers, and yet the question of whether these patterns are perceived and treated as flowers has not been investigated. In bees, research has addressed several topics in cognition (e.g. abstract categorization, timing), but these do not include picture-object correspondence, which has been studied in a variety of species, but not bees. This study is the first in a series of experiments intended to examine picture-object differentiation, transfer and generalization as mechanisms of floral recognition in bumblebees. Twenty bees in each of two groups underwent discrimination training in a 12 arm maze with exposure to artificial flowers and pictures of those flowers. In one group, the flower was rewarding and the picture unrewarding, and in the other group the contingencies were reversed. Following training, preference testing on unrewarding stimuli revealed higher than chance choice proportions in both groups for the stimulus that had been rewarding: flowers and their 2D representations were not confused. Future research will investigate whether bumblebees will, nonetheless, treat the two as similar and show spontaneous transfer of learning from objects to pictures of those objects.

Assessing Stereotypy and Learning in a Dead Reckoning Virtual Environment Task

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

P42 Dead reckoning is the ability of an organism to find its way back to a path's origin without the use of landmarks. The triangle-completion task, in which subjects are guided from the origin along two legs of a triangle before being allowed to freely return to the origin, is a standard method for assessing dead reckoning. Stereotypy, the tendency for subjects to equivalent rotation and distance estimates to the origin regardless of triangle itinerary, is a common finding when multiple itineraries are used during testing. However, the reason stereotypy occurs has not been assessed. We hypothesized that stereotypy is due to a lack of sensitivity to differences in triangle itineraries. In the current experiment, the range of difference between 2 sets of 3 triangle itineraries was manipulated across groups. Participants (undergraduate students) were tested in a desktop-computer virtual environment. Feedback regarding return accuracy was provided after each trial, and return distance and rotation errors were analyzed. Results and implications will be discussed.

Assessment of Human Spatial Blocking With Stable and Unstable Landmarks

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

P43 The purpose of the current experiment was to determine whether cue competition (e.g., blocking) occurs in the spatial domain with human participants in a desktop virtual environment. Beigler and Morris (1999) found that spatial blocking occurred in rats when trained to find a hidden goal relative to a stable landmark array. The present study investigated blocking of stable landmarks, which maintained a fixed spatial relationship to the goal location, in the presence of unstable landmarks, the location of which varied with respect to the goal location across trials. In Phase 0 (P0), participants were trained to find a goal in the presence of an array of directionally ambiguous landmarks (L0s). In Phase 1 (P1), a stable disambiguating landmark (L1) was added to the array. In Phase 2 (P2), a second stable landmark (L2) and several unstable landmarks (Ms) were introduced. All landmarks were the same shape, but had unique visual color patterns. On test trials, which were randomly interspersed amongst P2 trials, different combinations of landmarks were presented to determine the extent to which they controlled search. Search area in the presence of L2 and absence of L1 assessed blocking. Results and theoretical implications will be discussed.

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

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

P44 Comparative research on episodic memory has typically focused on examining the binding of spatial and temporal information in memory, but less is known about how animals integrate other relevant event features in memory. In the present study, we investigated how rhesus monkeys and 3-4 year old children integrate what, where, and when information along with information about their own role in a past event and their knowledge about the environmental context at encoding. We assessed this by presenting monkeys and children with a computerized memory task; on some trials they had to move a picture to a predetermined location on the computer screen using a joystick and on other trials they had to watch as the picture moved by itself. The event always took place within a particular environmental context (either a brightly lit or dim background display) and was followed by either a short (5s) or long (15s) delay. This was followed by a pair of memory tests, which were randomly selected on each trial. These pairings allowed us to examine how the different types of information (identity, spatial, temporal, agency and context) were integrated in working memory.

Proactive Interference in Rhesus Monkeys

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

P45 Repeating stimuli from trial to trial creates proactive interference. We tested three monkeys for proactive interference in a same/different task. Trial-to-trial stimulus repetitions were minimized by using a large 1024 set of picture stimuli. Proactive interference was tested by placing potentially interfering stimuli as sample stimuli in previous trials, 1, 2, 4, 8 or 16 trials prior to the test where it did not match the test-trial sample. Interference was greatest the closer the interference was to the test and dissipated with distance. Time intervals in the task were manipulated to test proactive interference.

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

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

P46 We observed captive vervet monkeys (Chlorocebus aethiops) in St Kitts using their tail to hook and retrieve grass outside their enclosure. Here, we tested their use of hooked and straight reaching tools in groups. Dominant individuals, who monopolized handling of all tools in two groups, retrieved a food cup presented either within a hook-tool or attached to a straight reaching tool. When presented with a choice of two hook-tools or two straight tools, the dominant juvenile in one group, similarly to vervet monkeys tested by Santos et al, (2006), chose the hooked or attached food-cup whereas the dominant adult in the other group chose the first tool she encountered when approaching the testing apparatus. Neither animal learned to capture and retrieve the reward using a hook. Also, unlike capuchins or human infants, they did not use straight sticks to extend the reach of their arm (cf., Thompson & Rattermann, 2001; Flemming et al, 2006). Results suggest that hook-tool use by vervet monkeys is not conceptually mediated but is a simple reach-and-pull retrieval response mediated by the discrimination of perceptual differences between rewards attached, or not attached, to a tool and enclosed, or not enclosed, by partial boundaries.

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

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

P47 Dolphins process and produce sounds very quickly across a wide frequency range. They are echolocators and vocal mimics, although we know very little about their vocal matching of broadband sounds, a large part of their repertoire. We focused on vocal exchanges and analyzed dolphin vocalizations produced by 4 dolphins in human care. Analyzed vocals were produced in response to our playbacks as well as to their tank mates' naturally occurring productions. Broadband sounds were frequent in all sessions. Fish were provided non-contingently in some playback sessions. Recorded subjects were alone or in pairs. We analyzed their response vocalizations in terms of attribute matching (duration, amplitude, frequency, number, frequency contour, bandwidth, category, fidelity) and social context. To date, we have discovered that dolphins were more likely to match frequency (45%) and amplitude (38%) than number (16%) and duration (12%). Frequency matches occurred with narrowband whistles but also with broadband burst pulse sounds, suggesting that dolphins are sensitive to the frequency bands in burst pulses, an unexpected finding. Analysis of dolphin burst pulse sounds may need to include an analysis of the differential distribution of energy across the frequencies in the sounds.

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

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

P48 Multiple memory systems are often involved simultaneously to generate a behavioral response, preventing a simple one-to-one mapping between cognitive processes and tasks. Process dissociation procedures (PDPs) have been adopted in both humans and monkeys to quantitatively separate one-trial memory and habit, with the assumption that these two processes make independent contributions to a given task. Violations of this assumption may lead to artificial dissociations. Evidence for independence has been reported in humans, but similar tests have not been conducted with monkeys until now. In a within-subjects design using matching-to-sample, we manipulated one-trial memory by changing delay lengths and encoding conditions while simultaneously testing four levels of habit produced by assigning a subset of images to be the sample, and thus the rewarded target at test, more frequently than others. This bias in the reward probabilities associated with different images had the intended effect of increasing habit scores, but did not affect one-trial memory scores. In contrast, increasing memory delays attenuated one-trial memory scores, while habit scores stayed the same. This behavioral double dissociation clearly shows that one-trial memory and habit can be manipulated independently, validating PDP as a valuable tool for studies of learning and memory in nonhuman animals.

Effects of dog´s sociability upon interspecific communicative responses

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

P49 Dogs have developed extraordinary interspecific communication skills. Recently, individual differences in communication skills related to breed or training levels have been found in dogs. In this work we studied whether a relationship exists between sociability levels of the dogs and learning interspecific communicative responses. We evaluated adult dogs in a sociability test consisting in the encounter with an unknown human. From these results, animals were divided in two groups: High Sociability (HS) and Low Sociability (LS). In study 1, the dogs were exposed to a conflictive situation where there was food in sight but out of reach. During three trials the gaze response towards the human face was reinforced, followed by three trials of extinction. The study 2 consisted of an object-choice task in which dogs must find hidden food following the direction of the head and the look of a person to the right place. Results showed that HS has longer gaze duration during extinction, compared with LS. In addition, the HS successfully followed the human gaze and find hidden food, resulting in a performance significantly above the chance level, unlike LS whose performance was at chance. In conclusion, the results herein presented suggest that sociability modulates interspecific communication.

Effect of bilateral hippocampal lesion on transitive inference task in pigeons

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

P50 We trained pigeons to discriminate four pairs of overlapping visual stimuli: A+ B-, B+ C-, C+ D-, and D+ E-. Because our prior research found no effect of the orderability of the primary stimuli on pigeons' behavior (Lazareva & Wasserman, 2006), we used non-orderable color stimuli in this experiment. We also controlled reinforcement history of stimuli B and D comprising a critical testing pair BD by using massed presentation of the pair D+ E- that produced richer reinforcement history for the stimulus D. After the first test involving the critical pair BD as well as other possible testing pairs, we performed a bilateral lesion of hippocampus by aspiration, and conducted the second test after a period of recovery. Preliminary results showed that in this task some, but not all, of the birds consistently select stimulus D over B during first test, suggesting a strong influence of reinforcement history on the choice in the novel pair. Moreover, the hippocampal ablation in these birds appear to lead to either chance performance in pair BD or a slight preference of the stimulus B over stimulus D, suggesting that the effect of reinforcement history may have been associated with hippocampus.

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

P51 The ways in which humans and animals interact is complex, but is set on the general foundation of body language, gesture, and verbal communication. Explorations into the complexities of human-animal interactions (HAI) in a team setting have led to inquiries of whether these models could be applied to human-robot interactions (HRI). In this paper we apply an interdisciplinary perspective to integrate research from animal cognition and metacognition, natural and acquired modes of human communication, animal specializations in communication, and studies of how humans interact with robotic animals. Intra-species communication within groups of animals will also be investigated to potentially apply to the robots themselves when working in a team setting. We conclude with a set of guidelines outlining how research can assess the efficacy of methods of communication from HAI in application to efficient HRI teams.

High Risk: Can Pigeons Observationally Learn to Gamble?
Carter W. Daniels, Jessica P. Stagner, & Thomas R. Zentall (University of Kentucky)

P52 We asked to what extent suboptimal choice by pigeons (gambling-like behavior in which pigeons choose a lower probability of reinforcement with discriminative stimuli over a higher probability of reinforcement without discriminative stimuli) is influenced by observation of another pigeon choosing sub-optimally versus choosing optimally. Observer pigeons were given a choice between (1) an alternative that provided them with a stimulus that predicted food 100% of the time on 20% of the trials or 0% of the time on 80% of the trials (20% reinforcement), or (2) an alternative that provided them with food 50% of the time irrespective of the stimulus. One group (Observe Suboptimal) observed a demonstrator that chose the suboptimal alternative; the other group (Observe Optimal) observed a demonstrator that chose the optimal alternative. Choice by the experimental subjects in the two groups did not differ significantly but both groups initially chose more optimally than control subjects that did not observe a conspecific. However, with additional experience with the task, all subjects chose suboptimally. The results suggest that exposure to a conspecific (pecking for food) prior to performance might affect the observers' attention or motivation and make it initially more sensitive to the overall probabilities of reinforcement.

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

P53 Cerebral lateralization, the superior control of neural functions by one hemisphere, is known to be ubiquitous amongst vertebrate species. Lateralization of the brain regions responsible for visuospatial attention may lead to a preference to attend to one side of visual space. It is uncertain why the directionality of these biases occur at a population level. However, it has been suggested to be the result of social living, where aligning the directionality of biases may promote group cohesion. When social avian species (e.g. domestic chicks and pigeons) have been tested, visuospatial attention is lateralized at the population level. This study examined whether black-billed magpies (Pica hudsonia), a social corvid, also show population-level lateralization of visuospatial attention. Magpies were tested using the standardized test developed for chicks and pigeons. Each magpie was presented with a matrix of seeds which they selected by entering their heads into the testing arena, while their body was constrained. The order and location of seeds selected were measured to determine whether the birds displayed a visuospatial bias. The presence of a population-level bias would support the social living theory; whereas, no bias would suggest other ecological factors may be influencing cerebral lateralization.

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

P54 Metacognition, or one's knowledge concerning one's own cognitive processes, is a construct based on studies of humans and is usually tested via verbal report, making it hard to test in nonhumans. In the current study we operationalized metacognition as the ability to use the presence or absence of memory to guide information seeking. We presented twelve rhesus monkeys (Macaca mulatta) with a computerized information-seeking task, designed after Call and Carpenter's (2001) manual tubes task. Monkeys were trained to remember and then select the location of a hidden stimulus. After a delay, they were simultaneously presented with the memory test, and the option to seek more information. We manipulated memory by presenting the stimulus at the beginning of half the trials and omitting the stimulus on the other half. Monkeys chose to take the test more often when knowledgeable, and sought information more often when ignorant. Probe trials using other manipulations of memory also affected information-seeking behavior. These results suggest that monkeys can discriminate between knowing and not knowing, and are able to use this information to guide their behavior.

Pseudoconcept Learning in Pigeons

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

P55 Katz & Wright (2006) found that set-size expansion plays an influential role in the ability of pigeons to utilize an abstract same/different concept. As stimulus training set size was gradually increased from 8 to 1024 items, the results showed a transition from item-specific learning to relational processing and full abstract-concept learning. In the present study, we explored this transition by training a group of pigeons in a pseudo same/different discrimination version of Katz & Wright (2006). Pseudo stimulus pairs consisted of arbitrarily assigned images that did not adhere to their assigned same/different discrimination. Comparisons are made between Katz & Wright (2006) and the current study at each subsequent expansion. Results show overall longer acquisition and no transfer to novel items in the pseudo group indicating that these pigeons only learned the task via item-specific rules.

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

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

P56 This experiment examined whether rats would extrapolate a previously learned rule when transferred to a pattern where they were not corrected for rule-inconsistent responses. Eight Rats were assigned to one of 2 groups for the pretraining phase of the experiment. One group was trained on an 18 element Runs Pattern composed of 6 chunks of 3 elements(123 234 345 456 567 678). The other was pretrained on an 18 element Trills Pattern also composed of 6 chunks of 3 elements(121 232 343 454 565 676). After 28 days of pretraining, the rats in the Runs Group and Trills Group were transferred to a pattern with 24 elements. The first 18 elements were the original pattern while the responses on the 6 remaining were always rewarded. All rats were trained on the transfer patters for 7 additional days. Rats in both the Perfect Runs and Perfect Trills transfer groups quickly adopted a "perseveration strategy" where they would repeat the response at a nosepoke receptacle until the original portion of the pattern started again. None of the 8 rats showed pattern extrapolation.

Elephant Cognition

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

P57 Though animal behavior has been an area of interest for several decades, Animal Cognition is a concept that has only recently begun to gain attention as a credible area of study. In order to perpetuate the momentum of the interest in comparative cognition, research must be continuous, reliable, and discussed. Such research is not always possible, particularly with species that are difficult to maintain in a research facility. Therefore, this study is a meta analysis of previously conducted research on the cognitive capabilities of Loxodonta africana (African elephants) and Elephas maximus (Asiatic elephants). Extensive review of relevant literature was conducted and individual results of several cognitive tasks are discussed. Evidence of problem solving, tool use, self-awareness, and cooperation is presented empirically. Due to the high black market value of the ivory tusks of the elephant, this species is at risk for extinction. Producing empirical evidence of cognitive abilities may help raise awareness and interest in the future of this species.

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

Yurika Komatsu, & Tomokazu Ushitani (Chiba University)

P58 We examined whether pigeons perceive Kanizsa-type illusory surfaces, in which humans perceive a surface brighter than the background when four pacman-like shapes have their open mouths directed toward the center of the pattern. During the training, brightness of two simultaneously presented patches, each surrounded by four pacmen was manipulated. Two pigeons were rewarded for choosing the brighter patch ("bright" group), whereas the other two pigeons were rewarded for choosing darker patch ("dark" group). The pacmen were arranged so as not to construct the illusory surface during the training. On the test probe trials, one pacmen were arranged to construct the illusory surface and the pigeons were rewarded regardless of their choice. If the pigeons perceive an illusory surface, it would be expected that pigeons in the "bright" group would choose the illusory pattern, whereas pigeons in the "dark" group would avoid it. However, pigeons in both groups frequently chose the illusory pattern. A subsequent test using a non-illusory, but a novel pattern did not reveal such a preference for that pattern. Thus, these results suggest that the illusory pattern may induce a distinctive perception in pigeons, similar to humans and that pigeons develop a preference for the pattern through the non-differentially rewarded trials.