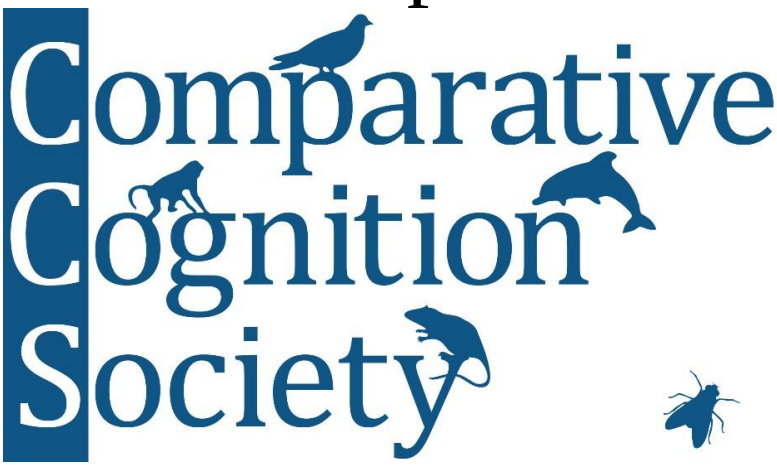
30th Annual International Conference on Comparative Cognition



Sponsored by the Comparative Cognition Society

April 12th to 15th, 2023

Radisson Hotel

Melbourne Beach, Florida

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PROGRAM NOTE: All times are "p.m." unless otherwise noted. Five-minute talks are designated by a talk number with a grey background. Five-minute talks are followed by two minutes for discussion. Ten-minute talks are followed by four minutes for discussion. Twenty-minute talked are designated by a box around the talk number and are followed by five minutes for discussion. Symposium talks are 15 minutes, including discussion.

Wednesday Afternoon

7:00 PM Opening Remarks – Lauren Guillette

7:10 PM Concept Learning (Chair: Jessica Stagner Bodily)

1

7:10 PM **Rats Can Distinguish Grape Varieties in Wine**

Elisa Frasnelli (University of Trento - Italy), Benjamin Chivers (Royal Veterinary College - UK), Barry C Smith (University of London - UK), & W Tecumseh Fitch (University of Vienna - Austria)

In the olfactory literature there is considerable debate about how differences in olfactory receptors across different species map onto variations in perceptual performance. Although humans have fewer functional olfactory receptors than most other mammals, it has been suggested that linguistic and cognitive abilities compensate for this apparent deficit. To address this live issue, we used discrimination of wine varieties, which is considered a challenging task for humans, and has been suggested to rely on human-specific cognitive abilities. Nine rats were trained in an olfactory discrimination task (go/no-go) using a specific wine variety (Riesling or Sauvignon Blanc) from different makers as the S+. Rats were then tested using novel wines of the same varieties in unrewarded probe trials. All nine rats successfully learned to discriminate the two varieties, and generalised to novel wines of the same varieties. We explore the implications of our results for wine tasting, and olfactory perception more generally.

2

7:17 PM **Maze Learning in Horseshoe Crabs (Limulus polyphemus)**

Dylan Davidoff, Marina Lourenco, Erin Frick, & Eron Higgins (Eckerd College)

Investigations of learning in nonhuman animals focus predominantly on vertebrates, with invertebrate species behavior largely considered static and inflexible. However, recent studies on select invertebrate species suggest that assessments of learning are possible when ecologically relevant learning tasks and associated rewards are utilized. Horseshoe crabs (Limulus polyphemus) in particular are an invertebrate species that is highly utilized in laboratory and biomedical research, yet little to no research on their capacity for learning or other cognitive functions has been undertaken to date. The goal of the present study was to develop an ecologically relevant maze learning task and establish the behavioral markers and criteria that indicate learning has occurred. Learning and being able to retrieve acquired information is often crucial for an animal to navigate their environment effectively and efficiently. Our results indicate horseshoe crabs were able to learn to solve a maze and indicatively show signs of memory retention of the learned pathway to exit. This documentation of their behavioral plasticity aims to broaden the attention of the Institutional Animal Care and Use Committee (IACUC) and other standard laboratory and in-situ protections, as well as establishing a baseline foundation towards horseshoe crab, and other invertebrate, learning and cognition-based research.

3

7:24 PM **The emergence of a minimal concept of death in Goffin's cockatoos (Cacatua goffiniana)**

Eleonora Rovegno (University of Ferrara and University of Veterinary Medicine Vienna), Antonio Osuna-Mascaró (University of Veterinary Medicine Vienna), Susana Monsó (Universidad Nacional de Educación a Distancia (Madrid)), & Alice M.I. Auersperg (University of Veterinary Medicine Vienna)

The concept of death (CoD) is considered an unusual cognitive feat in non-human animals. Experience, cognition and emotion are necessary for a full CoD to emerge (Monsó & Osuna-Mascaró, 2021). Monsó (2019) described a set of conditions that must be met to have a 'minimal CoD', on which non-subjective cognitive studies should initially focus on: first, expecting an irresponsive agent to be responsive, and then grasping its non-functionality and the irreversibility of the latter. As parrots are highly encephalized, long-lived birds, with complex sociality, they are good candidates to test for the emergence of minimal CoD in non-human animals. We designed an appetitive touch-screen task in which Goffin's cockatoos had the opportunity to optimize their effort by processing the non-functionality of certain icons and the irreversibility of that non-functionality. Fifteen Goffins participated in the experiment in which they faced 100 different backgrounds with functional, rewarding buttons that became non-functional after a specific event occurred. Preliminary data analysis shows that Goffins remembered the button's non-functional state when the backgrounds on which the event happened reappeared later in the experiment. Thus, Goffins can learn the concept of irreversible non-functionality, cognitive prerequisite for the emergence of a minimal CoD.

7:31 PM Associative Processes I (Chair: Anna Wilkinson)

4

7:31 PM **The Importance of Reward Surprise for Pavlovian Learning and Underlying Brain Circuits**

Andrew Delamater, Noah Hussein, & Daniel Siegel (Brooklyn College - CUNY)

Theories of associative learning emphasize the importance of reward surprise (or "reward prediction errors") in accounting for a variety of Pavlovian learning phenomena collectively referred to as "cue competition" or "cue interaction" effects. Some examples include: overshadowing, blocking, conditioned inhibition, contingency degradation, superconditioning, deepened extinction, protection from extinction, feature positive effect, relative cue

validity. Investigations of the neurobiological mechanisms of Pavlovian learning show how this key psychological concept can be realized in the brain. Here we investigated the nature of the "reward" that must be surprising for new learning to develop and what brain structures encode that surprise. We used a blocking/unblocking experimental design with rats to show that new learning was relatively weak when a stimulus was paired with a fully expected reward, compared to a stimulus paired with a reward that was surprising both in terms of its physical identity (its taste and texture) and its time of occurrence (early versus late in the stimulus). We have also begun to use neuroimaging (i.e., phosphorylation of ribosomal protein S6) to assess brain regions that code for reward identity or time prediction errors. Preliminary evidence suggests that surprising reward identities and times activate overlapping yet distinctive cortico-striato-limbic circuits.

5 7:45 PM

Do human-reared exotic cats look to familiar humans in an Impossible Task?

Victoria L. O'Connor (Bergen County Zoo; Oakland University), Brittany Greene (Panther Ridge Conservation Center), & Jennifer Vonk (Oakland University)

Hand-rearing may impact sociocognitive traits and behaviors in non-domestic species. For example, research suggests that hand-reared individuals may be increasingly reliant on humans, which may lead to lower levels of persistence in challenging tasks. This effect has important implications, especially for the potential release of hand-reared individuals into the wild. The Impossible Task assesses task perseverance and provides a context whereby subjects might gaze to humans when they cannot solve the task on their own. Whereas human reliance is usually attributed to domestic or social species, we presented the Impossible Task to 12 non-domestic and relatively asocial captive felids of seven species that had been hand-reared. These subjects received constant hand contact and training and have built strong relationships and positive associations with humans. On half the trials, a familiar human was present and on the other half, an unfamiliar human was present. We expected that they would look longer to familiar than non-familiar humans and demonstrate less task persistence compared to mother-reared individuals tested previously. Non-domestic cats are still grossly understudied in cognitive work and this study helps to remedy the lack of data on less social species.

6 7:52 PM

Functional Equivalence in Rats: Transfer of a Novel Response Across Symbolic Classes

Madeleine Mason, Cassondra Giarrusso, Katherine Bruce, & Mark Galizio (University of North Carolina Wilmington)

A repeated simple discrimination reversal procedure has produced evidence for classification of arbitrary (symbolic) stimuli in several species, showing promise as an animal model of symbolic learning. The present study in rats assessed whether a novel response trained to one class member would transfer without direct training to other class members, as has been demonstrated in humans. In Phase 1, using a go/no-go arrangement, rats were trained to nose-poke in a center response port in the presence of odors designated as members of Set X, while responses to members of Set Y were unreinforced. Contingencies (i.e., which set was positive) were repeatedly reversed each time subjects met mastery criteria. Discriminative performance on the first presentation of odors following a reversal was considered evidence for functional class formation. In Phase 2, a novel left- or right-side port response was trained to one member of each class in a new context (X1-right, Y1-left). Following task mastery, other class members were presented on unreinforced probe trials to test for response transfer. Some rats demonstrated statistically significant transfer, but overall, probe performance was variable. Further analysis is warranted to ascertain sources of variability to validate this task as a model of symbolic processes.

7 7:59 PM

Exploring cognition with multiple rewards: A new dimension into the cognitive ecology of pollination

Felicity Muth (University of Texas at Austin)

Animals often make decisions between multiple, complex rewards. However, cognition is generally studied in relation to a single reward type, usually across a single dimension of quality. This is relevant for bumblebees, where individuals collect both nectar and pollen rewards from flowers, and need to learn associations with both stimuli simultaneously. I will discuss a series of experiments showing that bees can learn about pollen and remember associations long-term, and that flower visitation can be guided via pollen taste. These findings have implications for our understanding of how bee cognition has shaped, and been shaped by, the plants they pollinate. I will then discuss bee cognition in relation to two rewards, showing that collecting nectar de-motivated bees to collect pollen and made it more difficult for them to learn associations with pollen-associated stimuli. This finding indicates that nectar is a more salient reward and may have evolved as a strategy to 'distract' bees from pollen removal. Finally, I will discuss recent work on another aspect of reward complexity, the chemical complexity of nectar. We discovered the insect neurohormone octopamine in floral nectar, and found that it mediated the effects of another nectar chemical, caffeine, on bee cognition.

8:24 PM Tool Use and Problem Solving (Chair: Kate Chapman)

8 8:24 PM

Examining the variation in innovation of Asian elephants across human-dominated and protected environments in Kanchanaburi, Thailand

Sarah L. Jacobson (The Graduate Center and Hunter College CUNY), Marnoch Yindee (Akkhraratchakumari Veterinary College Walailak University), & Joshua M. Plotnik (The Graduate Center and Hunter College CUNY)

Wild Asian elephants are frequently faced with novel challenges in the rapidly changing environments of the Anthropocene. As their forested habitats shrink, many elephants live in close proximity to human settlements. While some individuals choose to spend time foraging in these human-dominated landscapes, others choose to remain in protected areas. Innovation may be particularly advantageous to the former group, as this ability allows animals to exploit new resources or establish themselves in a novel environment. However, variation in innovative ability across anthropogenic landscapes is not well understood. To study this, we installed multi-access boxes inside and on the border of Salakpra Wildlife Sanctuary, a protected area in Thailand surrounded by agricultural development. We will present innovation scores from over 100 individuals between the two locations as well as data on several individual behavioral traits, including persistence, neophilia, and exploratory diversity. We will also compare results between individuals tested inside the Sanctuary and along crop fields bordering it, to investigate whether these traits are related to habitat use and risk-taking across landscapes. This study will provide insight into how innovation varies in elephants, and whether such variation may predict if certain individuals are more likely to engage in conflict with humans

8:31 PM **Wild Goffin tool use: A four-fruit story (so far)**

Alice Auersperg, Berenika Mioduszewska, Mark O'Hara, Antonio Osuna-Mascaro, & Theresa Rössler (University of Veterinary Medicine Vienna)

9

Recent years showed that Goffin tool use is not limited to captivity: In 2018 we analyzed a video taken from a feral population in Singapore: A Goffin seemed to probe the inside a coconut with a stick. While the effect of the stick on the nut remained out-of-sight, there were more pieces of fruit falling while the the stick was combined with the latter. In 2021, we were able to systematically record a complex sequence of stick tool on a Seamango stone in birds from an endemic population on Tanimbar/Indonesia. Shortly after, we analyzed videos showing a Singapore Goffin employing a stick on a Pong Pong fruit stone. The tool use had distinct overlaps but also discrepancies with the observations on Tanimbar. A first 'field' season in Singapore provided multiple observations of tool use on a sea almond. Again, we found differences and overlaps with previous examples of wild tool use in this species. Since Goffin tool use seems to be limited within wild populations, we argue that it is probably the result of individual innovations. Nevertheless, the way that tools are employed on a specific fruit is likely to be constrained by the properties of the latter.

8:46 PM *Break*

8:56 PM Development (Chair: Lauren Guillette)

8:56 PM **Chicken Soup for the Soul: The Heartwarming Tale of Chickadee Rescuers**

Katharine H. Stenstrom, Moriah J. Deimeke, & Christopher B. Sturdy (University of Alberta)

10

Rescue behavior is a special form of altruism in which an individual aids another individual that is currently in distress or danger, with no obvious direct benefit to the rescuer. In March of 2022 the SNL trapping team observed black-capped chickadees freeing each other from Potter traps. The non-trapped bird flew into the swinging door of the Potter trap with enough force to open it, allowing the trapped bird to escape. I hypothesize that what we saw was rescue behavior, and have performed a preliminary literature review to inform my following experiments. My review focused on the hypothesized motivators for rescue or rescue-like behavior, identifying the taxa where rescue or rescue-like behavior has been found, finding a working definition of rescue behavior itself, and sourcing methods used by other researchers to test rescue in vertebrates and invertebrates. Here I will go in depth in my scoping review and future directions for assessing rescue behavior in chickadees.

9:03 PM **The Impact of Individual Differences in Dogs on the Dog-Human Bond**

Jordan G. Smith, Jeffrey S. Katz, & Sarah Krichbaum (Auburn University)

11

The domestic dog (Canis familiaris) has assumed many roles in society, due to its propensity to interact and bond with humans. However, considering the wide variety within this species, variations between individuals likely influence the quality of the bond between a dog and its owner. Therefore, we asked dog owners to fill out a series of validated questionnaires measuring dog temperament and the dog-human bond, specifically the Canine Behavioral Assessment and Research Questionnaire (C-BARQ), the Monash Canine Personality Questionnaire – Revised (MCPQ-R), the Dog Impulsivity Assessment Scale (DIAS), and the Monash Dog-Owner Relationship Scale (MDORS), along with some demographic questions. Overall, we collected data on 210 dogs (104 males). To condense the measures of dog temperament, we ran a PCA on the C-BARQ, MCPQ-R, and DIAS items and found that 5 factors (anxious arousal, excitability, trainability, unsociability, and fear) explained the variation in dog temperament across scales. In addition, we found that age, temperament, and sex all influence the dog-human bond as measured by the MDORS. For example, the level of dog-human interaction depended on both the age and the excitability of the dog. These findings could help inform future pairings to ensure cohesive dog-human relationships.

9:10 PM **Sexual conflict and the development of social cognition**

Molly Cummings, Luke Reding, Phil Queller, Ross DeAngelis, Vural Yurt, Claire Marrone, Kiyara Martinez, & Yasmin Shirali (University of Texas at Austin)

12 There are several competing theories regarding the evolution of social cognition, but currently no direct comparative test of their contributions in development. Here we directly test the contribution of social complexity and conflict on the development of social cognition by conducting a social rearing experiment with a polymorphic fish. We raised female swordtails from birth to adulthood in five density-controlled conspecific environments that differed by social complexity and sexual conflict. At adulthood, we evaluated social cognition by presenting females with novel male animations exhibiting two different behaviors (sexual coercion or neutral behaviors), followed by a discrimination test. Females reared in complex environments familiar with both coercive and courting males were unable to discriminate between the novel phenotypes. However, females reared exclusively with coercive males approached the previously neutral phenotype significantly faster than the previously coercive phenotype. Here we show that costly social interactions can drive the development of advanced social cognition even in non-variable social environments.

9:24 PM **Effect of rearing environment on the development of depth perception in egg-laying hens**

Claire T. Jones, Allison N. Pullin, Richard A. Blatchford, Maja M. Makagon, & Kristina Horback (Center for Animal Welfare Department of Animal Science University of California Davis)

13 The effect of elevated structures in the rearing environment on the development of depth perception was investigated in cage-free laying hens at 7-8, 15-16, and 29-30 weeks of age. Dekalb White pullets (n = 30, 10/treatment) were reared in separate environments of increasing vertical complexity (perches, ramps, and platforms). At each age block, a modified Y-maze task with a 1:3 ratio or a 1:1 ratio difference in arm lengths was used and exit choice (short, long, no choice) was recorded. A visual cliff test was used to evaluate the frequency and latency to cross the cliff at three depths (15, 30, and 90 cm). All birds exited through the short arm more than chance ($p = 0.032$, chance level = 0.5) and displayed shorter latencies to exit the Y-maze with age ($F(2, 52) = 4.7$, $p=0.01$). Birds which were quick to cross the cliff at 16 weeks were likely to do so at 30 weeks (30 cm; $r = 0.46$, $p=0.01$). These results indicate that elevated structures in the rearing environment does not necessarily impact a bird's ability to perceive depth, and instead, age and individual differences in activity are more likely to impact a bird's performance in cognitive-locomotor tasks.

9:31 PM Cognitive Processes I (Chair: Jenna Congdon)

9:31 PM **Shape categorization is biased by position in a learned sequence**

Angelle Antoun, & Benjamin Wilson (Emory University)

14 When presented with a novel word in a sentence, word order can be used to determine the category (noun, verb, etc.) to which the word belongs. However, it is currently unclear whether this tendency to use sequence information to infer category membership is a domain-specific feature of language or a more domain-general phenomenon. To examine this, we conducted two experiments in humans and Rhesus macaques, using three perceptually distinct shape categories (A=rounded shapes; B=squared shapes; C=pointed shapes). Subjects were first taught to categorize shapes, then to select them in a fixed sequence order (A->B->C). We then generated ambiguous stimuli by morphing together shapes from different categories. In humans, when an ambiguous morph was presented in a sequence, its subsequent categorization was radically shifted based on the position in which it occurred (e.g., an AB morph in the A position was more often categorized as A than B). These results demonstrate that the tendency to use sequence information to infer category membership is not unique to the domain of language. Data collection in macaques is currently underway, and will help determine whether this tendency is even restricted to humans, or instead represents an ancestral ability in primates.

9:38 PM **Cognitive arms-race in free-ranging pigs**

Ludwig Huber, Ariane Veit, & Marianne Wondrak (Messerli Research Institute - Vienna - Austria)

15 In social groups foraging on patchy distributed food, some individuals will find food sources which others might want to exploit by expelling them from there due to higher rank, or, if low-ranking, by scrounging. This might result in a cognitive arms-race, with the informed pigs trying to develop counter-strategies to keep what they found. We tested adult Kune Kune pigs that lived for several years in free-ranging conditions and, importantly, formed a semi-natural multi-male/multi-female group. Ten middle-ranking pigs were trained to find food in one of five food patches in a large foraging arena, thus becoming "informed foragers" (IF). Eight other pigs, four of them higher-ranking (HR) and four lower-ranking (LR) to the IF, learned that food is somewhere in the arena, but not exactly where ("non-informed foragers", NI). On test, IF were let into the arena first alone and then with either a NI-HR or a NI-LR. Each IF was tested with all NI 10 times (800 tests in total). We found IF discriminating between NI-HR and NI-LR and adjusting their foraging behavior accordingly, especially by developing several tactics to avoid exploitation by NI-HR. In contrast, if paired with NI-LR, the IF behaved as if foraging alone.

Assessment of monkey visual imagery using pupillometry

9:52 PM *Mackenzie Webster, Sophie Park, & Robert Hampton (Emory University)*

16 It is often thought that non-human animals, lacking language, are especially dependent on visual imagery. However, recent evidence from "aphantasic" humans, who report no visual imagery, indicates that imagery may play a much less central role in visual cognition than previously thought, admitting the possibility that nonhuman animals also demonstrate visual competence without imagery. When humans with imagery think of a bright stimulus, such as the sun, their pupils constrict, and when they imagine a dark stimulus, their pupils dilate. This was not found in aphantasic humans, potentially providing a physiological correlate of imagery, independent of behavioral competence. We trained five monkeys on a task designed to activate mental representations of bright and dim stimuli and measured their pupillary responses. We recorded robust and large differences in pupil size when monkeys viewed stimuli that differed in luminance ($F(9,36) = 24.27$, $p < .001$). Under conditions in which we expected monkeys to activate mental representations of these same stimuli we did not find differences in pupil size ($F(9,36) = 1.03$, $p = .507$). Thus, in our first experiment we did not find evidence of visual imagery in monkeys. Implications and limitations of these results will be discussed.

Investigating cognition using animal architecture

10:06 PM *Benjamin A. Whittaker, Liam Nolet-Mulholland, Connor T. Lambert, Sara C. Blunk, Andrés Camacho-Alpízar, & Lauren M. Guillette (University of Alberta)*

17 Animal architecture (e.g. burrows, bowers) conveys physical traits of builders, such as their size or breeding status. Here, we investigated whether architecture might also reveal cognitive attributes of builders, such as learning and memory. Fourteen pairs of zebra finches built four successive coconut fibre nests. Some pairs had previous nest building experience while others were naïve nest builders. Nest architecture was quantified using size measurements and shape landmarks. We found differences in nest architecture among pairs, with higher variation among nests built by different pairs than among nests built by the same pair. We also found marginal differences in architecture of nests built by the same pair over time: earlier nests were more similar to one another than to later nests and vice versa. Moreover, pairs with prior building experience had lower variation in nest architecture compared to naïve pairs. This suggests experience helped builders learn construction skills and/or recall previous architectural styles. These analyses demonstrate consistent among-individual differences in architecture that changed with both successive building attempts and prior experience, implying that the cognition of builders influences animal architecture.

Prospective and concurrent metacognition of familiarity and working memory

10:20 PM *Jad Nasrini, Tara Dove-VanWormer, & Robert R. Hampton (Emory University)*

18 Working memory involves active maintenance and is sensitive to competing cognitive load. In contrast, familiarity is a passive process that allows recognition of previously experienced stimuli without active maintenance during the delay interval. The difference between these two kinds of memory in cognitive activity during the delay interval suggests that working memory may be more accessible to cognitive monitoring than is familiarity. We tested how accurately monkeys predict their memory performance with repeating images, expected to require working memory, and with non-repeating images that could be recognized at test using familiarity alone. We compared the ability of monkeys to make accurate metamemory judgements both prospectively, at the end of the delay interval but before the memory test, and concurrently, at the time of the memory test. We found that monkeys were able to make accurate metamemory judgements at both times with both types of stimuli (one-tailed t-test comparing chosen minus forced trial accuracy to zero: Familiarity prospective $t(5)=5.244$, $p=.002$, concurrent $t(5)=4.174$, $p=.004$; Working Memory prospective $t(5)=2.435$, $p=.030$, concurrent $t(5)=4.140$, $p=.004$).

Thursday Afternoon

12:00 PM Ron Weisman Outstanding Student Presentation Competition (Chair: Matthew Murphy)

Do dogs have elements of Williams-Beuren Syndrome? Transposons, behavior & training success in assistance dogs

12:00 PM *Gitanjali E. Gnanadesikan (University of Arizona), Dhriti Tandon (Princeton University), Emily E. Bray, Evan L. MacLean (University of Arizona), & Bridgett M. vonHoldt (Princeton University)*

19 Williams-Beuren Syndrome is a neurodevelopmental disorder in humans that is caused by a hemizygous deletion of 28-30 genes and characterized by hyper-sociability and cognitive deficits. In canines, the homologous region shows a strong signature of selection in domestic dogs relative to gray wolves, and four structural variants derived from transposons have been associated with social behavior. To explore these associations in more detail, we genotyped

1,001 assistance dogs from Canine Companions, including both successful graduates and those released from the training program for behavioral reasons. Phenotypes included puppy-raiser questionnaires, trainer questionnaires, and cognitive and behavioral tests. Bayesian mixed models revealed strong associations between genotypes and certain phenotypic measures, including separation-related problems, aggression when challenged or corrected, and reactions to other dogs. Furthermore, we found moderate differences in the genotypes of dogs who graduated versus those who did not; insertions in GTF2I showed the strongest association (β=0.23, CI95%=-0.04–0.49, LOR=1.25). Using random forests for predictive modeling of training outcomes, we demonstrated that genotypes improve prediction accuracy, with GTF2I genotype being particularly informative. Our results provide insight into the role of these four loci in dog sociability and may inform breeding and training practices, particularly in working dog organizations.

12:07 PM

20

Do sex differences in behavior relate to performance on a physical cognition task in zebra finches?

Connor T. Lambert, Cailyn Poole, Julia Self, Nicole Gerle, Harleen Kooner, & Lauren M. Guillette (University of Alberta)

Nest construction is widespread across taxa and involves both cognitive and non-cognitive mechanisms that facilitate selecting and manipulating materials into a nest. We hypothesized that variation in nest-building behaviours might be related to physical cognitive abilities but found no difference in learning speed between male (the nest builder) and female zebra finches on a series of physical cognition tasks. In one of these tasks, the string flexibility discrimination, the S+ was stiff string and the S- was flexible string. We anecdotally observed that males' performance may have been inhibited by their tendency to mandibulate the S-. We have now quantified this behavior and found that males did indeed spend more time mandibulating both string types compared to females and that males mandibulated the S- more than the S+. To test if these sex differences in behaviour may have masked sex differences in cognitive performance we re-ran the flexibility discrimination with new birds and reversed the reward contingencies of the initial experiment so that flexible string was now the S+ and stiff sting was the S-. Again we found no sex-differences in learning speed between males and females. Our results indicate sex-differences in cognition may not underlie sex-differences in behaviour.

12:14 PM

21

Visual laterality during nest building: does it relate to learning speed?

Andrés Camacho-Alpízar, Jessica Hewitt, Tristan Eckersley, Connor T. Lambert, Gopika B. Balasubramanian, & Lauren M. Guillette (University of Alberta)

Cerebral lateralization, the specialization of each brain hemisphere for different perceptual, cognitive and behavioural tasks, is a widespread phenomenon. Although theory proposes a link between laterality and cognitive performance, theory does not specify whether this link only occurs within the sensory domain used to detect stimuli (e.g., visual laterality/visual task), or if the link can also occur across sensory domains (e.g., visual laterality/auditory tasks). We examined the relationship between laterality and cognitive performance both within and across sensory domains. First, we calculated a visual laterality index for each of 58 zebra finch (Taeniopygia guttata) males during nest building based on the eye with which he focused on the nest material before picking it up to deposit in his nest. Second, using data of cognitive performance (i.e., learning speed - trials to criterion) in three visual discrimination tasks (same sensory domain as nest material pickup) and three auditory discrimination tasks (different sensory domain from nest material pickup), we examined the relationship between laterality and cognitive performance. While one third (19/58) of our males were highly lateralized (in either direction), laterality strength was not related to cognitive performance neither within nor across sensory domains.

12:21 PM

22

Moving Beyond Bimanual Behaviour: Using Search Patterns in Parrots and Primates to Investigate Responses to Mutually Exclusive Possibilities

Jennifer A. D. Colbourne, Alice M. I. Auersperg (University of Veterinary Medicine Vienna), Sarah R. Beck (University of Birmingham), Megan L. Lambert, Christoph J. Völter (University of Veterinary Medicine Vienna), & Amanda M. Seed (University of St Andrews)

An integral element to conceive of the future involves taking into consideration multiple possibilities. The current paradigm for testing this concept consists of dropping a reward into an opaque forked tube, which has an equal chance of falling out of either exit. If the subject can account for these two alternative outcomes, they should try to catch the reward by covering both exits. Studies using this method have shown young children and great apes fail to do so; however, recently it has been shown that apes show little proclivity towards using bimanual coordination for falling objects, even when there are two objects to be caught. Furthermore, this approach is unsuitable for species that are incapable of simultaneous bimanual actions, such as birds. We propose an alternative set up, including a straight tube, to analyze the subject's search patterns after the reward has already fallen and is hidden from sight, to see if unrewarded search is abandoned sooner when there is more than one possible outcome, than when only one outcome is possible. The results from research with this new method are presented for both the tufted capuchin and the Goffin's cockatoo, and the implications for near future cognition discussed.

12:28 PM Canine Cognition (Chair: David Stahlman)

23

Using priming methodology with dogs in an overimitation task

12:28 PM *Louise Mackie, & Ludwig Huber (Messerli Research Institute - Department of Comparative Cognition – University of Veterinary Medicine Vienna)*

Overimitation — the copying of another's unnecessary or irrelevant actions towards a goal — has been considered to be uniquely human. Recent studies, however, have found evidence for this behavior in dogs. In humans, priming feelings of ostracism has proven to be an effective method to increase one's social motivation to imitate another individual. Dogs may also have social motivations to overimitate, as they copy irrelevant actions more from their caregivers than strangers. To test whether a dog's motivation to overimitate can be primed, we invited caregivers to demonstrate irrelevant and relevant actions to their dog following either a dog-caregiver relationship prime, an attention prime, or no prime. There was no significant main effect of priming on either relevant or irrelevant actions, despite dogs with no prime having the least copying behavior. Still, dogs more often and more accurately copied their caregiver's relevant actions per trial. In trials where both the irrelevant action and the goal were copied, dogs were much more likely to copy irrelevant actions after achieving the goal. This study discusses possible social motivations behind the imitative behavior of dogs, and also has methodological implications for dog researchers concerned about the influence of priming on behavioral data.

24

Do Dogs Rely on Their Experience With a Novel Cue to Predict How Others Would Respond to It?

12:35 PM *Dana Ravid-Schurr (College of Staten Island and The Graduate Center - CUNY), Sarah-Elizabeth Byosiere (Hunter College and The Graduate Center - CUNY), & Bertram O. Ploog (College of Staten Island and The Graduate Center - CUNY)*

Theory of Mind (ToM) had been extensively studied in nonhuman animals, but findings are still controversial. Dogs were shown to behave in accordance with what humans see or know. However, it is unclear whether they do so by attributing mental states such as knowledge (a ToM behavior), or by relying on how they saw humans behave in similar circumstances in the past. To disambiguate this, we tested whether pet dogs relied on their own experience with a novel auditory cue to predict how others would respond to it, without ever having observed them do so. Seven dogs learned to use a sound to find a hidden treat. We then tested whether they would predict that an experimenter would use the cue in a similar manner. Our results indicated that the dogs did not rely on the auditory cue to predict the experimenter's success. We are about to begin data collection in a follow-up study to test whether altering the training procedure would change the dogs' performance. This study has implications for our understanding of dogs' cognition and behavior and the dog-human relationship. Additionally, the method implemented here may be used to study ToM-related behaviors with other species.

25

Contrafreeloading in domestic pet dogs (Canis lupus familiaris)

12:42 PM *Liza Rothkoff,, Lynna Feng, & Sarah-Elizabeth Byosiere (Guide Dogs for the Blind - Hunter College)*

Contrafreeloading can be defined as an animals' willingness to work for food when freely available food is present. To date, multiple studies have evaluated contrafreeloading in various animal species, observing that many non-domesticated species (e.g. maned wolves, red jungle fowl) and domesticated species (e.g. pigs, goats) demonstrate a preference to work for food when readily available food is present. Most recently, Delgado et al., (2021), observed that domestic cats prefer freely available food over food that requires effort. In an adaptation of this research, we assessed whether or not another domesticated companion animal, dogs, prefer to work when presented with a food puzzle (snuffle mat) and a tray. Thirty-eight pet dogs participated in the study in which they were presented with ten feeding trials (50% of food in a snuffle mat and 50% of food on the tray). All dogs wore activity trackers for the duration of the study and feeding trials were video-recorded and behaviorally analyzed. Here we present novel findings that evaluate the amount of food eaten from, the time spent in physical contact with, the number of first approaches to the snuffle mat and tray to answer the question, "do dogs prefer to contrafreeload?"

26

Do dogs understand the role of a human partner in a cooperative task?

12:49 PM *Juliana Wallner Werneck Mendes, Giulia Cimarelli, & Friederike Range (University of Veterinary Medicine Vienna)*

Dogs and humans present an unique opportunity to understand interspecific cooperation, and previous studies show dogs cooperate with humans in the string-pulling paradigm. However, it is not clear if they understand the role of the partner. We presented pet dogs with an adaptation of the string-pulling task with the economic game "stag-hare hunt". Partners can coordinate (choose stag) to obtain a high value reward but risk obtaining nothing if the partner defects, or work alone and obtain a low value reward (choose hare). We tested ten dogs with their owners, who varied which strategy was used: only choosing stag, only hare, or random. There were 60 trials of each strategy. The GLMM shows that dogs were more likely to choose stag when the owner did the stag strategy than the hare or random strategy ($P < 0.001$), indicating they were matching the owner's choice. However, in the random strategy, dogs matched the owner when they chose stag ($P < 0.01$), but not when they chose hare ($P = 0.054$). We conclude that dogs might match the owner's choice for stag because of attraction to the high-value reward, speaking against a true understanding of the contingencies of the game.

12:56 PM **Dog communication: from points to keyboard use - What do we really know?**

Heidi Lyn (University of South Alabama)

27

Over the past few decades, interest in dog cognition and communication has grown tremendously. Unfortunately, with the ready availability of dogs and the growth in interest of citizen science, we have also seen the growth of methodological and interpretive errors in dog studies. Similar to the replicability crisis in Social Psychology, dog studies are frequently single group comparisons, but without many controls and without replications. For years, we have heard about dogs out-performing apes in pointing tasks, but when methodological differences are lessened, these claims do not hold up. And now we see an interest in dogs using keyboards (an outgrowth of very popular TikTokers' and YouTubers' dogs using "talking buttons"), but very little talk of potential methodological or interpretive issues or plans for controlled testing. The ape language studies of the 60-70s were almost destroyed by allegations of fraud and over-interpretation, even given the most careful of data collection, so any new keyboard projects need to take those lessons into account. I detail a plan for a dog keyboard system that will allow me to gather and analyze the use of symbols by dogs, along with a plan for detailed testing of the dogs' referential understanding of symbols.

1:17 PM Communication (Chair: Erin Frick)

Can horses discriminate human body odors from joy and fear contexts?

1:17 PM *Plotine Jardat (Université de Tours - PRC - F-37380), Alexandra Destrez, Fabrice Damon (Université de Bourgogne-Franche-Comté), Zoé Menard--Peroy, Céline Parias, Philippe Barrière, Matthieu Keller, Ludovic Calandreau, & Léa Lansade (Université de Tours - PRC - F-37380)*

28

Animals are commonly believed to detect human emotions through smell, in link with the primitive and ubiquitous characteristics of chemoreception. Indeed, the brain areas dedicated to odor processing are among the oldest structures in mammalian evolution, and chemosignals may play a role in interspecific communication. However, few studies have conclusively demonstrated that animals can perceive human emotions through smell. To determine whether horses can discriminate between human odors of fear and joy, a habituation-discrimination protocol was used. Horses were exposed to sweat odors from humans who declared they had experienced fear or joy while viewing a comedy or a horror film, respectively. A first odor was presented twice in subsequent trials (habituation), and then the same odor and a novel odor were presented simultaneously (discrimination). Both odors came from the same donor. Experimenters presenting the odors or coding the behavioral responses of horses to odors were blind to the condition. Horses sniffed the novel odor more than the repeated odor, indicating that they discriminated between the human odors produced in fear and joy contexts. Moreover, asymmetric nostril use and differences in habituation speed further imply differences in the emotional processing of the two odours by horses.

Call convergence and mechanisms of discrimination in chickadees

1:24 PM *Sarah M. L. Smeltz, Moriah J. Deimeke, Prateek K. Sahu, Katharine H. Stenstrom, Carolina Montenegro, Victoria Rennie, Inaara Ebrahim, Holly Starenchak Baukhagen, & Christopher B. Sturdy (University of Alberta)*

29

Black-capped chickadees (Poecile atricapillus) rely on vocal plasticity throughout their lifespans. Fledglings employ vocal plasticity, refining their vocalizations by mimicking tutors. Adults employ vocal plasticity in the process of acoustic convergence, whereby flockmates' vocalizations become increasingly similar and distinct from other flocks. Convergence of the chick-a-dee call has been observed in wild and free-flying communally-housed laboratory flocks. Our study aimed to answer whether convergence occurs in the absence of physical interactions, in individually-housed laboratory chickadees. Six individually-housed chickadees from two laboratory colonies were introduced to a new colony room. Birds' calls were recorded at baseline and weekly thereafter for ten weeks, and their acoustic features compared. While qualitative trends supported convergence of some spectral features, further quantitative analysis is required. We conducted an operant conditioning study to further examine the mechanisms underlying convergence in a laboratory setting. Chickadees were presented with pre- and post-convergence calls, and were differentially-reinforced according to the caller's original colony. Chickadees successfully discriminated reinforced from non-reinforced individuals using pre-convergence calls, but did not transfer this learning when later presented with post-convergence examples. Our findings suggest that chickadees can perceive differences in pre-versus-post calls. Furthermore, convergence may alter individual identity information, as post-convergence calls impeded individual discrimination.

1:38 PM *Break*

1:48 PM Attention (Chair: Chris Sturdy)

Effects of Immediate Social Context on Attention and Salivary Cortisol in Tufted Capuchin Monkeys

1:48 PM *Andrew DeSana, Aiko Amano, Morgan Benowitz-Fredericks, & Reggie Paxton Gazes (Bucknell University)*

30

Social context can alter cognitive performance in animals, but the mechanisms for this remain unclear. One possibility is that the stressors associated with social contexts mediate changes in cognitive performance through their influence on attention. In this study, we investigated how social context affects performance on an attention task in tufted

capuchin monkeys (Cebus [Sapajus] apella). We additionally validated and measured physiological stress through salivary cortisol. Eleven socially housed capuchins were each exposed to three conditions where they were either isolated or paired with an affiliative or agonistic social partner. Following a period of social interaction or isolation, subjects were tested on an attention task, and saliva samples were collected. We analyzed the relationship between social condition, attention performance, and salivary cortisol levels. Neither attention performance nor cortisol differed significantly across the three social conditions. When animals were isolated, there was a negative correlation between cortisol and attention. However, this relationship was not present in either social condition, suggesting that adding social context may interfere with the physiological relationship between cortisol and attention. These results imply a potential role of cortisol in attention performance and highlight the importance of including social contexts in cognitive studies.

1:55 PM

31

Dimensional reinforcement prediction in a visual discrimination task by pigeons

Olga Vyazovska (V.N. Karazin Kharkiv National University; Kharkiv International Medical University)

We trained eight pigeons (Columba livia) on a stagewise go/no-go visual discrimination task. A total of 16 visual stimuli were created from all possible combinations of four binary dimensions: brightness (dark/bright), size (large/small), line orientation (vertical/horizontal), and shape (circle/square). In the first stage, we presented S+ and four S– stimuli: sharing one (brightness), two (brightness and orientation), three (brightness, orientation, and size), or no dimensional values with S+. In the second stage, all 16 stimuli were presented. In the first stage, stimulus discrimination was controlled by the number of dimensional disparities between non-rewarded stimuli and a rewarded one rather than by stimulus dimensional salience, whereas at the beginning of the second stage, pigeon behaviour was controlled mainly by dimensional reinforcement expectancy learned in the first stage. At the beginning of the second stage, pigeons correctly rejected 6–8 of 11 new added S- stimuli. A significant inverse correlation between the number of S– stimuli sharing dimension values with S+ in the first stage and the dimensional discrimination ratios at the beginning of the second stage was found.

2:09 PM

32

Attentional strategies by capuchin monkeys in multi-dimensional visual search

Suzanne L. Gray (Hunter College CUNY), Muhammad A. J. Qadri (College of the Holy Cross), & Michael J. Beran (Georgia State University)

Previously, in a visual search task comprised of two simultaneously available discrimination tasks, humans strategically chose items from one dimension before switching to the other, while pigeons did not preferentially stay within one dimension over consecutive choices. To study the evolution of attentional allocation strategies, capuchin monkeys were tested using a similar visual search task. Each search display contained 16 total items from two orthogonal dimensions; participants were reinforced for selecting the four brightest (or darkest) of the eight brightness items and the four most vertical (or horizontal) of the eight orientation items. Some capuchins preferentially selected items from one dimension before switching to the other, with stable individual differences. These results suggest that, similar to humans, some monkeys are sensitive to the benefits of attentional staying and the costs of switching between dimensional tasks. These findings highlight potential differences in how pigeons and primates allocate attention in complex choice situations.

2:23 PM

33

Categorizing Dogs' Real World Visual Statistics

Madeline H. Pelgrim, & Daphna Buchsbaum (Brown University)

Little is known about the kinds of visual information available to dogs, as well as how they direct their attention within their environment. The present study, inspired by comparable work in infants, aims to identify and categorize the objects available to dogs in their visual environment during a common event in their daily lives, a walk. Using a head-mounted eye-tracking apparatus, dogs walked on a pre-determined route outdoors, under naturalistic conditions. Frames from walk videos were analyzed using computer vision techniques to determine both the objects available in dogs' view and which of those objects they look at. Data collection is ongoing (n = 9 dogs and 9,853 looks). Controlling for time in the dog's view, dogs looked to objects differently, $F(14) = 5.54$, $p < .001$, looking more to buses (looked at a bus 45% of the time it was in view), construction equipment (21%), and people (17%), than to other objects such as the sky which they rarely look to (looked 7% of time in view, present in view 83% of time). The results of this project provide a foundational step towards understanding how dogs' look at and interact with their physical world.

2:30 PM

34

Inattentional Blindness in Dogs

Emma Cox, Jordan G. Smith, Sarah Krichbaum, Donyae Royster, Jeffrey Katz, & Lucia Lazarowski (Auburn University)

Inattentional blindness occurs when attention is highly focused on a task and leads to failure to notice other stimuli in the environment. Inattentional blindness has been well researched in humans, and recently examined in horses. The current study aimed to assess whether dogs demonstrate inattentional blindness. We divided a cohort of dogs into an experimental group (n=12) and a control group (n=12), balanced by sex and temperament to control for individual differences in motivation and reactivity. Dogs ran down an empty corridor for 5 consecutive trials. From trial 6-10, the experimental group was rewarded at the end of the corridor to condition an expectation of reward and induce inattentional blindness, while the control group continued to be unrewarded. On trials 11 and 12, a novel object was

placed in a side opening halfway down the corridor for all dogs (side of object counterbalanced within each group). Dogs in the control group were significantly more likely to orient to the object than the experimental group ($p < .05$), suggesting that the expectation of reward can lead to dogs failing to notice stimuli in their environment. This "blinder effect" may have important implications for the training and performance of working dogs.

2:37 PM **Dogs' expectations about occlusion events: from expectancy violation to exploration**

Christoph J. Völter, & Ludwig Huber (University of Veterinary Medicine Vienna)

35

Occlusion events are a fundamental aspect of the physical environment. Expectations about when something should be visible and when not might help animals to track objects and animate beings. However, previous research provided mixed evidence for object permanence in many animal species, including dogs (Canis familiaris). In the present study, we first administered two eye-tracking experiments to examine whether dogs indeed have expectations concerning (screen-based) occlusion events and react with increased attention (i.e., with longer looking times and dilated pupils) when these are violated. Dogs indeed reacted with increased attention to events in which objects failed to reappear when they should have. In a third experiment, we investigated (i) whether we could replicate this expectancy-violation effect in a real world setting and (ii) whether any expectancy violation subsequently would trigger increased object exploration (as in human infants). Dogs again looked longer at the event that violated occlusion principles and, in the following, they also interacted more with the object that was involved in such an expectancy-violating event. We conclude that also nonhuman animals might be inclined to explore objects further that behaved in an irregular manner, which might provide them with learning opportunities concerning fundamental properties of their environment.

2:51 PM **Detouring strategies by a mosquito-eating spider**

Fiona R. Cross, & Robert R. Jackson (University of Canterbury; International Centre of Insect Physiology and Ecology)

36

Jumping spiders (family Salticidae) have unique, complex eyes and a capacity for spatial vision exceeding that known for any other animals of similar size. Most species from the salticid subfamily Spartaeinae are known to express an active preference for other spiders as prey ('araneophagy'), and there is much evidence that these salticids execute pre-planned detours to reach this type of prey. Here we present findings from recent research on Evarcha culicivora, a species from a different salticid subfamily (Salticinae) which has a very different prey preference (blood-carrying mosquitoes). In these experiments, we also demonstrate for the first time that prey odour can influence a salticid's detouring decisions. When presented with odour from blood-carrying mosquitoes, E. culicivora was significantly more inclined to take a detour and significantly more inclined to take a detour leading to a blood-carrying mosquito.

3:05 PM **Rensink-type change blindness in pigeons (Columba livia)**

Tomokazu Ushitani, Kiwako Shimada, Miki Yoshida, Kanna Okamoto, & Arii Watanabe (Chiba University)

37

Change blindness is a phenomenon in which we miss visual changes by a brief visual disruption such as blank displays and scattered spots. Whereas evidence of change blindness using simple line arrangements was found in pigeons (Herbranson, et al., 2013), we investigated pigeons' change blindness using Rensink-type of repeatedly alternating displays involving landscape photographs (Rensink, et al., 1997, O'Regan, et al., 1999). In the training of both Experiments 1 and 2, two displays were presented in repeated alternation -- Display A containing four or five items superimposed on a landscape photograph, and Display B that differed from A in that one item (the target) was missing. Pigeons were rewarded for responding to the location of the target item. In Experiment 1, a grey blank display was inserted between Displays A and B (Blank condition), and the accuracy of this condition was compared to that of Baseline (no-blank) condition. In Experiment 2, a "mudsplash" (checkerboard-patterned lattice) was superimposed at the same time as the change occurred. Performances for Blank and Mudsplash conditions were lower in accuracy than that of the corresponding Baseline conditions, suggesting that Rensink-type change blindness occurs in pigeons.

3:04 PM *Snack Break*

3:34 PM Social Learning (Chair: Joshua Wolf)

3:34 PM **The nose knows? Assessing social learning in Asian elephants (Elephas maximus) in a problem-solving task**

Matthew S. Rudolph (The Graduate Center; Hunter College CUNY), Celine E. Persad, Katherine E. Canter (Hunter College CUNY), Sarah L. Jacobson (The Graduate Center; Hunter College CUNY), Shermin de Silva (University of California San Diego), & Joshua M. Plotnik (The Graduate Center; Hunter College CUNY)

38

Elephants are highly social animals that use a variety of olfactory cues to make decisions about foraging, reproduction, and navigation. While studies have shown that elephants can learn socially when visually observing conspecifics, to our knowledge, their ability to learn through olfaction has not yet been assessed experimentally. We developed a novel puzzle tube that Asian elephants at the Rosamond Gifford Zoo in Syracuse, NY could solve by either pushing or pulling, using either their trunk or foot, to expose a food reward. We first trained a model elephant to interact with a manipulated tube so that it could only be solved using one particular method. We then investigated whether elephants would use olfactory information left behind by the model to a) find the 'soiled' tube amongst an array of untouched tubes, and b)

choose the same solution to the tube when multiple options were now available. Here, we will present our findings from this study and discuss the relevance of nonvisual sensory information to an elephant's social decision-making. We will also discuss the potential implications of this work for mitigating human-elephant conflict in the wild, with particular attention to the design of olfactory deterrents based on social cues.

3:41 PM **Nearby conspecifics and gambling proclivity: How the social facilitation effect alters suboptimal choice**

39

Peyton Mueller (University of Kentucky)

The social facilitation effect dictates that performance on a task will be affected by the presence of a conspecific. Zajonc (1965) posits that this change in performance due to the mere presence of another animal is due to the interaction of habit with the task and an increase in drive (motivation) caused by the conspecific, though other competing hypotheses refute this claim. Pigeons (Columba livia) make a smaller proportion of suboptimal choices when allowed social interaction following each experimental session; however, they also make a larger proportion of suboptimal choices when they are food deprived (i.e., highly driven). In this experiment, pigeons were randomly assigned to conditions where they were either exposed to another pigeon in an adjacent box during the experiment or completed the task alone. The proportion of suboptimal choice was compared between groups and determined that it is likely that pigeons treat the conspecific as social reinforcement, rather than a motivating factor. (155 words).

3:48 PM **Losing my mind: loss of unused cognitive skills in blind cavefish**

40

Noam Miller, & Britney Sekulovski (Wilfrid Laurier University)

Though we have intensely studied many cognitive skills that help animals respond to specific environmental challenges, we have far fewer examples of animals losing cognitive abilities that are no longer adaptive. One morphotype of the blind cavefish (Astyanax mexicanus) lives in caves with no light, little food, and no predators, and has evolved away its eyes, enhanced its lateral line, feeds constantly, and does not school. A sighted morphotype of the same species lives in the rivers above and does school. We measured the collective movement of both blind and sighted Astyanax, along with zebrafish and a theoretical null model of agents that ignore each other. We find that blind cavefish do not ignore but actively avoid each other, suggesting their behavior is not due to sensory limitations but occurs because schooling is not adaptive in their environment. Sighted Astyanax schools are as dense and polarized as those of zebrafish. These results suggest that blind cavefish have lost either the motivation or the ability to engage in a behavior they no longer require, a complementary process to the acquisition of adaptive cognitive skills that may be common, and whose mechanisms are largely unstudied.

4:02 PM **How does the personality composition of a group affect collective behaviour?**

41

Tanya Shoot, & Noam Miller (Wilfrid Laurier University)

Many animals live in groups whose members vary in personality. Although personality traits have been studied at the individual level, how group personality composition and variation affect collective behavior has yet to be addressed. We assessed both zebrafish (Danio rerio) and guppies (Poecilia reticulata) individually for boldness, sociability, and aggression. We constructed groups of known personality compositions and ran them through both group and individual tasks. Individual innovation was first assessed using a detour task. Groups of 4 fish then completed a novel detour task to assess innovation, a maze foraging task to assess collective decision-making, and a predator inspection paradigm to assess cooperation. We found that individual guppies show little improvement in latency to social reward across barrier types or trials in the detour task. However, individual zebrafish show extreme evidence of an effect of barrier type on latency. When comparing groups on the novel detour task, we found moderate evidence of differences in latency in guppies, but anecdotal evidence of differences in zebrafish. This experiment highlights how a group's personality composition affects collective behaviour and the advantages of being in a heterogeneous group. Differences across species demonstrate that the effects of personality depend crucially on ecology.

4:09 PM **Do tortoises know what another tortoise can see?**

42

Anna Wilkinson, Olivia Toone, & Simon R. Clegg (University of Lincoln (UK))

Gaze following (aligning gaze direction with that of another individual) is considered adaptive as it is likely to alert individuals to the presence of important stimuli in the environment. Geometric gaze following (following gaze behind a visual barrier) is considered complex as it requires an individual to reposition themselves to look behind the obstacle. This requires an animal to assess the difference in the visual perception between themselves and the cue-giver. There is evidence of gaze following into the distance in reptiles but, so far, no evidence of geometric gaze following. In this experiment we investigated geometric gaze following in red-footed tortoises (Chelonoidis carbonaria). To do this, the tortoises were presented with videos of another tortoise looking in a certain direction and their responses monitored. In some trials the observer tortoise's view was blocked by a barrier that it could move around. The findings reveal that not only are tortoises are able to follow gaze into the distance, they are also able to follow gaze around a barrier, suggesting that they can assess the difference in perception between themselves and another individual. This has important implications for our understanding of the evolution of these abilities.

Investigating social norms in nonhuman animals

4:16 PM *Kristin Andrews (York University), Simon Fitzpatrick (John Carroll University), & Evan Westra (Purdue University)*

43 Social norms—rules governing which behaviors are deemed appropriate or inappropriate within a given community—are typically taken to be uniquely human. Recently, this position has been challenged (Andrews 2020; Fitzpatrick 2020; Kappeler et al. 2019; von Rohr et al. 2011). The view that norms are human unique stems from commitments regarding the psychological capacities required for having them, and skepticism that animals possess these prerequisites (Rakoczy and Schmidt 2019; Schlingoff and Moore 2017; Tomasello 2016). However, among norm cognition researchers there is little agreement about the cognitive architecture that underpins social norms in humans. This makes empirical study of animal social norms difficult at this stage. To make progress, we draw inspiration from the animal culture research program, and offer an an operationalized account of social norms. We propose examining normative regularities: a socially maintained pattern of behavioral conformity within a community (Westra and Andrews, 2022). Research suggests five contexts for exploring social norms in nonhuman animals: dominance hierarchies; infanticide; play; conformity to local traditions; and inequity avoidance. We suggest methods for studying social norms in wild and captive primate populations inspired by these five contexts, and report on an ongoing research project in collaboration with primatologists.

4:30 PM Special Session: International Society for Comparative Cognition (Chair: Aaron Blaisdell)

4:30 PM **Beyond anthropocentrism: Why studying diverse cognitions matters for comparative psychology**

Jennifer Vonk (Oakland University)

44 There has been an increased breadth in the number of species studied by comparative psychologists in the past decade. However, there is still a bias to test highly social species when studying cognition. This bias poses challenges for testing hypotheses like the Social Intelligence Hypotheses because we are missing data on important test cases – those animals that are not highly social. Studying species with a diversity of social lifestyles and foraging ecologies is necessary to better understand the role that these selection pressures may play in shaping cognition. We have recently tested a number of less social species, such as bears, large cats, binturongs, armadillos, snakes, amphibians, and pair-bonded species, like African Crested Porcupines, Southern ground hornbills, and macaws to gain a better understanding of cognition in species that vary in terms of diet and other ecological factors. I will present just a snapshot of some of our work with some lesser studied species.

4:44 PM **Midsession reversal task with starlings: A quantitative test of the timing hypothesis**

Marco Vasconcelos, Armando Machado, & Marilia Carvalho (University of Aveiro)

45 In the Mid-Session Reversal task (MSR), an animal chooses between two options, S1 and S2. Rewards follow S1 but not S2 from trials 1 to 40, and S2 but not S1 from trials 41 to 80. With pigeons, the psychometric function relating S1 choice proportion to trial number starts close to 1 and ends close to 0, with indifference (PSE) close to trial 40. Surprisingly, pigeons make anticipatory errors, choosing S2 before trial 41, and perseverative errors, choosing S1 after trial 40. These errors suggest that they use time into the session as the preference reversal cue. We tested this timing hypothesis with 10 Spotless starlings. After learning the MSR task with a T-s Inter-Trial Interval (ITI), they were exposed to either 2T or T/2 ITIs during testing. Doubling the ITI should shift the psychometric function to the left and halve its PSE, whereas halving the ITI should shift the function to the right and double its PSE. When the starlings received one pellet per reward, the ITI manipulation was effective: The psychometric functions shifted in the direction and by the amount predicted by the timing hypothesis. However, non-temporal cues also influenced choice.

4:58 PM **Incentive disengagement and the adaptive significance of frustration**

Mauricio R. Papini (Texas Christian University), & Carmen Torres (Universidad de Jaén-Spain)

46 Mammals respond to an unexpected reward omission or reduction with a variety of behavioral and physiological responses consistent with an aversive emotion traditionally called frustrative nonreward. This conclusion is supported by behavioral, pharmacological, and neurobiological evidence. However, frustrative nonreward has been mainly studied in terms of its mechanisms, across development in rats, and across vertebrate species in comparative research, whereas its adaptive function remains obscure. One possible hypothesis, known as incentive disengagement, suggests that the adaptive function of frustrative nonreward is to break an attachment to a site that no longer yields appetitive resources or to the absence of an attached conspecific so as to promote the search for alternative rewards. This function is of particular relevance to mammals because of the energy demands of their relatively large brain. We will review research showing that surprising reward omissions or reductions enhance various forms of activity, redirect behavior to other sources of reward (e.g., alcohol), induce search behavior in foraging and sexual-partner scenarios, and eliminate and even reverse previously preferred options in a free-choice situation.

47 5:12 PM

Pigeons playing pacman: Using video games to quantify insight behavior

Aaron P. Blaisdell (UCLA), Rafael S. Rodrigues (University of São Paulo-Brazil), Cyrus Kirkman (UCLA), & Miriam Garcia-Mijares (University of São Paulo-Brazil)

The study of insight behavior in animals has historically relied on observational or operant procedures involving real-world objects. Tasks have ranged from moving and stacking boxes to connecting sticks to digging and climbing tasks. Such procedures are often labor intensive, and the qualitative nature of the results makes quantitative comparisons difficult. Video-game procedures, however, have been used to study problem-solving behavior in several studies with humans, thereby overcoming the shortcomings of real-world tasks. We adapted a touchscreen navigation procedure to resemble the classic video arcade game pacman to study insight in pigeons. In an analog to Epstein et al.'s (1984) insight task, pigeons were trained to move a pacman icon across the display to reach an icon of a banana as a target. Next, pigeons were trained to move the pacman around visual barriers to reach the banana. Pigeons were then trained to move the pacman through portals to teleport the pacman across the display to reach a green circle as a target. In a final nonreinforced insight test, pigeons were provided with displays in which they had to navigate the pacman through a portal to reach the banana. All pigeons that had mastered the prior phases of training successfully navigated the pacman to the banana. More importantly, we calculated the "steps above par" (SAP) required to solve each display to quantify navigation efficiency. We discuss the psychological processes that underlie insight behavior and the utility of the pacman task for comparative analyses.

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

See Poster Abstracts Starting on Page 27

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

Friday Afternoon

10:30 AM CO3 Mentoring Program: Getting Involved in CCS Event

Welcome back to live CO3! The mentoring event this year focuses on initiatives and opportunities in CCS that offer members ways to get more involved. Leaders of the newly formed 1) Undergraduate Education and 2) Equity, Diversity and Inclusion committees will provide an overview of their goals and activities as well as hold small group discussions about involvement opportunities. In addition, CCS officials will be on hand to describe the duties of different elected positions. This event is geared toward CCS members early in their careers (graduate students, post docs, and untenured faculty) who are looking for ways to contribute to the society and build leadership skills. In addition, all CCS members are welcome to attend and learn about the new initiatives.
Chairs: Kate Bruce and Julia Espinosa
Mentors: Reggie Gazes, Suzanne Gray, Lauren Guillette, Ali Qadri, and Victoria Templer

12:00 PM Early Career Award Winner – Muhammad A.J. Qadri

Pigeon as radiologist: Training pigeons to classify abnormal 3D structures in multi-slice CT scans

12:00 PM *Muhammad A. J. Qadri, Reuben R. R. Reyes (College of the Holy Cross), Daria Kifjak, Bilal Elkaddouri, Alexander A. Bankier, Max P. Rosen (University of Massachusetts Chan Medical School), & Gregory J. DiGirolamo (College of the Holy Cross University of Massachusetts - Chan Medical School)*

48 Pigeons are able to categorize a variety of object classes, actions, and behaviors. This highly flexible and accurate visual cognition is substantially not-human-like, as seen in studies of amodal completion and hierarchical stimuli. Lung nodules on CT examinations are surrounded by vasculature, which on a single image section is indiscriminable by human radiologists from the abnormality but becomes recognizable when viewing a stack of CT sections. Using a go/no-go paradigm, we presented six pigeons with multiple CT sections on a single trial, which either contained an abnormality or not. For some pigeons, pecking during these latter "normal" displays was associated with reinforcement and pecking during the abnormal displays contributed to a dark timeout (the opposite reinforcement schedule was used for the remaining pigeons). Pigeons learned to discriminate and generalized to novel stimuli, suggesting categorization and not simple memorization of exemplars, with greater success seen by pigeons whose pecking during abnormalities was reinforced and during normals were not reinforced. The birds' success suggests a visual cognitive ability akin to 3D reconstruction specific to dynamic stimuli. The utility of comparative visual cognition for informing both human training in medical image reading and machine learning will also be discussed.

12:20 PM Memory (Chair: Marisa Hoeschele)

Comparative approaches to the natural ecology of metacognition.

12:20 PM *Bennett L. Schwartz (Florida International University), Ali Pournaghdali (University of Southern California), & Kelsey L. Hess (Eastern University)*

49 Most cognitive scientists assume that some, if not many, human cognitive abilities evolved through natural selection. We promote the view that we can understand natural selection of human cognition through the comparative study of animals and their natural ecology. In this paper, we consider metacognition, the experience and knowledge of one's own cognitive system. Metacognition has been operationalized differently in humans and non-human primates. In humans, it relies on verbal judgments, whereas in non-human primates it relies on specific behaviors, including escaping or opting out of difficult trials. We review the research literature on human and non-human primate metacognition with a focus on the search for common mechanisms that serve as the basis for metacognition across species and how different methods can be employed to study metacognition. We advocate for an approach to metacognition that makes hypotheses based on the natural ecology of species and then applies those hypotheses to a wide range of species.

For how long can hoarding parids remember their caching locations?

12:34 PM *Anders Brodin (Lund University)*

50 Several species of parids (tits, titmice and chickadees) store huge amounts of food. For example, willow tits, and their close relatives black-capped chickadees, store tens of thousands of seeds in one autumn. They make cryptic caches that are really hard to spot and possess a highly developed spatial memory for the exact positions of their caches. It has been demonstrated that stored food is an important part of the winter diet. Most highly specialized of all food-hoarding birds are the nutcrackers Nucifraga spp. They can remember their caching locations for more than a year after storing which make sense since they are highly dependent on stored food during winter. Unlike nutcrackers, however, experiments suggest that caching memory only lasts up to three weeks in parids. This creates three questions: 1. How can they relocate caches in winter, several months after storing? 2. Why do they have such a good memory for their caches? 3.

How does this agree with evolutionary theory that postulates that a hoarders must "possess" (i.e. remember) its caches? I will try to answer these questions using knowledge from theoretical models, experimental results and field data.

12:48 PM **Acclimation to a modified aquatic T-maze prior to training eliminates evidence of escape learning in amphipods.**

Joshua Wolf, & Susan Lewis (Carroll University)

51 Previously, amphipods (Gammarus pseudolimnaeus) placed into a modified T-maze submerged in water were able to escape the maze and do so faster and with fewer errors across days of training. This may be evidence of amphipods' ability to learn how to escape more efficiently. However, these findings should be interpreted through the lens of a small sample size. The current study had two main objectives. The goal of Experiment 1 was to retest the parameters of the initial pilot study (i.e.,light conditions, discriminable arms) with a larger sample size. The goal of Experiment 2 was to address methodological concerns with the earlier research. Previous research did not provide a maze acclimation period prior to training and therefore the improved performance, especially from Day 1 to Day 2, may have been the result of acclimation to the maze and not learning. The results from Experiment 1 supported the initial pilot study data. Experiment 2 supported the idea that the improved performance from Day 1 to Day 2 in the previous research was due to acclimation to the apparatus.

1:02 PM **Morphological Changes Persist Following mTBI-Induced Episodic Memory Impairment in Rats**

Gabriel Nah, Nicholas Port, Andrea Hohmann, & Jonathon D. Crystal (Indiana University)

52 Mild traumatic brain injury (mTBI) is the most common type of traumatic brain injury. It leads to temporary memory impairment and an excitotoxic response in the brain, particularly in the hippocampus. In an earlier study, we used the item-in-context task (Panoz-Brown et al., Current Biology, 2016) to assess episodic memory function in Sprague-Dawley rats who sustained an mTBI using the Wayne State University weight drop model (a model of mTBI that recapitulates key elements of a sport-related injury). We observed a selective decline in episodic memory performance during the first four days post-injury. In this study, we analyzed the expression of astrocytes and microglia at various time points following mTBI. Using several measurements to quantify morphological changes, we documented a delayed onset of substantial changes to the morphology of astrocytes and microglia. On most measures for astrocytes, we detected changes at eight days; one change was detected at four days. Microglia showed substantial differences in one parameter at four days. We conclude that morphological changes persist after the peak episodic memory deficit.

1:09 PM **Bonobos and chimpanzees remember friends and other familiar conspecifics for decades**

Laura S. Lewis, Erin G. Wessling (Harvard University), Fumihiro Kano (University of Konstanz), Jeroen M. G. Stevens (Royal Zoological Society of Antwerp), Josep Call (University of St Andrews), & Christopher Krupenye (Johns Hopkins University)

53 Recognition of familiar conspecifics provides the foundation for complex sociality and is vital to navigating an unpredictable social world. In humans, social memory incorporates content about interactions and relationships and can last for decades. Although individual recognition is widespread among animals and sometimes lasts for years, little is known about social memory in nonhuman apes, and therefore about the shared evolutionary foundations of human social memory. In a novel preferential-looking eye-tracking task, we presented chimpanzees and bonobos (N = 26) living in multiple populations with side-by-side images of a previous groupmate and a conspecific stranger of the same sex. Apes' attention was biased toward former groupmates, indicating long-term memory for past social partners. The strength of biases towards former groupmates was not impacted by the duration apart, and results suggest that recognition may persist at least 26 years beyond separation. Apes' looking biases were stronger for individuals with whom they had more positive histories of social interaction, suggesting that, like humans, ape social memory may incorporate content about relationship quality. Long-lasting social memory likely provided key foundations for the evolution of human culture and sociality as they extended across time, space, and group boundaries.

1:23 PM *Break*

1:33 PM Choice (Chair: Jonathon Crystal)

1:33 PM **Temporal Attention Interventions: Self-control with Reluctance?**

Travis Smith, & Kimberly Kirkpatrick (Kansas State University)

54 Impulsive choice is preference for a smaller-sooner (SS) reward over a larger-later (LL) reward and is associated with maladaptive behavior. Interventions targeting impulsive choice in rats have been designed to understand the mechanisms underlying self-control. The present study tested the effects of two interventions on impulsive choice and choice latency. The "temporal attention" intervention setup the reward using a fixed-interval schedule (active waiting). The "delay tolerance" intervention setup the reward using a fixed-time schedule (passive waiting). The control groups received reward according to a fixed-ratio schedule (no waiting). The proportion of LL choices increased between pre-/post-intervention assessments compared to the control groups for both interventions. Choice latencies on the LL option increased following the temporal attention intervention, the delay tolerance and control groups did not see changes in their response latencies. Furthermore, the latencies only increased for LL choices and did not change on forced-choice

trials. These results cannot be explained with a reinforcement-based explanation of intervention effects which would predict shorter latencies. The temporal attention intervention appeared to slow down choices for the LL and may indicate choice deliberation or hesitancy to select the self-controlled option.

1:47 PM

55

Justification of Effort: Early and Consistent Individual Preferences in Pigeons (Columba livia)

Matthew S. Murphy (Coastal Carolina University)

Justification of effort, in which there is a preference for a stimulus that a subject has worked harder for, has been demonstrated in several animal species using different techniques. Some research suggests that pigeons do not consistently establish these patterns of preferences. In our research, we tested pigeons in a longitudinal justification of effort task. We tested their preferences for the stimuli following either easy or difficult tasks at 3 different time-points in training. The pigeons showed differing individual preferences that were established early in training and persisted across training. This contrasts prior research and calls for closer scrutiny of differences in methodology and training time in sub-optimal choice research.

2:01 PM

56

Influencing Impulsivity: Effects of Reinforcement Contingencies on Forced Choice Trials Selectively Generalize to Choice Behavior During Free Choice Trials

Robert Southern, Travis Smith, & Kimberly Kirkpatrick (Kansas State University)

Impulsive choice is associated with many maladaptive behaviors and is often characterized as a preference for a smaller-sooner (SS) reward over a larger later (LL) reward under conditions where the LL provides more reinforcement over time. We tested two novel impulsive choice procedures to determine whether influencing the subjective value during forced choice trials would impact rats' choice behavior on free choice trials. Responding in the Reduction group increased subjective value by reducing the delay to reward. In the Omission group, subjective value was decreased by omitting a reward if a response occurred during the delay. Beginning with the SS Phase, the response contingencies were present on SS-forced choice trials but switched to LL-forced choice trials for the LL Phase. Rats in the Reduction group made fewer LL choices when the SS delay could be reduced, compared to when the LL delay could be reduced. Rats in Omission group made more LL choices in the LL phase, but fewer LL choices compared to the Reduction group. Together, impulsive choice was influenced by reinforcement contingencies designed to alter subjective value, providing direct evidence for the role of subjective value in choice behavior.

2:08 PM

57

A matter of method: Preferences for animal sounds in Western lowland gorillas vary across assessment method

Jordyn Truax, & Jennifer Vonk (Oakland University)

Sounds in an animal's environment carry information important to the animal's survival. Thus, hearing is an essential function for many species. However, a proper understanding of the influence of auditory enrichment in captive animals is lacking, particularly among Western lowland gorillas (Gorilla gorilla gorilla). Frequently, captive animals are exposed to different sounds, typically human created music or environmental sounds, without assessing how this impacts the animal and without choice. Previously, we assessed the preferences of three captive male gorillas for a variety of sounds: silence, white noise, electronic instrumental, naturalistic, animal, and percussive. We found that the gorillas highly preferred silence, white noise, and electronic instrumental sounds. As this finding partially conflicted with previous research, we wondered if this low preference for animal sounds was stimuli dependent. Therefore, we further investigated the gorillas' preferences among a wider variety of animal sounds: gorillas, baboons, squirrels, gulls, crows, and crickets. Preferences were assessed across two methods: a paired-forced choice task, and a six option array. In the paired-forced choice task, we analyzed the influence of the pairings on sound preferences. Gorilla preferences differed across methods of assessment, indicating that multiple methods should be used to properly assess the preferences of nonhumans.

2:15 PM

58

Validity of a Social-Feed Tradeoff Task in Predicting Sociability in Rangeland Cattle

Maggie Creamer, & Kristina Horback (UC Davis)

Domestic cattle have been shown to exhibit 'grazing personalities', which refer to distinct inter-individual foraging patterns related to exploratory, boldness, and sociability traits. To determine if grazing personalities can be predicted by a social-feed tradeoff task, 45 cows (2-8 yrs) were placed in a modified T-maze over three consecutive days during which access to feed increased in distance from herdmates (6-18m). Individual preference (food access versus social proximity) was consistent across consecutive days: latency to herdmates ($R = 0.48$, $P < 0.001$), latency to food ($R = 0.22$, $P < 0.05$), and time spent eating ($R = 0.46$, $P < 0.001$). A social network was constructed based on individual GPS data of cattle while grazing on rangeland over one summer. When feed was furthest from herdmates in the choice task, a longer latency to approach herdmates predicted a lower network centrality [$F_{7,37} = 2.97$, $P<0.05$], and a lower network strength when grazing on range [$F_{7,37} = 2.90$, $P <0.05$]. These results indicate individual consistency in the preference to access feed versus being in proximity to the herd and that the social-feed tradeoff task can be used as a proxy to estimate the sociability aspect of cattle grazing personality.

2:22 PM **Self-Control, Inter-temporal Choice and Rate-Maximising: one reality, three paradigms.**

Alex Kacelnik (Department of Biology and Pembroke College Oxford)

59

Actions have costs and benefits, and many experimental protocols emulate natural situations in which two actions rank differently according to each factor. This is the case when behavioural biologists, economists and psychologists study preference between 'worse-sooner' and 'better-later' outcomes. Foraging theorists envisage repeated choices, and compute resulting benefit rate to identify optimal strategies. Economists focus on inter-temporal choices in one-shot situations, and map the time-discounting equations that best fit empirical data. Psychologists and animal cognitivists use self-control protocols, and implicitly assume a divided self, with an 'impulsive' moiety that promotes 'sooner' regardless of quality ranking and an 'executive' one that favours 'better' regardless of the time cost. In the self-control literature, greater bias towards the executive is treated as evidence for greater cognitive sophistication. Since prevalent protocols can be addressed by all three conceptual frameworks, it is possible to contrast the relative virtues (and vices) of each research program.

2:36 PM **Individual differences in gambling by pigeons (Columba livia)**

Walter Herbranson (Whitman College)

60

Previous investigations of choice in pigeons have demonstrated many similarities with human gambling, as well as some differences. To further explore this phenomenon, pigeons were given a choice between two alternatives. One led to a slot machine-like display across three keys. Occasional wins were signaled by a uniform display (red-red-red), with other displays (e.g., red-red-green) producing no reinforcement. The other alternative produced a random display that provided no advance feedback about a trial's outcome. Overall reinforcement probability for each option began at the same value, and was gradually raised for the uninformative, random option. While most pigeons had an initial preference for the informative slot machine-like option, some quickly switched when the alternative yielded a higher rate of reinforcement. Other pigeons persisted, even when the random display was three times more likely to lead to reinforcement. Analysis of non-required keypecks during stimulus presentation revealed different patterns by early and late switchers. Persistent gamblers in particular pecked stimulus elements consistent with wins, and produced anticipatory responding on unlit keys. Those patterns could be seen early in the experiment, even before individual birds' preferences diverged.

2:50 PM *Snack Break*

3:20 PM Associative Processes II (Chair: Olga Lazareva)

Going back to 'basics': Harlow's learning set task with wolves and dogs

3:20 PM *Dániel Rivas-Blanco (University of Veterinary Medicine Vienna), Tiago Monteiro (University of Veterinary Medicine Vienna / University of Oxford), Zsófia Virányi (University of Veterinary Medicine Vienna / Medical University Vienna / University of Vienna), & Friederike Range (University of Veterinary Medicine Vienna)*

61

Dogs were the subject of Pavlov's original studies, but relatively little research has been done exploring dogs' basic learning capabilities since. Moreover, dog domestication might have impacted these capabilities when compared to non-domesticated species. We explored the effects of domestication on instrumental learning by testing similarly-raised wolves and dogs in Harlow's "learning set" paradigm. In Experiment 1, pairs of objects were presented to the animals - with one object baited while the other was not. Both species' performance gradually improved with each new set of objects, but no differences were found between the species. In Experiment 2, we used one set to test performance in a sequential reversal paradigm. Dogs performed better than wolves', albeit only in the very first session of each reversal, suggesting that either dogs had not learned the previous association as well as wolves or that dogs are more flexible. The latter interpretation is in line with the hypothesis that dogs were selected to live in ever-changing human environments (social ecology hypothesis) and/or bred for increased flexibility and proneness for learning (flexible learning hypothesis). Further research (and more refined methods) would help ascertain whether differences between wolves and dogs are persistent across different learning tasks.

Associative Learning in Groups of Animals

3:27 PM *Cristina Santos (Arizona State University), Supraja Rajagopal (University of Georgia), Matthew Gildea (Arizona State University), Takao Sasaki (University of Georgia), & Federico Sanabria (Arizona State University)*

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Associative learning theories are often evaluated by training and testing animals in isolation, even when those animals are naturally gregarious. In this talk we discuss a quantitative model of collective learning, which indicates how the presence of conspecifics trained on a simple associative task may affect how individual animals learn that task. The central assumption of this model is that conditioned responses from conspecifics may serve as conditioned stimuli to other animals. Our discussion includes not only the mathematical specification of the model, but also its implications, potential applications, and limitations. Preliminary data obtained from rats and ants will be presented.

3:41 PM **Feature-positive discriminations of where, not whether, to respond**

Kenneth Leising, Sara Bond, Taryn Pittman, Jordan Nerz, Sophie Jones, & Krista Randall (Texas Christian University)

63

In an operant feature-positive discrimination, a response in the presence of a target (A) and feature stimulus (X) is reinforced, but not when A is presented alone. Previous research has found that simultaneous presentations of X and A result in X controlling responding, whereas serial presentations result in X setting the occasion to respond to A. The current research examined whether the temporal arrangement of X and A has the same effect on learning a discrimination of where, rather than whether, to respond. In Experiment 1, rats were trained that one response (R1; e.g., left lever press) was reinforced during simultaneous (Group Sim) or serial (Group Serial) feature-target trials (XA:R1+), and a different response (R2; e.g., right lever press) was reinforced during target-alone trials (A:R2+). Test 1 included trials of XA, A, and X, followed by extinction of X and Test 2. Experiments 2 and 3 involved manipulations of the salience of the X. Experiment 1 revealed occasion setting in Group Sim and control by X in Group Serial, which is inconsistent with previous research. Experiments 2 and 3 revealed direct control in all groups. These results bear little similarity to those obtained in a standard feature-positive discrimination.

3:55 PM **Thumb rules mask qualifiers and boundary conditions in science as well as everyday life.**

Ralph Miller (SUNY at Binghamton), James E. Witnauer (SUNY at Brockport), Kristina Stenstrom, Samuel Woltag (SUNY at Binghamton), & Jeremie Jozefowiez (University of Lille)

64

Humans appear to simplify information available from experience, presumably to avoid information overload. This takes the form of human decision-making and behavior being guided largely by heuristics (i.e., thumb rules), biases, and associative learning principles, which often operate below the level of conscious awareness and sometimes deviate decisions that would be expected from a fuller rational analysis of the available information. As a result, heuristics and associative learning sometimes result in suboptimal behavior. However, their use is frequently functional in the daily life of the layperson in that it facilitates rapid responding and reduces cognitive load. This is all well-known to cognitive researchers. But we often forget we scientists are humans and consequently subject to the same unconscious biases as everyone else. Scientific training sharpens our ability to reason at the conscious level, but it has less effect on our unconscious information processing. As we are poorly equipped to turn off unconscious processes, heuristics, and simple associative principles influence our scientific conclusions unbeknown to us. Exceptions to, boundary conditions for, and qualifiers of our conclusions are largely ignored by these unconscious factors. I will describe several instances from the basic learning and memory literature in which widely-cited principles were later found to be constrained by qualifiers and boundary conditions; however, the citation rate of these thumb rules was not altered by these later findings, and the qualifiers and boundary conditions usually go uncited. Scientists, in their quests for simplicity, as well as fame and fortune, seek broadly generalizable principles concerning cognition and behavior. But the only principle that Nature gives a damn about is getting one's genes into future generations. There are a multitude of different ways of increasing evolutionary success, so the expectation that a 'principle' that captures behavior in one situation will generalize to a different situation may be naïve. Perhaps, until tested and found to generalize, the norm expectation should be that our research findings will not broadly generalize rather than that they will.

4:20 PM *Break*

4:30 PM Auditory Discrimination (Chair: Heidi Harley)

4:30 PM **What is a 'contact call'?**

Moriah J. Deimeke, Katharine H. Stenstrom, & Christopher B. Sturdy (University of Alberta)

65

Many animals emit vocalizations that are used and referred to as 'contact calls'. In fact, almost every species investigated possesses such vocalizations. As a preliminary step in studying one such call, the chickadee tseet, I conducted a scoping review in order to better understand the prevalence and usage of the contact call across taxa. The review examined: (1) the operational definitions of the contact call and (2) any meaningful trends across those definitions. In the literature searched, contact calls were rarely - if ever - operationally defined. This could make the development of testable hypotheses and experimental predictions for contact call research more difficult. Is this lack of definition a byproduct of an understudied vocalization? Or a feature? Here, I will provide details of my scoping review, offer suggestions for navigating the ambiguous nature of the contact call, and outline future experimental studies to be conducted with chickadee tseets.

4:37 PM

Feed time manipulations in operant conditioning tasks: More feed time, same great data!

Prateek Sahu, Carolina Montenegro, Connor Lambert (University of Alberta), Alexandra Oprea (Dalhousie University), Moriah Deimeke, Victoria Rennie, Sarah Smeltz, Thomas Benowicz, Divya Patel (University of Alberta), Leslie Phillmore (Dalhousie University), & Christopher Sturdy (University of Alberta)

66 Since the 1980s, operant conditioning procedures have been used to study auditory perception in small birds. Since this time, many automated systems for operant conditioning procedures have been developed and refined. Refining experimental procedures are critical in improving methodology and minimizing animal distress. Here we asked if an increase in feed time duration affects discrimination in an operant go/no-go task. Specifically, we used zebra finches' sexually dimorphic distance calls as acoustic stimuli to test whether zebra finches could discriminate calls according to the sex of the producer. A key experimental parameter, feed time duration, was increased from 1 sec to 2 sec to see if there were any significant differences in performance in the operant discrimination task. There were no differences in learning speed (trials to criterion) between birds that were given 1 sec or 2 sec of food access following a correct go response. Our results indicate doubling food access duration did not impact the speed of acquisition of distance call discrimination in zebra finches. These findings suggest that we can provide twice as much time for zebra finches to access food, potentially improving animal welfare, with no significant impact on experimental outcomes.

4:44 PM

Investigating the perception of consonant and dissonant sounds in pigeons

Asumi Tanaka, Arii Watanabe, & Tomokazu Ushitani (Chiba University)

67 The characteristic of sound perception in non-songbirds is an important question for understanding the evolution of auditory information processing in the animal kingdom. In this study, we focused on the perception of consonant and dissonant sounds in pigeons by training them to discriminate between consonant and dissonant sounds in a two-alternative-forced-choice (2AFC) task. In Training 1, sound stimuli were two-note chords composed of pure tones that could be categorized as either consonance or dissonance, depending on their simplicity of the frequency ratio. Since the pigeons showed difficulties in this training, the procedure was changed so that responses to choice stimuli were not permitted until the sound onset to direct pigeons' attention to the sound stimuli (Training 2), and sound stimuli were changed to three-note chords composed of french-horn tones that were similar to those used in a previous study (Training 3), but the pigeons' discrimination accuracy stayed at chance level. In Training 4, they were trained with single-note tones composed of french-horn tone and, under this condition, the pigeons eventually learned the discrimination, suggesting that our pigeons were sensitive to the pitch difference of the sound stimuli.

4:51 PM

Group size and the biological significance of consonant and dissonant music

Marisa Hoeschele, & Hannah Treffner (Acoustics Research Institute - Austrian Academy of Sciences)

68 In musical cultures across the globe, ratings of which musical intervals sound "consonant" (or pleasing) and "dissonant" (or jarring) are similar. Interestingly, consonant intervals match the intervals found in the overtones of all harmonic sounds, which, in the natural world, are most commonly found in vocalizations. Past research from our group and others suggested a correlation between the clarity of harmonics in a given species' vocalizations and that species' preference for consonance over dissonance. In part, this may be a simple preference for vocal-like sounds. However, humans use dissonance in a variety of contexts, and debates are still ongoing as the role of culture in consonance preference. Considering the parallel contexts where humans and other animals produce simultaneous vocalizations (e.g., choirs/chorusing) lead us to another hypothesis: perhaps consonance creates a unified group sound via overlapping harmonics. In the current study, we found a correlation between the preference of sung musical intervals and the predicted group size of the singers in humans. Consonant signals were perceived as having fewer voices than dissonant signals. I will discuss how these findings impact our view of the biological relevance of consonance, and how further comparative cognition research can help us unpack the full story.

5:05 PM Temporal Processes (Chair: Heidi Harley)

5:05 PM

Coding of stimulus sequences in pigeons

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

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

70 5:19 PM

An Exploratory Study of Cattle Bone Enrichment on Six Species of Captive Felid: The Behavioral Effects of Enrichment Novelty, Size, and Habitat Type

Kate M. Chapman (University of Arkansas), & Riley N. Hoogerwerf (University of Wyoming)

Environmental enrichment is typically used in captive animal facilities to reduce negative behaviors (e.g. stereotypy) and increase positive behaviors. While food-related enrichment is the most engaging for captive felids, it usually stimulates behavior for shorter durations due to rapid food consumption. This study aimed to examine the effects of a more durable type of food enrichment; cattle bones. The sample included 24 individuals from 6 species of large and small felids (tiger, lion, liger, leopard, cougar, bobcat) at Turpentine Creek Wildlife Refuge. Using focal-animal and time sampling, felid behavior was observed across two sessions of bone enrichment. Analyses evaluated the effects of habitat type (shared, solitary), novelty of enrichment exposure (immediate, delayed), felid species, and size category on frequency of various behaviors. Overall, felids were more behaviorally active and spent more time engaged with bone enrichment during the immediate session compared to the delayed session. There were no significant differences between small and large felids in the type of behaviors elicited by bone enrichment, but trends indicated that small felids showed more diverse behaviors than large felids. Group-housed felids did not differ from solitary felids in frequency of behaviors of interest; this was likely due to a floor effect.

8:30 PM Poster Session II (8:30 - 11:00)
See Poster Abstracts Starting on Page 35
Poster Presenters: Please set up your posters between 8:00 and 8:30

Saturday Afternoon

12:00 PM Business Meeting (All are welcome)

1:10 PM Group Photo

1:30 PM Cognitive Processes II (Chair: Robert Hampton)

1:30 PM

Rats replay incidentally encoded episodic memories

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

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In many situations, we are able to remember events that happened to us in the past despite the fact that the information was seemingly unimportant at the time we encountered it. Notably the ability to replay a stream of events that occurred in the past is a key aspect of remembering. This type of remembering consists of incidental encoding (the information was not known to be important enough to explicitly encode into memory) followed by an unexpected assessment of memory. Here we show that rats replay episodic memories of incidentally encoded information in an unexpected assessment of memory. In one task, rats reported the third last item in an explicitly encoded list of trial-unique odors. In a second task, rats foraged in a radial-maze in the absence of odors. On a critical test, rats foraged in the radial-maze but scented lids covered the food. Next, memory of the third last odor was assessed. All participating rats correctly answered the unexpected question. These results suggest that rats incidentally encode multiple pieces of putatively unimportant information, and later they replayed a stream of episodic memories when that information was needed to solve an unexpected problem.

1:37 PM

Nebulized vasopressin improves social cognition

Catherine F. Talbot (California National Primate Research Center and Florida Institute of Technology), Ozge Oztan (Stanford University), Sierra M. V. Simmons, Callum Trainor, Lesly C. Ceniceros (California National Primate Research Center), Duyen K. Nguyen (Stanford University), Laura A. Del Rosso (California National Primate Research Center), Joseph P. Garner (Stanford University), John P. Capitanio (California National Primate Research Center and the University of California Davis), & Karen J. Parker (California National Primate Research Center and Stanford University)

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Low arginine vasopressin (AVP) concentration is a biomarker of social impairment in primates. Here, we investigated the effect of AVP "replacement" to improve social cognition in naturally low-social rhesus macaques. Monkeys voluntarily participated in aerosolized drug administration of either AVP or a placebo. Following administration, we examined low-social monkeys' responses to social vs. nonsocial stimuli across two tasks. In a task comparing face vs. object recognition performance, low-social monkeys showed a strong preference for novel faces following AVP (P=0.0017) but no preference for novel faces following placebo (P=0.3079). In contrast, preferences for novel objects did not differ between AVP and placebo administration (P=0.4838). In a task comparing responses to either affiliative or aggressive social communicative cues in video footage of a conspecific vs. nonsocial video footage of a conspecific, low-social monkeys' affiliative responding to affiliative vs. aggressive stimuli was significantly enhanced following AVP administration (P=0.0003), whereas no behavioral difference was evident following placebo administration (P=0.9260). In contrast, aggressive responding to either affiliative or aggressive stimuli was not affected by AVP or placebo (P=0.5348). These findings indicate that AVP administration "rescues" species-typical responses to social information and that AVP effects are restricted to the social domain.

1:51 PM

Mechanisms of echoic object recognition by the bottlenose dolphin

Heidi E. Harley (New College of Florida and Disney's The Seas), Wendi Fellner, Barbara Losch, & David Feuerbach (The Seas, Epcot Walt Disney World Resorts)

73

Dolphins can recognize objects using echolocation alone, but the host of mechanisms they use to achieve this task are not well described. Here we investigated two potential mechanisms for echoic recognition of objects with relatively difficult-to-recognize complex shapes: wholistic shape-matching versus component parts-matching. Our stimuli were groups of three 3-object PVC sets (e.g., Sets A, B, C). Objects within each set differed in shape but shared identical component parts (e.g., 6-inch PVC tubing with 45-degree elbows). In contrast the component parts differed across sets. In the wholistic-shape condition, the dolphin was reinforced for choosing the identical shape after experiencing it as a sample (e.g., shape 1 to shape 1). In the parts-matching condition, only differently shaped objects made of identical parts were available for making a reinforced choice (e.g., parts x y z to parts z y x). In this 3-alternative echoic matching-to-sample task, the adult male blindfolded dolphin performed significantly above chance (33%) in both the wholistic-shape (X=40.0%) and parts-matching conditions (X=44.7%). Results from the two conditions were comparable even

though shape information was absent in the parts-matching condition. The dolphin's narrow echolocation beam may facilitate recognition of complex items by their components irrespective of wholistic shape.

2:05 PM **Goffin's cockatoos innovate two new foraging techniques with different function to prepare their food**

Jeroen Zewald, & Alice Auersperg (University of Veterinary Medicine Vienna)

74 Foraging innovations reflect an animal's ability to use new food types or new foraging techniques, thereby showing cognitive flexibility. One type of foraging innovations are food preparations. Food can be prepared by animals in two ways: either by making food edible/available for consumption (for example during extractive foraging) or by improving the quality of an already edible food item. We observed captive Goffin's cockatoos (Cacatua goffiniana), a model species for technical cognition and tool use, dunking food in two different contexts. In two experimental setups, we investigated the functions of these behaviours. First, we observed 7 out of 18 birds dunking dry rusk in water, often leaving it in for 30s before taking out and eating it. Other food types were not dunked and/or also often eaten dry, suggesting the function of softening/moistening the rusk. In the second experiment, we observed individuals dunking potatoes and noodles in flavoured soy yogurt, but less in neutral yoghurt or water and thereafter eating it. Thus, suggesting the function of seasoning their food, which has rarely been reported in animals. Both behaviours suggest that cockatoos innovated two new methods of distinct functions to prepare their food prior to consumption.

2:12 PM *Break*

2:20 PM Many Many Symposium (Chair: Laurent Prétôt)

2:20 PM **ManyX projects: Joining forces to address challenges in comparative research with big team science**

ManyManys Project, Jeffrey R. Stevens (University of Nebraska-Lincoln)

75 The replication crisis has motivated a number of changes in how scientists conduct their research. One new addition has been the formation of big team science projects that consist of large-scale, multi-site collaborations conducting the same experiment across many facilities. In the past few years, several big team science initiatives have begun conducting behavioral and cognitive comparative research. These "ManyX" projects focus on one or a group of related species with the aim of (1) addressing methodological and theoretical issues associated with the use of small and nonrepresentative samples and (2) promoting good scientific practices, including openness, transparency, reproducibility, and inclusivity in research. Current projects include, for example, ManyBabies, ManyBirds, ManyDogs, ManyFishes, ManyGoats, ManyPrimates, ManyZoos, and Psychological Science Accelerator. We will review the origin and state of these projects, as well as describe an exciting emerging project that combines several of the ManyXs into a ManyManys Project. Our aim is to provide a forum to address important comparative cognition questions with large sample sizes across a wide range of species.

ManyZoos: Comparative research across zoos

2:34 PM *ManyZoos, Victoria L. O'Connor (Bergen County Zoo; Oakland University), & Lisa P. Barrett (San Diego Zoo Wildlife Alliance)*

76 Sample size is a limiting factor of comparative cognition studies, especially those involving rare species. Following the lead of similar groups such as ManyBabies and ManyDogs, we introduce our big data initiative called ManyZoos, which leverages zoo collections to increase the number of subjects researchers can include in their sample. By facilitating inter-zoo collaborations, incorporating tools such as the ZooMonitor application, and providing resources such as information on research approval processes and funding opportunities, we hope to connect researchers across fields and across species. We discuss the goals and proposed methods of ManyZoos, as well as a study of behavioral flexibility in felids across five zoos- Bergen County Zoo, Bronx Zoo, Oklahoma City Zoo, Miami Zoo, and Turtle Back Zoo. We conclude with open questions in the study of zoo science that would benefit from joint efforts of researchers and actions for interested researchers to become involved in future directions of ManyZoos.

2:48 PM **Using the detour task to assess inhibitory control across the fish taxon**

ManyFishes, Laurent Prétôt (Pittsburg State University)

77 Inhibitory control is a central component of executive functions that allows organisms to suppress predispositions in favor of more appropriate actions. It helps individuals cope with fluctuating environments and is considered to be highly correlated with intelligence. Among many existing paradigms used to test inhibitory control abilities in animals, the detour task consists of presenting individuals with a situation where a direct route to the goal (e.g., a food reward) is blocked and a detour must be made to reach it. In one version called the cylinder task, subjects are presented with the reward placed inside a transparent cylinder open on either side, and they must delay gratification by moving away from the goal and going around the see-through barrier without touching it to reach the reward. The cylinder task has been extensively used across species and taxa. It is simple to implement, applicable to a wide range of species and testing sites, and requires little to no training. In addition, recent results indicate that, despite their relatively small brain size, fish perform at levels similar to mammals and birds in the task. The goal of the current study is to test inhibitory control across the fish taxon using a standardized version of the cylinder task. The experiment will represent the first study of

the ManyFishes initiative, the first large-scale collaborative project dedicated to comparative cognition and behavior in fishes.

3:02 PM **Exploring variability in dogs' responses to human pointing**

ManyDogs, Julia Espinosa (Harvard University)

ManyDogs is an international, collaborative network in canine science, facilitating multi-site studies that address reproducibility issues and advance open science practices within animal cognition. This approach (a) uses diverse samples to investigate and replicate findings, (b) encourages preregistering hypotheses, methods, and analysis plans, (c) investigates the influence of population and breed differences, and (d) examines contextual differences in research environments. Our first study, ManyDogs 1, combines a phenomenon that appears to be highly robust—dogs' ability **78** to follow human pointing—with a question that remains controversial: do dogs interpret pointing as a social communicative gesture or as a simple associative cue? Uniting 20 research teams on 3 continents, we conducted a within-dog (N > 500) study comparing two conditions of a 2-alternative object choice task: (1) Ostensive (experimenter pointed to a baited cup after making eye-contact and saying the dog's name); (2) Non-ostensive (experimenter pointed to a baited cup without making eye-contact or saying the dog's name). Preliminary results suggest that dogs are more likely to follow ostensive pointing, and that dog breed may be an important factor underlying responses. Additional contributors to behavioral variability will be discussed, including individual life history and cultural differences in dog-human relationships.

3:16 PM **Many Primates – A large-scale collaboration to better understand primate cognition**

ManyPrimates, Darby Proctor (Florida Institute of Technology), Michael J. Beran (Georgia State University), & Derry Taylor (University of Neuchâtel)

The different "Many" projects have established platforms for large-scale collaborative research within the social sciences. The goal of these projects is to address difficult outstanding methodological and theoretical issues that a single lab (or field site, zoo, or sanctuary) could not study on its own. Primate cognition research faces the difficulties of small samples in the typical lab, zoo, or sanctuary, and very limited access for any one individual researcher, laboratory, or zoo to access the wide range of primate species that exist. To overcome these issues, and to expand collaboration among **79** the world's primatologists, we founded the ManyPrimates project. Its aim is to provide a platform for researchers to interact and collaboratively decide on research projects that are subsequently carried out in each individual testing location, which can include laboratories, zoos, sanctuaries, and field sites. We will discuss the shared and unique challenges faced by primate cognition researchers compared to the other Many projects, and we will address how collaboration across labs can help to overcome them. We will describe the structure and functioning of the ManyPrimates team, and we will present some of the data that already have emerged from ManyPrimates. We hope that by joining forces with other Many projects, we will be able address interesting and compelling questions about cognition even beyond the primates.

3:35 PM *Snack Break*

4:05 PM In Honor of the Contributions of Ken Cheng (Chair: Debbie Kelly)

4:05 PM **Local vectors without Views: Partial Vector Suppression in Desert Ants**

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

Animals employ a variety of navigational strategies to home and a widely observed strategy across animal groups is the use of a path integrator (PI). PI provides an updating spatial estimate of the origin location, typically the home or nest. This estimate or 'global vector' has been widely studied, yet there is evidence in ants that the PI can be modified to direct foragers to non-nest sites along the foraging route, suggesting the PI system may allow the suppression of **80** portions of this global vector (local vectors). This ability remains controversial and is largely excluded from current models of PI. Here, we show local vectors in the desert harvester ant (Veromessor pergandei) are independent of other cues, suggesting PI contains the ability to suppress portions of the global vector allowing homing along non-straight-line routes. Inbound foragers trained on a foraging route which contained two distinct foraging legs along their pheromone marked trail, when displaced distantly, followed the compass direction of the first inbound foraging leg then switched to the second leg, never orienting to their global vector with no access to familiar cues. Foragers suppress portions of the inbound route based on the current state of their current PI alone.

4:20 PM **From Oscillating Ants to Dancing Dogs: Ken Cheng's Contributions to Comparative Cognition**

Michele Merritt (Arkansas State University)

81 In honor of Ken Cheng's research into animal cognition, I will discuss the ways his investigations of movement and navigation have informed my work in the philosophy of animal minds. In the philosophy of cognitive science, there has been a growing appreciation for how deeply embodied and enacted thought is, and I have extended this discussion

to the intersubjective realm – in particular how we humans interact with dogs. The "scribbling and bibbling" we engage in while playing with dogs mirrors the "pirouetting" ants do when navigating. It is similar, as well, to the "bouncing of ideas" off one another humans enact when collaboratively planning or in activities like contact improvisational dance. What Cheng's work has shown me, as I've worked on philosophical problems in animal cognition, is that thinking, as it occurs among animals, differs more in degree than kind, especially when we examine embodied and intersubjective thought.

4:35 PM **It's about time**

Jonathon D. Crystal (Indiana University)

82 In this presentation, I reflect on the impact Ken Cheng has had on me and my research trajectory. I briefly describe my research on basic timing mechanisms. Next, I describe how timing research and immersion in the Cheng lab at the University of Toronto impacted my entry into research on memory. Finally, I describe the importance of time in the development of animal models of episodic memory.

4:50 PM **Comparative Studies of Spatial Cognition: A Tribute to Ken Cheng**

Debbie M. Kelly (University of Manitoba)

83 Ken Cheng's research on spatial cognition has had, and continues to have, substantial impact on my career. Indeed, my replication of his 1986 publication "A purely geometric module in the rat's spatial representation" with pigeons was my earliest first-authored publication as an undergraduate student under the supervision of Marcia Spetch (who subsequently was also my PhD supervisor). I remember the first time I met the famous Dr. Cheng when he came to visit Marcia at the University of Alberta. I was struck not only by his incredible wealth of knowledge, but also his kindness for students and the research animals; for instance, he showed me how he liked to train the pigeons to enter the plastic weighing containers on their own volition so as not to cause them undue stress. It is an incredible privilege to be part of the symposium to honor Ken's contributions over the years to the field of comparative cognition. In my talk, I will provide an overview touching on some of my research, past and present, that has been directly influenced by Ken's work on spatial cognition.

5:15 PM Closing Remarks and Awards - Lauren Guillette

5:45 PM Master Lecture - Ken Cheng

7:30 PM Banquet

Posters

Poster Session I - Thursday Evening

PhyloPsy.org: A New Resource for Phylogenetic Comparative Cognition

Gabriela Venable, & Brian Hare (Duke University)

P1 Comparative psychology is increasingly turning to the use of phylogenetic comparative methods, which allow for high resolution tests of evolutionary hypotheses. However, studies using such methods require large-scale multi-species collaborations. We have launched PhyoPsy.org, a new online resource where researchers can propose a project and find collaborators with access to species necessary for their study as well as phylogeneticists that can aid with statistical analyses. After a soft launch, we now have 71 PhyloPsy members (18 of which are phylogeneticists), which represent 37 institutions and over three dozen different species, including (but not limited to) insects, birds, and primates. In the coming year we will be actively growing our community and inviting all who are interested to join us. In our presentation, we will detail how PhyloPsy works, how it complements the various "ManyX" Projects, and what we hope to accomplish with this new resource.

Can snakes recognize familiar humans?

Amity Jordan, Jacob Pappas, & Jennifer Vonk (Oakland University)

P2 Despite increasing research on snakes over the past few decades, knowledge of snake cognition is still limited. The capacity to recognize individual heterospecifics has been determined in various social species, but less social species are seldom tested for sociocognitive abilities. Identifying whether snakes can distinguish between scents of familiar and unfamiliar humans is beneficial for understanding the olfactory discrimination of snakes and may impact husbandry practices as snakes are commonly housed in captive environments. Nagabaskaran and colleagues (2021) determined that corn snakes in enriched environments spent more time exploring the scents of unfamiliar humans, compared to familiar humans whereas snakes in non-enriched environments did not discriminate between the scents. We presented snakes of various species from captive facilities, breeders, and private ownership with the scent of a familiar handler, a sex-matched unfamiliar person, and a neutral stimulus in counterbalanced order. We coded exploration, such as tongue flicks to each stimulus. Owners provided demographic information and information about the availability of enrichment in the captive environments. Preliminary results will be discussed with consideration of how captive environments may shape snakes' discrimination abilities; in particular, their recognition of familiar humans.

"Watch Me!": The Impact of Training Experience on Social Referencing in Domestic Dogs During a Novel Object-Choice Task

M. Murray, & S.E. Byosiere (CUNY Hunter College)

P3 Due to the close relationship with humans during domestication, dogs developed the unique ability to read human facial expressions and vocal tone and apply this information to situations or objects in a phenomenon known as social referencing. Current literature indicates that dogs use social referencing when presented with new situations, such as when approaching a novel object or when greeting a stranger, but the factors impacting a dog's ability to social reference remain unclear. We investigated the impact of dog training experience on a dog's likelihood to social reference during a novel object-choice task. In this study, dogs were presented with novel object pairs and watched an experimenter react to the objects positively, neutrally, or negatively. Dogs were then given the opportunity to approach the two objects. Their latency to approach the objects, proximity to objects, object choice, and gaze duration at objects were analyzed against their training experience. Considering dog training rewards dogs for observing and responding to human-given cues, we hypothesized that dogs with increased training experience would be more likely to social reference. Here we will discuss our current findings, which provide valuable insight into factors that impact dog learning and decision-making.

Are dog owner's perceptions of their pets' intelligence accurate?

Miriam Ross, Madeline Pelgrim, & Daphna Buchsbaum (Brown University)

P4 Dog owners regularly comment on their dogs abilities, such as intelligence. But how much do these beliefs correspond to their pets' actual ability? Exploring owners' beliefs about their dogs' intelligence can highlight where public perceptions match or diverge from formal intelligence assessments. Our study investigates whether dogs' perceived intelligence correlates with performance on a battery of cognitive tasks, predicts overall task battery score, and predicts performance on social or nonsocial tasks.Our task battery assesses both social and non-social aspects of intelligence: memory, executive function, communication, physical reasoning, and social motivation. We measure dog-owner perceived closeness (Development of the Monash Dog Owner Relationship Scale) and intelligence (The Perceptions of Dog Intelligence and Cognitive Skills Survey) via survey. We hypothesize that perceived dog intelligence will correlate with dogs' performance on social tasks, with high (social) performers being perceived as smarter. We also hypothesize that owners who are strongly attached to their dogs will rate their dogs as smarter. Data collection is ongoing. Our results are important for research on cross-species interaction and could inform how owners develop (in)accurate judgments about their pets, as well as their understanding of their pets abilities as compared to other dogs.

Lateralization of turn behavior in discoid cockroaches (Blaberus discoidalis)

Abrielle Luther, & Olga Lazareva (Drake University)

P5 Lateralized behaviors have been described in many vertebrate species; however, invertebrates received less attention. Among order Blattodea (termites and cockroaches), lateralization has only been studied in the German cockroach (Blattella germanica). We have investigated the lateralization behavior of a turn behavior in a T-maze in discoid cockroaches, a non-invasive species that inhabit floor of tropical rainforests in Central America. To motivate cockroaches to move through the T-maze, both arms ended in a dark enclosed space that provided an opportunity to escape a brightly lit environment. Individual cockroaches were released at the start of the maze and allowed to make a choice of either the left or right arm. The T-maze was cleaned thoroughly and left to air out for a minimum of 24 hours between trials to eliminate the influence of scent cues. Cockroach behavior was videotaped and analyzed to determine direction of the first turn, latency to make the first turn, and latency to complete the trial. Preliminary data has shown little evidence of strong lateralization tendencies at a species level; however, there was evidence of significant differences in variability of latency to make the first turn and latency to complete the trial.

The Creative Canine: Investigating the concept of creativity in dogs (Canis lupus familiaris) using citizen science

Kaitlyn Willgohs, Jenna Williams (Eckerd College), Elaina Franklin (Positive Solutions Animal Training), & Lauren Highfill (Eckerd College)

P6 There is no shortage of anecdotal evidence that domestic dogs (Canis lupus familiaris) can solve problems in individual or creative ways. Whether it is figuring out a new way to knock over the trash can or combining puppy-dog eyes with a whine for some table scraps, dogs approach their world in many ways. In recent years, dogs have been studied for a number of cognitive functions but their ability to demonstrate creative behaviors has not been empirically studied. The present study extends training of the create behavior, as previously trained in dolphins, to dogs. The criteria of the create behavior required the dog to present a behavior that had yet to be performed in the session, therefore, the only incorrect response was a repeated behavior. Mastery of the create command was coded on three components: repetition, energy, and novelty. Possible implications of this research will be discussed. This study adds to the literature on dog cognition and supports the utilization of citizen science for canine cognition research.

Performance on a Cooperative Task by Zoo-housed African Elephants (Loxodonta africana)

Madeline Ketner, Kaitlyn Willgohs, Kayla Fulkerson, Olivia Minney (Eckerd College), Kristina Przystawik, Christi Reiter, Mike Burns (ZooTampa), & Lauren Highfill (Eckerd College)

P7 Several species have demonstrated the ability to cooperate with conspecifics in a lab or zoo setting. The current study sought to replicate previous research in which pairs of elephants had to pull cooperatively on two ends of a rope in order to bring food rewards within reach. The initial study was conducted in a free contact setting with Asian elephants, whereas the current study was conducted under a protected contact management program with ZooTampa's herd of six African elephants. Overall, 15 different pairings were tested on the rope-pulling cooperative task, while being released simultaneously. Trials were deemed successful if the sled was pulled to a distance where both elephants were able to claim food that was resting on the sled. Results suggest that the majority of pairings quickly learned that a form of cooperation was necessary to complete the task successfully ($p<.05$). After initial trials, trials were run with a 5-second delay for one of the individuals to assess the elephant's understanding of the role of their partner. Most pairings were successful, but the elephants displayed different strategies to complete the task. This study supports the collaboration between zoos and local colleges/universities to better understand the cognitive abilities of elephants.

Irrelevant Relations' Impact on Extrapolation of Patterned Sequences

P8 *Shannon M.A. Kundey (Hood College)*

Withdrawn

Dominance hierarchy in adult male discoid cockroaches (Blaberus discoidalis)

Becca Gatewood, Olga Lazareva (Drake University), & Reggie Gazes (Bucknell University)

P9 We explored stability and linearity of the dominance hierarchy among adult male discoid cockroaches by using a dyadic interaction method. Five male cockroaches were repeatedly paired for a 15-min, videotaped agonistic interaction trial. Each male was paired with each other male once and experienced on trial per day, for a total of 10 trials over 5 days. After a 7-day break, the entire procedure was repeated to evaluate the extent to which dyadic outcomes were maintained over recurrent interactions. Individual aggressive and submissive behaviors were coded from the videos using an established ethogram. The dominance hierarchy was calculated using Elo scores based on both the final outcome (win/loss) and the record of individual aggressive and submissive behaviors for each cockroach in each interaction. We found that dominance hierarchy in adult male discoid cockroaches was linear and stable over time, making them an excellent candidate species for future research on social behavior and social inference.

Hand Preferences for Match-to-Sample Tasks in Olive Baboons (Papio anubis)

Caroline DeLong, Katie Becker, Jessica Wegman, Logan Brownell, Matt Altobelli, Kera Hampton, Shaya Gibbs (Rochester Institute of Technology), & Jessica Cantlon (Carnegie Mellon University)

P10 Seven olive baboons residing at the Seneca Park Zoo (Rochester, NY) participated in cognitive testing at the Primate Portal exhibit. The exhibit includes a primate-friendly touch-sensitive monitor which is freely accessible. While the subjects engaged in three experiments over several months using a match-to-sample (MTS) task, we observed which hand was used to touch the start box,

sample stimulus, and choice stimulus and to retrieve the food reward. The experiments involved identity matching, geometric shape matching, and numerosity. Preliminary results show that performance accuracy on these experiments varied by subject and experiment (50-80% correct). Two female baboons used their right hand on 98-99% of each step of the MTS task. One female and one male baboon used their left hand on 92-100% of each step of the MTS task. Three male baboons used their left hand on the majority of trials (59-97%) to touch the start box, sample, and choice; and typically used their left hand to retrieve the food reward (79-100%). Baboons showed either a right- or left- hand preference on these match-to-sample tasks. These data suggest that baboons have a dominant hand and thus show handedness biases like humans, and baboons can be either right- or left-hand dominant.

What Makes the Ephemeral Reward Task So Difficult?

Peyton M. Mueller, Daniel N. Peng, William C. Burroughs, & Thomas R. Zentall (University of Kentucky)

P11

The ephemeral reward task tests subjects by providing two stimuli (A and B) that both yield identical rewards, but selection of Stimuli. A ends the trial while selecting stimulus B means that Stimuli A can then be selected, doubling reinforcement before ending the trial. Thus, optimal performance involves always selecting Stimulus B. Some species such as wrasse and parrots can learn this optimal strategy while other species, such as rats, pigeons, and some nonhuman primates cannot. Some research suggests that providing a delay between choice and reward can facilitate optimal choices in rats and pigeons. Impulsivity has been hypothesized to contribute to the difficulty of this task. To understand the effect of impulsivity, human subjects were given an operant version of this, with and without delays between choice and reward. Many participants were unable to choose optimally in both the delay and no delay groups. Performance on this task was not correlated to tests of impulsivity (BART and the abbreviated impulsivity survey). The task seems to be confusing to participants because there is no incorrect response.

Foraging with their "Neigh-bor": Does status impact foraging behavior of informed horses?

Gina Montalto, Joy Ott, Jared Edge, & Jennifer Vonk (Oakland University)

P12

Numerous studies have demonstrated the impressive cognitive abilities of horses. We are particularly interested in their social cognition because of their social structure, both in the wild and in captivity. The informed forager paradigm provides a means to study whether horses adjust their foraging behavior based on the knowledge and status of competitors. In this paradigm, an informed individual is paired with a partner that is higher or lower in status and that is uninformed as to where food is located. Here, one informed horse was trained on the location of two food sources (out of six possible locations). In testing, she was paired with a higher-ranking uninformed participant and with a lower-ranking uninformed conspecific for four sessions each where the horses had five minutes to find the food. Foraging behavior and site visits were recorded for each horse, along with vigilance and displacement behaviors. Given the small sample size, further research with more pairings and a larger sample size is necessary to indicate how social status may impact individual foraging behavior but there was an observable difference in the informed horse's behavior between the two pairings.

Intuitive Understanding of Probabilities in Dogs vs Humans

Steven Baker, & Heidi Lyn (University of South Alabama)

P13

The idea of luck has been immersed across human cultures spanning generations. As it is such a prevalent belief, one may ponder whether this belief is consistent among any non-human animal populations. To test this inquiry, researchers have relied on the related concept of probability. Probability is generally poorly understood by humans, which can lead to a long list of issues, including gambling addiction, healthcare biases, and poor investing performances. It has been found that some animals, such as rats, perform better than humans in probability tasks, such as choosing options with randomly assigned probability of being correct. This difference may be due to humans overanalyzing simple tasks, whereas their nonhuman counterparts rely on straightforward associations. To test this hypothesis, and expand the species pool, we compared dogs (Canis lupus familiaris) to humans in a similar test to the rat study. Our results show that dogs may do better than humans in tasks associated with picking correct answers in randomness. Obviously, dogs cannot grasp advanced concepts of probability, however, these results may point to the possibility that dogs have a better intuitive understanding of probabilities than humans.

Context Dependent Renewal of Conditioned Positive and Negative Responses in Rats

Rachael M. Layden, Christopher M. Walsh, Shelby E. Bawden, Jose A. Pena, Tess Cody, Christopher M. Bloom, & Victoria L. Templer (Providence College)

P14

Recent work suggests the Posterior Parietal Cortex (PPC) is necessary for the renewal of an extinguished conditioned fear response in a novel (ABA), but not a familiar (ABC) context (in ABA/C, slot 1 refers to acquisition; 2- extinction, 3 –renewal). We investigated whether such context-dependent renewal generalizes to positive conditioned stimuli in sham operated control rats and a small cohort of Designer Receptor Activated Only by Designer Drugs (DREADDs) PPC rats after delivery of CNO to inactivate PPC. Control rats renewed positive (light-food) and negative associations (tone-shock) regardless of the renewal context, replicating context dependent renewal in rodents found in previous literature. The positive condition conferred a significantly higher magnitude of renewal compared to the negative condition. When the PPC was deactivated, rats did not renew in both the positive and negative ABC condition but did in the ABA condition. However, when the PPC was active in both the ABC and ABA conditions all subjects renewed both positive and negative associations, matching the sham operated controls. These results suggest the PPC plays a crucial role in renewal of a context dependent conditioned fear response as well as a context dependent conditioned positive response.

Transitive Inference in Rats

Shelby E. Bawden, Jose Pena, Tess Cody, Rachael M. Layden, Christopher M. Walsh, Colin Call, & Victoria L. Templer (Providence College)

Transitive inference (TI) is a form of deductive reasoning where once stimulus pairs are learned (A>B; B>C), it can be inferred that A>C. Studies evaluating TI in rodents are limited. Ten male Long-Evans rats were trained to discriminate four overlapping stimulus (odor) pairs (A+B-; B+C-; C+D-; D+E-; list 1). After reaching criterion on adjacent stimulus pairs, rats received non-differentially reinforced probe trials of non-adjacent stimulus pairs (e.g., B, D) to determine the extent to which rats responded based on inferred order or associative value. Rats were then trained on a second list (F>G>H>I>J) using the same procedure with the exception that specific odors were consistently presented in unique spatial locations to increase premise pair acquisition. Most subjects selected B significantly more than D, and this effect was stronger in the second list, suggesting use of implied order rather than associative value. To further examine if implied order controlled choice rather than associative value, list-linking procedures (E>F) were conducted to prompt construction a ten-item list (A>B>C>D>E>F>G>H>I>J). Between list probes (e.g., BI, CH, DG) accuracy will be discussed to determine if associative value or inferred order controlled choice as linking cannot be explained by associate values.

P15

Does reinforcer palatability govern behavioral variability and the formation of equivalence classes in an open field?

Talyn Derflinger, Sam Bertsch, Caitlin O'Leary, Scott McDonald, & W. David Stahlman (University of Mary Washington)

The degree to which reinforcement is differential relates to various important behavioral phenomena. Variability in operant behavior is a function of reinforcer quality—organisms behave more variably with delivery of relatively weak reinforcers. For another, equivalent reinforcement for multiple actions contributes to acquired equivalence—formerly distinct actions may become parts of a larger class. In this experiment, we examined the effects of reinforcement on acquired equivalence and variability in search behavior. Rats were trained with a set of four individually presented landmarks on an open field. Two landmarks (A) indicated a highly palatable reward at a specific location, while the others (B) indicated availability of a less-palatable reward at a different location relative to the landmark. We then reversed this relationship for one A and one B landmark (e.g., A now indicated the less-palatable reinforcer). We then conducted test trials to examine whether initial training had produced acquired equivalence. Replicating and extending previous work, rats demonstrated significantly more variable behavior on trials in which a palatable reinforcer was available. There was little evidence of acquired equivalence of the operant classes. We suggest that further research using refined methods may help to determine the possibility of acquired equivalence in search behavior.

P16

Do Goldfish Recognize Conspecifics Using Visual Cues?

Katie Becker, Jessica Wegman, Kaitlin Gunther, Izzy Deglans, Kelsey Beers, Moet Aita, Shaya Gibbs, & Caroline DeLong (Rochester Institute of Technology)

This study focuses on goldfishes' ability to visually identify conspecifics. Eleven subjects performed a two-alternative-forced-choice task in which they were trained to differentiate between different images of goldfish and a black triangle, and then tested on their ability to discriminate between images of goldfish (S+) and various other stimuli (S-) that were goldfish-colored (e.g., orange, yellow) and non-goldfish-colored (e.g., blue, purple) in the first three test phases. In test phase 1, the S- stimuli included geometric shapes (e.g., rectangle, circle) and average performance was 83%. In test phase 2, the S- stimuli included everyday objects (e.g., envelope, leaf) and average performance was 73%. In test phase 3, the S- stimuli included heterospecific fish (e.g., betta, snapper) and average performance was 70%. In test phase 4, the S- stimuli were conspecifics (other goldfish with solid or bicolor coloration) and average performance was 71% (preliminary results, 3 fish). The subjects performed significantly worse on S- stimuli with similar colors and coloration patterns as the S+ stimuli. This suggests that goldfish can visually recognize conspecifics and they may have utilized color as a cue.

P17

Lending a Helping Paw: Factors Influencing Empathy-like Behaviors in Rats

Olivia R. Mandel, & Julia E. Meyers-Manor (Ripon College)

Previous research found that a rat would free a trapped rat by opening a door, therefore, allowing the trapped rat to escape (Ben-Ami Bartal et al., 2011). It is unclear whether this opening is primarily motivated by social contact or the result of empathy behaviors. This study aimed to investigate whether signs of distress in the trapped rat in a tube affected whether the free rats open the door. Additionally, we compared sex differences in the rats. It will also investigate if there were differences in rats freeing their peers based on familiarity. The research found that males were significantly more likely to open a trapped rat than females, $p=0.015$, and strangers were opened for more than cagemates, $p= 0.016$. Keywords: empathy, prosocial behavior, rats, stress behaviors, sex, acquaintanceship

P18

Flexible Learning of Matching and Mismatching by Pigeons

Thomas R. Zentall, Peyton M. Mueller, & Daniel N. Peng (University of Kentucky)

In this research we asked if pigeons learned a matching task faster than a mismatching task. We also asked if they learned two matching tasks faster than two mismatching tasks, and if they learned either pair of tasks faster than one matching and one mismatching task. Finally, after learning the two tasks, for each task we asked if they learn to select the correct alternative, reject the incorrect alternative, or both, and does that depend on whether the task is matching or mismatching. Pigeons were trained on two matching tasks, two mismatching tasks, or one of each, with red and green stimuli for one task and blue and yellow stimuli for the other. On transfer test trials that controlled for familiarity with the transfer stimuli, the stimuli from one task replaced either the correct or the incorrect comparison on the other task. Results suggested that the three groups learned their tasks at the same rate and

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replacement transfer testing indicated that all three groups learned both to select the correct comparison and to reject the incorrect comparison stimulus.

learning in the Pigeon: implicit or explicit?

Daniel Peng (University of Kentucky)

P20 With humans, a distinction can be made between explicit and implicit learning. language can be used to describe explicit rule-based learning. Unfortunately, we cannot do so with animals. A non-verbal paradigm is needed to differentiate the types of learning. One method to make such a distinction is by training animals under a conditional discrimination task with reinforcement delayed until a choice is made on the next trial: otherwise known as a 1-back procedure. According to Smith, Jackson and Church (Journal of Comparative Psychology, 134(4), 423-434, 2020), delaying reinforcement following a correct response by 1 trial is too long for implicit learning to occur. Thus, any learning is explicit. In this experiment an alternating matching/mismatching to sample task under a 1-back schedule of reinforcement was used to determine if pigeons can demonstrate explicit learning. Pigeons were trained on red-green matching, and blue-yellow mismatching. Trials would randomly begin with either a matching or mismatching sample stimulus and would alternate every trial. Reinforcement occurred on trial N if the response on trial N-1 was correct. Despite the reinforcement schedule, pigeons showed significant levels of learning. However, given that the learning was slow and gradual it is unlikely that subjects learned the task explicitly.

Evaluating boldness in Asian elephants (Elephas maximus) using predator playbacks

Robbie Ball, Matthew S. Rudolph, Sarah L. Jacobson (The Graduate Center CUNY and Hunter College), Marnoch Yindee (Akkhraratchakumari Veterinary College Walailak University), & Joshua M. Plotnik (The Graduate Center CUNY and Hunter College)

P21 Acoustic playback studies can investigate the behavioral responses of animals to a variety of stimuli, including predator calls. Predator playbacks typically involve playing recorded vocalizations of a predator near prey and measuring behavioral responses. Such measurements include latency to respond, reduced body movements, and retreat behavior. Automated Behavioral Response (ABR) systems are growing in popularity for wild animal behavior research as they allow for the remote activation of playback audio when an animal approaches. Because anthropogenic activities are an increasing threat to the lives of wild elephants (Elephas maximus), we are using ABRs to investigate elephants' responses to predator vocalizations (including big cats and humans) inside the Salakpra Wildlife Sanctuary, a protected national park in Thailand, and around croplands that border it. We hypothesize that boldness, a behavioral trait measured using playbacks, will vary between individuals and across landscapes. We will present preliminary data to test this hypothesis, as well as discuss the potential relationship between individual variation in boldness and the elephants' propensity to enter croplands on the Sanctuary's border. By investigating how elephants respond to predator playbacks, we hope to use behavioral data to better inform human-elephant conflict (HEC) mitigation strategies that account for elephant personality and behavior.

What-Where-When-Which Stimulus Control in Rats

Hawken Hass, Sophie Shea, Gracie Goddard, Mark Galizio, & Katherine Bruce (University of North Carolina Wilmington)

P22 Stimulus control by what, where, and when features of an event has been termed "episodic-like" remembering. We used the Odor Span Task (OST) to assess control by what-where-when stimulus properties. The OST is an incrementing non-match-to-sample procedure where selection of session-novel odors results in reinforcement; previously reinforced comparison odors do not. After partially replicating the results of Panoz-Brown et al. (2016) suggesting that odor selection by rats in this task can also come under contextual control, we extended this research to add another layer of stimulus control: reinforcer flavor. While correct OST trials resulted in an unflavored sucrose pellet, a flavored reinforcer (e.g., banana) was paired with a randomly selected odor from the OST in one apparatus. Selecting the replenishing flavor-paired odor was reinforced on subsequent presentations. In the other apparatus, a different odor was paired with a different flavor (e.g., chocolate). Thus, rats had to remember which flavor reinforcer they recently encountered in addition to what-where-when components. Rats learned to select the replenishing scents in a context and flavor-dependent manner, thus showing behavioral control by multiple stimulus properties. Adding another component to remember, or more details to remember, to the procedure may provide a better characterization of episodic-like remembering.

The Influence of Positive Affectivity on the Characteristics and Use of Burst Pulse Vocalizations in Bottlenose Dolphins (Tursiops truncatus)

Joclyn Villegas (University of South Alabama)

P23 Positive affect is the external expression of emotion(s) within the contexts of behavior and decision-making. However, emotions, and especially positive emotions have been difficult to study, as a result, there is a lack of scientific literature on positive affect in humans as well as nonhuman animals. Bottlenose dolphins (Tursiops truncatus) may be a good candidate species to study positive affect as Ridgeway et al. (2014) has suggested they emit a "Victory Squeal" to signify the success of prey capture or task completion, which may be an expression of the emotion "joy". The purpose of this study is to investigate burst pulse vocalizations in context of positive affect and look for potential behavioral associations, as well as further examples of victory squeals (as seen by Ridgeway et al., 2014, 2015, 2018). We will report on the analysis of bottlenose dolphin vocalizations in high- and low-energy contexts, both whiles being trained on a new behavior and during free sessions. If specific vocalizations are found only in instances of "success" (rewarded training behaviors or figuring out a new toy as potential examples), we can argue that those vocalizations support the victory squeal hypothesis and are an indicator of positive affect in bottlenose dolphins.

Fast Object Association Mapping (FOAM) by Inference of Exclusion in Pigeons

Kayley Ozimac, Cyrus Kirkman, & Aaron P. Blaisdell (University of California Los Angeles)

Fast mapping is a relational learning strategy used by human children in word acquisition that involves inference-by-exclusion to associate a novel word with a novel object. While well-documented in children, few studies have investigated this in nonhuman animals. Aust et al. (2008) failed to find evidence for fast mapping in pigeons in a choice-by-exclusion procedure. Pigeons were only trained on eight stimuli, however. Bodily et al. (2008) found that small training sets led to exemplar learning in a matching-to-sample (MTS) procedure in pigeons, while larger sets led to relational learning. Perhaps, pigeons require more exemplars to employ a fast-mapping learning process. The proposed experiment will investigate the role of increasing training set size on how pigeons learn novel stimulus-stimulus associations. We hypothesize that increases in set size will facilitate fast object association mapping (FOAM). This would be tested using eight pigeons in a conditional, binary pair association MTS task consisting of three phases (training, choice-by-exclusion test, and fast mapping test), wherein training pair set size doubles (3, 6, 12, 24, etc.) following failure of each test. Consequently, the proposed experiment will test for an unexplored strategy of relational learning in pigeon models - namely, FOAM.

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Assessing the Subjective Effort of Working Memory Maintenance in Monkeys

Jad Nasrini, & Robert R. Hampton (Emory University)

Holding something in working memory requires active maintenance or information is lost. In contrast, recognition of items as familiar does not depend on an active memory process during the delay interval. We can distinguish these memory processes in monkeys by manipulating the source of stimuli to be remembered in a match-to-sample paradigm. Using a small set of repeating images requires monkeys to hold each sample in working memory, while a large set of initially novel images can be recognized as familiar at test without active maintenance. Six monkeys chose between completing tests of working memory or familiarity. Reward likelihood was made equivalent using false feedback. If monkeys are sensitive to the effort involved in working memory maintenance, then they should prefer to take familiarity tests that can be solved without rehearsal. In Experiment 1, monkeys showed no preference for either type of test when memory delays were fixed ($t(5)=.619, p=.563$), but accuracy was very high on both tasks. In Experiment 2, we determined a memory delay for each monkey that resulted in working memory accuracy below 75%, and monkeys still showed no preference ($t(5)=-1.293, p=.252$). These findings suggest that monkeys are not sensitive to the cognitive effort involved in working memory maintenance.

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Approach-avoidance conflict behavior: differences and similarities between male and female rats

Joshua Hahn, Trinity Pierce, Hadley Hauser, Mayela De Luna Alonzo, Isabella Moechnig, & Rachel Anderson (Bethel University)

Approach-avoidance conflict is thought to arise in situations where a decision has to be made whether to pursue a potential reward or to avoid a potential negative consequence. The balance of whether to continue on for a reward or to stay back in relative safety tends to be tipped towards avoidance in anxiety disorders. While many paradigms exist to study this conflict, few represent ethologically relevant situations that most animals find themselves in on a daily basis. Here we study this conflict in male and female Sprague-Dawley rats in a naturalistic foraging arena, where a robotic predator is present. Rats were trained to leave a safe "home nest" to forage for their daily food. However, in some trials, after the rat left the nest, a robotic predator advanced and approached the rat. Both males and females showed fearful and anxious behaviors with some differences reported between the sexes. We report on the importance of looking at anxiety and fear behavior in naturalistic settings, as well as the need to examine both sexes when attempting to understand these behaviors.

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Intertrial proactive interference in dogs during olfactory match-to-sample

Adam Davila, Jordan G. Smith, Emma Cox, Lane Montgomery, Sarah Krichbaum, Lucia Lazarowski, & Jeffrey S. Katz (Auburn University)

Proactive interference (PI) occurs when memories of past experiences causes worse memory in the present moment. One way to induce PI is to increase repetition of stimuli in a session of matching-to-sample (MTS), such that PI negatively impacts performance. Using only two stimuli to construct a session of MTS leads to maximum repetition. When the sample repeats from one trial to the next, there should be no effect of interference (referred to as positive transfer), yet when the previous trial changes from one trial to the next there is often an effect of interference (referred to as negative transfer). Further, these effects can interact with previous choice. In this study, six dogs, previously trained on an olfactory MTS task, were tested for the effects of PI. Dogs demonstrated an effect of PI such that when the current sample was same as the dog's previous choice, there was no effect of PI, but when the current sample was different from their previous choice there was an effect of PI. These results were not modified by response outcome. These findings suggest that for dogs a source of interference is their previous choice, regardless of the outcome of that choice.

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Bolder together: boldness is affected by social context in garter snakes

Gokulan Nagabaskaran, Morgan Skinner (Wilfrid Laurier University), Tom Gantert (Fanshawe College), & Noam Miller (Wilfrid Laurier University)

Personality is defined as individual differences in behaviour that are consistent across time and context. However, the extent to which personality limits behavioural plasticity is an open question, as too much constraining of behaviour by personality may be maladaptive. We aimed to assess the consistency of boldness across non-social and social contexts in gartersnakes (Thamnophis sirtalis). We predicted that snakes would conform when in social contexts, displaying personality plasticity, with boldness scores converging. Snakes explored a novel open arena either alone or in a pair, with one shelter available per snake. Data were initially collected in the non-social boldness assay to assess individual boldness scores. Based on these scores, the snakes underwent two paired boldness trials - one with a bolder and one with a less bold partner. We found that boldness plasticity was the result of an

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interaction between conformity and repeatable individual differences in plasticity. Specifically, snakes were consistent in their plasticity across paired trials, but conformed more when they were the less bold partner. Personality reflects a consistent bias in decision-making, but the expression of personality traits in behavior is flexible and depends on context. Our results show that both consistency and plasticity contribute to behavior.

Do sex-differences in nest building relate to memory for material properties?

Julia L. Self, Cailyn Poole, Connor T. Lambert, & Lauren M. Guillette (University of Alberta)

P29 Nest-building behaviour in birds may be relevant to understanding the evolution of physical cognition, in part because birds learn from nest-building experiences and adjust material composition of future nests to increase the likelihood of reproductive success. Thus, learning and remembering nest material choice is important for effective nest construction. We tested whether nest-building ecology is related to memory for material properties using laboratory-bred zebra finches (Taeniopygia guttata). We predicted that males, who select and deposit most of the nest material, would have better memory for material properties compared to females. We tested 28 males and 26 females that had previously learned three material discrimination tasks: (1) length, (2) flexibility, and, (3) colour. Learning speed for these tasks was re-tested between 4 and 21 months after completing initial learning. As a group, the male and female zebra finches completed each of the three discrimination tasks faster (in fewer trials) the second time. Male zebra finches showed greater improvement in learning speed compared to females on the flexibility discrimination, but not on the length or colour discriminations. Our results provide evidence of memory for material properties in zebra finches, and suggest that there may be sex-differences in memory for physical cognition tasks.

Comparative assessment of raptor cognition via the string-pulling task

Colby Smith, & Dr. Erin Colbert-White (University of Puget Sound)

P30 One group of animals whose cognition remains understudied is the birds of prey. Due to the challenge of securing appropriate sample sizes, few studies have examined these birds' performances on cognitive tasks. A common cognitive task used to evaluate features of cognition such as learning over time, means-end analysis, and insight problem solving is the string-pulling task. Previous research has examined string-pulling in only three species of raptor, the Harris's Hawk, Great Grey Owl, and Turkey Vulture. We tested seven raptor species on a standardized experimental set up, with two strings tied around a perch, one baited with a piece of meat and the other serving as a control with a rock attached. Birds underwent multiple 60 minute trials. Four of the seven species of raptors solved the task with three birds solving consistently across trials, including the first recorded solving of the task by a Western Screech Owl. Our findings illustrate how natural history affects performance on cognitive tasks. In the case of the string-pulling task, we observed diverse apparatus-directed behaviors and solving methods that corresponded with species' biomechanical abilities and hunting patterns, challenging the unadapted use of the task across many different species as a marker of cognition.

The Lure of 'What If': Do Multiple Species Seek Information About Alternative Past Events?

Elizabeth L. Haseltine, & Michael J. Beran (Georgia State University)

P31 Counterfactual thinking is the mental construction of alternative scenarios to past events. Curiosity for the counterfactual acts as an important driver of learning under uncertainty, a technique to improve on past behaviors by informing future choices, and a confirmation when correct decisions were made. While highly studied in humans, there is little research on the willingness of nonhuman primates to obtain counterfactual information. The presented study explores the appeal of counterfactuals when there is no benefit to having informational clarity. Human and nonhuman primates were given the same gambling task with the choice to receive a visible reward or a nonvisible reward, creating a component of uncertainty. When choosing the visible reward, participants could resolve uncertainty by either viewing the value of both the visible and nonvisible rewards, or viewing a blank control screen. When not gambling on the unknown reward, human participants collected counterfactual information on 70% of trials. This rate of information collection was similar to previous studies surrounding counterfactual curiosity in humans. Data collection with nonhuman primates is still ongoing. Once completed, this will be the first study providing a direct comparison between human and nonhuman primate counterfactual information collection.

Do dogs develop social preferences over time?

Zachary A. Silver, Emily M. Richards (Yale University), An T. Le (University of Texas), Dolores Marcial-Modesto (Trinity College), Amari S. Lowery (Washington State University), & Laurie R. Santos (Yale University)

P32 The ability to seek out prosocial agents based on observed behavior represents a critical evolutionary adaptation for many social species. Previous research suggests that untrained pet dogs fail to spontaneously evaluate novel humans while agility trained dogs demonstrate preferences for prosocial actors. One potential explanation for trained dogs' success concerns their increased social experience with humans acquired during the training process. Here, we explored whether untrained dogs are more likely to develop social preferences for prosocial human agents if they receive repeated exposure to their prosocial behavior. Using a six-week longitudinal design, we first tested dogs' preferences for prosocial humans using a preexisting social evaluation paradigm (week 1). In weeks 2-5, dogs got repeated experience with the human agents through repetition of their prosocial or antisocial behaviors. In the final session (week 6), we retested dogs' preferences using an identical paradigm to week 1. We found that dogs did not show a spontaneous preference for prosocial humans and did not update their preferences across the six-week experiment. This finding suggests that canine social evaluation does not depend on the quantity of social experience and raises new questions about why trained dogs outperform untrained dogs on social evaluative tasks.

Dogs prefer humans who help their primary caregivers

Tina Wu, Zachary A. Silver, Emily M. Richards, & Laurie R. Santos (Yale University)

P33 Humans evaluate others based on observed social behavior and use these assessments to select potential social partners. The emergence of this capability in human development raises questions about its evolutionary origins in other animals. Dogs, with their history of coevolution and experience with humans, are an ideal species to address these questions. Previous canine social evaluation research has produced mixed results, potentially due to unexplored methodological factors. Here, we investigate whether dogs demonstrate different patterns of social evaluation depending on the recipient of a prosocial action. Dogs watched as either their caregiver or a stranger attempted to open a container before asking for help from a prosocial actor who helped open the container. Dogs could then accept food from either the prosocial actor or a neutral actor. Dogs demonstrated a significant preference for the prosocial actor in the caregiver condition but not in the stranger condition. These data suggest that dogs' performance on social evaluation tasks may depend on methodological factors that include dogs' relationship with the particular human involved in the social interaction. Additionally, this finding reveals the need to explore other methodological factors that might contribute to dogs' perceived salience of evaluative scenarios.

Cat's got their tongue: Do exotic cats recognize the voice of their keepers?

Taylor Crews, Dr. Jennifer Vonk (Oakland University), & Dr. Molly McGuire (Zoo Miami)

P34 The ability to recognize and distinguish between familiar and unfamiliar human voices has been studied in multiple species, both wild and domestic, but very little research has investigated this ability in wild cats. With many species of exotic cats being highly prolific in the human world, from private collections to zoos and sanctuaries, information regarding how they perceive and categorize human vocalizations could be highly beneficial towards husbandry and conservation of these species. In this study, I will be examining captive, non-domestic members of the Felidae family, using audio playbacks of five different human voices, varying in degrees of familiarity, to test whether these animals respond differently on the basis of familiarity. Discrimination will be measured by observing and analyzing response behaviors following the audio playbacks, such as body positioning, movement, and response vocalizations. I will also be examining differences in response when the animal's name is spoken during the playbacks by different speakers. The information gathered by this study could influence husbandry practices to better suit the needs of captive cats in regard to training, management, and exhibition. If the sample allows, I will also examine if rearing history (raised by humans vs. raised by conspecifics) influences cats' responsiveness to human cues.

Did the pandemic affect Sumatran Orangutan (Pongo abelii) Welfare at the Toronto Zoo?

Ezekiel F Gading, & Suzanne E MacDonald (York University)

P35 The COVID-19 pandemic led to lockdowns and changes in behaviour for humans around the world. The lockdowns also affected animals living in zoos. The purpose of this study was to look at the behavioural and physiological responses of the Sumatran orangutans at the Toronto Zoo to the reintroduction of visitors after pandemic restrictions were lifted. In orangutans, a previous study reported increase in behavioural stress indicators, and faecal cortisol with increase in visitor numbers (Amrein et al., 2014). We expected to see similar behaviour changes after pandemic restrictions were lifted at the zoo. However, we found that the orangutans did not change their space use or foraging levels when visitors were introduced. In fact, the orangutans hid less when visitors were introduced than during the lockdown. This suggests that visitor presence was not aversive to these orangutans. Behavioural stress indicators also did not change when visitors were introduced. Faecal consistency and glucocorticoids did not change across the study. However, the presence of conspecifics and keepers strongly affected the behaviours of the orangutans. The results are congruent with studies that found that the pandemic lockdown measures did not negatively affect the welfare of a variety of species (Krebs et al., 2022).

Self-directed Learning in Nonhuman Primates

Joseph McKeon, & Michael J. Beran (Georgia State University)

P36 Self-directed learning (SDL), a form of learning wherein individuals have primary control over much of their learning process, emerged as a topic in the field of adult education in the 1960s. However, little research has been done to investigate this topic in nonhuman animals. To do this, rhesus monkeys and tufted capuchins will be tested on a chained sequential learning task. After familiarization with four distinct symbols that represent the number of items to be sequenced, monkeys will either be forced to sequence a randomly assigned number of items, or they will be allowed to choose the number of items they want to sequence. Evidence for SDL comes from whether monkeys adjust the number of stimuli they choose to sequence based on relative expertise (i.e., they should choose fewer stimuli when new sequences are presented, and then adjust to choosing longer and longer sequences). Because of the important role of metacognition in SDL it is predicted that rhesus monkeys, but not capuchins, will demonstrate evidence of SDL. Support for these predictions would give us new insights into the development of SDL as an evolutionarily advantageous metacognitive trait, as well as one of the first valid measures of SDL in animals.

How does parasitism influence amphipod escape performance in modified aquatic T-maze?

Elena Donely, Melissa Larsen (Carroll University), Nabeel Bhimani (Illinois Wesleyan University), & Joshua Wolf (Carroll University)

P37 Amphipods (Gammarus pseudolimnaeus) have demonstrated the ability to escape from a modified T-maze submerged in water and do so faster and with fewer errors across days of training. Amphipods are intermediate hosts for a parasite that influences their behavior and physiology to make them easier prey for ingestion by final hosts. It is unclear however, if the parasite also influences the amphipods' ability to learn. The purpose of this experiment was to compare the maze escape performance of healthy and parasitized amphipods and to extend training beyond the five days used in the earlier research. Parasitized amphipods tend to be positively phototactic while healthy amphipods tend to be negatively phototactic. Because we use a bright light over the maze as the aversive stimulus, we expected that parasitized amphipods would demonstrate poor performance in the maze (i.e., more errors, longer latency to escape) compared to healthy amphipods. Parasitized amphipods were slower to escape from the maze than healthy amphipods but did not make more errors.

Poster Session II - Friday Evening

Flexible Social Choice Behavior in Rats

M.M. Mazumder, T.B. Wise, & R.D. Burwell (Brown University)

P38 Rats are highly social animals commonly used in cognitive research. Thus, they provide a useful model to investigate the neural mechanisms of social decision-making. Basic questions surrounding rat social cognition, however, remain unanswered. Although previous work investigated spontaneous social exploration in rats, little is known about their social cognitive flexibility or use of social information to guide goal-directed behavior. To address this gap, we introduced a new behavioral paradigm to test whether rats are able to flexibly discriminate on the basis of social identity. Rats were trained to select one of two conspecifics for a reward, the contingency was reversed, and then a novelty probe was presented in which innate social preferences competed with a food-reinforced conspecific. We show that rats can successfully discriminate based on social identity and flexibly maintain relevant social information. Our results offer novel insights into social cognition including how social information is used for goal-directed behavior in a social context.

Juvenile corn snakes do not prefer familiar conspecifics in a 3-chamber task

Maggie-Rose Johnston, Morgan Skinner, & Noam Miller (Wilfrid Laurier University)

P39 Snakes have historically been assumed to have little interest in social interaction. As a result, most pet-trade species remain housed in isolation. Research has only recently begun to dismantle this perception, identifying complex group behaviors in snakes, such as biased social networks and a preference for associating with related conspecifics. In addition to association preferences in some species of snake, recent work has shown that Corn snakes (Pantherophis guttatus) can recognize the scent of familiar handlers, pointing to individual recognition even beyond their species. It is therefore reasonable to expect corn snakes to be capable of identifying conspecifics and, when presented with a choice between two snakes, to differentiate between the novel and familiar individual, especially if one is related to the subject. Despite prior research suggesting this to be within snakes' capabilities, juvenile P.guttatus in a 3-chamber assay adapted from rodent studies failed to show a preference for either a related cagemate or a novel conspecific, and displayed only a weak, non-significant bias for being near a snake vs. an empty container. These curious results suggest these snakes are either too young to discriminate conspecific scents, or that an experimental setup better tailored to their perception is necessary.

A comparative test of odor self-recognition in two species of snake

Troy Freiburger, Morgan Skinner, & Noam Miller (Wilfrid Laurier University)

P40 The mark test is commonly used to assess whether a species is capable of self-recognition. However, self-recognition abilities are rarely linked to species' ecology, and research directly comparing species is rare. We tested odor-based self-recognition in Eastern gartersnakes (Thamnophis sirtalis) and ball pythons (Python regius). We placed snakes in an arena with odor stimuli at either end and compared their interest (as indicated by tongue flicking) in the scent of their own skin oils when either unadulterated or with an added scent 'mark' (olive oil). We also compared preferences for the mark odor alone, a familiar conspecific's odor, and a conspecific odor with the mark added. Gartersnakes, but not ball pythons, displayed an increased interest in their own modified scent over just their own scent, just the mark odor, and a modified conspecific's scent, suggesting that gartersnakes' responses could not be attributed to an interest in more complex stimuli, any snake's odor, or in the mark odor itself. Gartersnakes and ball pythons inhabit very different ecological niches, climates, and social structures, any of which could be driving the difference in their self-recognition behaviors. Our findings highlight the importance of directly comparing cognitive processes across species facing different ecological challenges.

Long-term memory of visual information in gopher tortoises

Kelsey Felder (University of Lincoln (UK)), Elisa Frasnelli (University of Trento), Thomas W. Pike, & Anna Wilkinson (University of Lincoln (UK))

P41 Gopher tortoises (Gopherus polyphemus), like other Chelonia, have long life spans. Long-term memory is therefore critical for these animals as they interact with their environment and conspecifics, and travel between multiple burrows and foraging sites. Six gopher tortoises were trained on a visual discrimination task involving 2 sets of compound stimuli that differed in both shape and color. The animals learned this task and tests revealed that they predominately used color when making the discrimination. After approximately 6 months they were given a memory test. All animals retained the information, preferentially choosing the positive stimuli over

negative stimuli. Moreover, retraining times were significantly shorter than in initial training. This work reveals that visual cues are likely to be important to this species when making decisions and this information can be retained for extended periods of time.

New Methodologies to Foster Animals' Explicit Cognition

Brooke N. Jackson, Barbara A. Church, & J. David Smith (Georgia State University and the Language Research Center)

P42 Comparative researchers have used displaced feedback to break the time-locked stimulus-response-reinforcement chain needed for associative-operant category learning (Smith et al., 2018; 2020). When these operant processes are unavailable, humans rely on explicit-declarative processes. It is an open question whether animals have similar processes to rely on. In the current study, rhesus macaques are completing a series of simple categorization tasks with different reinforcement schedules. Each reinforcement schedule uses a different colored background. Stimuli are simple, colorful shapes that can be categorized using either a color or shape rule. For each stimulus set, monkeys complete an immediate feedback task, as well as three displaced feedback tasks: delayed (feedback 4 seconds after choice), deferred (complete 3 trials, then all correct feedback followed by all incorrect feedback), and one-back (feedback refers to the trial before the trial just completed). The first three stimulus sets started with immediate feedback to teach the monkeys the relationship between the background colors and the feedback types. Then the tasks were randomized to determine whether the monkeys could learn new categories with each type of feedback. Initial results suggest that, though learning from displaced feedback is harder, the monkeys can learn new categories with displaced feedback.

Increased visual working memory performance in a single stimulus property, using pre and retro-signalling strategies

John Solorzano-Restrepo, Maria Mendoza, Simon Mendoza, Noemi Gallegos, & Ken Leising (Texas Christian University)

P43 Direct forgetting and memory reallocation research has found that an external cue that signals a task-relevant or irrelevant stimulus improves memory performance in pigeons and humans. External cues also improve recognition when presented before (pre) or after (retro) the task-relevant stimulus. Differences in signalling one (e.g., shape) or another (e.g., location) task-relevant visual property of the same stimulus have not been evaluated. We analysed the effect of pre and retro-cueing a single stimulus in a visual working memory (VWM) recognition task. A set of snowflakes were used as stimuli. Each trial followed the structure: colored background (CB1), delay, target stimulus, delay, colored background (CB2), delay, probe stimulus. College students were instructed that the color of CB1 or CB2 would signal whether to respond "same" or "different" regarding the relationship of the identity (Id) or location (Sp) of the probe stimulus to the target stimulus. An analysis of d' revealed significant differences in Trial type (Id vs. Sp), Cueing (Pre vs. Retro), and a significant interaction. Performance in control trials was close to chance. Our results support previous research and reveal a difference in the effect of cueing task-relevant identity and spatial features.

Impulsivity as a trait in domestic dogs: A systematic review and meta-analysis

Jessica Barela, Yasmin Worth, & Jeffrey R. Stevens (University of Nebraska-Lincoln)

P44 Impulsivity is a critical component of dog (Canis familiaris) behavior that owners often want to curtail. Though studies of dog impulsivity have examined their inability to wait and to inhibit inappropriate behaviors, it is not clear whether impulsivity is a behavioral trait with consistent characteristics across contexts. For this project, we conducted a systematic review and meta-analysis to investigate whether impulsivity exists as a behavioral trait in domestic dogs. Under a pre-registered protocol, we scanned over 10,000 bibliographic database entries to uncover 12 articles with multiple impulsivity tasks. Across 46 pairs of impulsivity tasks, 38 failed to detect a correlation in performance between tasks and 8 detected a correlation. A meta-analysis on a set of tasks (A-not-B and cylinder tasks) that had effect sizes from seven different studies showed no overall correlation between the tasks. At the moment, we do not have good evidence of impulsivity as a behavioral trait that transfers across contexts, suggesting that perhaps we should focus on the context-specific nature of impulsivity.

Are giant pandas, a relatively solitary mammal, averse to inequity?

Miranda Trapani (Department of Psychology Hunter College and the Graduate Center CUNY), James Ayala, Zhang Mingyue (Chengdu Research Base of Giant Panda Breeding Chengdu Sichuan PR China), & Joshua Plotnik (Department of Psychology Hunter College and the Graduate Center CUNY)

P45 Inequity aversion, or resisting situations where reward distribution is unequal, is associated with fairness and cooperation and is thought to be present primarily in social species. However, attention to differential distributions of resources could be adaptive for nonsocial species as well. While giant pandas (Ailuropoda melanoleuca) are solitary in the wild, captive rearing in social groups provides an opportunity to assess how development in a social setting might facilitate expressions of inequity aversion. Ten juvenile pandas were exposed to an effort inequity paradigm. Pandas were tested in social conditions – where one (inequity) or both (equity) individuals in a pair were required to stand up when cued to get a food reward – and in similar nonsocial conditions. The social conditions evaluated for inequity aversion and nonsocial conditions aimed to rule out refusals due to a 'frustration effect.' While we found no statistically significant differences in the pandas' responses between conditions, one panda behaved in a way consistent with inequity aversion, suggesting that more research in this area using alternative paradigms may yield different results. This work also suggests that comparative research across social and nonsocial species could shed light on the factors influencing the evolution of socio-cognitive traits.

Voluntary Oral Consumption of Cannabidiol (CBD) in Rats does not Reduce Anxiety-like Behavior

Sara Bond, Jordan Nerz, Taryn Pittman, Sophie Jones, Krista Randall, Macy Lasater, & Ken Leising (Texas Christian University)

Previous research suggests that IP injections of cannabidiol (CBD) result in anxiolytic effects (Blessing et al., 2015). We investigated whether CBD would act as an anxiolytic when voluntarily consumed. An elevated plus maze (EPM) and an open field (OF) were used to assess anxiety-like behaviors. Reduced anxiety would be observed as more time in the open arms of the EPM and in the center of the OF. In Experiment 1, rats were either given an acute oral dose of non-pharmaceutical grade CBD or coconut oil. Rats
P46 were tested on an EPM on day 3 of administration. Experiment 2 was the same, except CBD was administered chronically (12 days), the control group received distilled water, and the OF was also used. Testing occurred in the same manner in Experiment 3, except pharmaceutical grade CBD was used and the control group received olive oil. Results revealed that the CBD group spent more time in the center compared to the control group on the OF in Experiment 2, but there were no other differences between any groups. These results are discussed with respect to administration route, timing of test, and type of test.

Dogs' Performance on an Object-Choice Task Utilizing a Momentary Contralateral Point

Courtney Collins-Pisano, Lane Montgomery* (Auburn University), Lyndsey Elrod, Lucia Lazarowski (Canine Performance Sciences: Auburn University College of Veterinary Medicine), & Jeffrey Katz (Auburn University) (*specifies joint first author)*

Dogs are capable of extrapolating information via human gestures with equivalent performance to infants and better performance than other non-human animals such as apes and wolves. Like infants, research suggests that dogs require ostensive conditions to utilize pointing information. However, study procedures vary for important cues such as eye contact (maintained or alternating) and
P47 length of cue (momentary or continuous), which hinders analysis of which cues are necessary for dogs to comprehend human gestures. A population of kennel reared working dogs (n=19) and companion dogs (n=19) were tested on an object-choice task in ostensive and non-ostensive conditions, utilizing a momentary contralateral point. One-sample Wilcoxon signed ranked tests revealed that dogs performed below chance (50%) in the ostensive condition and at chance in the non-ostensive condition. The results align with research finding below chance performance in laboratory populations but is unique in finding poor ostensive performance in companion dogs. We suggest that dogs may have failed to follow pointing in this experiment due to training techniques, the nature of the pointing gesture, and the stress of an unfamiliar environment. This research emphasizes the need for further testing on the implications of various methods for the object-choice task and standardization of methodology.

Applications of elephant cognition research to conservation in practice

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Researchers invested in studying animal behavior and cognition have only recently begun to engage with conservation efforts. Interestingly, attempts at mitigating conflict between wildlife and humans have historically focused on physically managing their interactions, rather than considering how best to fulfill their ecological and behavioral needs. Habitat fragmentation, the result of
P48 increasing human-driven environmental change, is a significant threat to Asian elephants, our study species, throughout their range. These landscape changes have led to an increasing number of negative interactions between humans and elephants in agricultural areas bordering natural wildlife habitat. Human-elephant conflicts (HEC) vary in intensity but are often mitigated using methods that sometimes include fear conditioning, such as electric fencing, noisemaking, and aggression. These strategies often fail to account for elephant behavior, ecology, or cognition, which may contribute to their lack of long-term efficacy. Here, we will discuss the ways in which research on elephant cognition, including problem-solving, personality, and sensory perception, may contribute to the development of appropriate tools for preventing HEC in the long-term. Our work with captive and wild elephant populations in Thailand aims to promote human-elephant coexistence rather than conflict by ensuring the perspectives of both species are considered.

Individual Differences in Recovery Rate from Reward Downshift: An Effect of Sensation Seeking?

Christopher Hagen (Texas Christian University), Pedro Ogallar (Universidad de Jaén), & Mauricio Papini (Texas Christian University)

Frustration is a complex emotional state activated by violations of reward expectancies. In laboratory settings, frustration is often modeled through a paradigm known as consummatory reward downshift (cRD), which involves training rats to expect a high-value sucrose solution (32%) followed by a downshift to a low-value sucrose solution (2%). cRD is followed by the suppression of consummatory behavior and sympathetic arousal, but these effects are transient. There are also individual differences in the rate of behavioral recovery. Previous research showed that fast-recovery (FR) rats work more for access to alcohol than slow-recovery rats
P49 (SR) in a progressive ratio schedule, a result consistent with sensation/novelty seeking. Two experiments showed that FR animals spent more time in the center of an open field than SR animals after a 32-to-2% sucrose downshift, but not after an 8-to-2% downshift. This result suggests that FR animals exhibit less unconditioned fear to open spaces than slow recovery animals. Further experiments will use open field activity as an index of sensation/novelty seeking to predict recovery rate. Overall, these and analogous results from our lab suggest that individual differences in sensation/novelty seeking may explain the degree of resilience/vulnerability to reward loss in the cRD task.

P50 **The effect of temporal arrangement and varying degrees of LM stability on a spatial occasion setting task in pigeons**

Jordan Nerz, Taryn Pittman, Sara Bond, Sophie Jones, Noemi Gallegos, & Ken Leising (Texas Christian University)

In a feature-positive discrimination, responding to a target stimulus (A) is reinforced when presented with a feature stimulus (X), but not when presented alone (XA+/A-). When the feature and target occur simultaneously, direct control by X is typically observed, whereas serial pairings produce occasion setting. The present experiment evaluated the effect of these conditions in a spatial task with pigeons. Two features (background colors; W, X) were simultaneously presented with landmarks (LM; visual icons), and the LMs and their associated goals were always in the same spatial location (simultaneous/static). Two other features (Y, Z) preceded the presentation of different LMs, and these LMs and their goals varied in position across trials (serial/dynamic). Responses were reinforced to the right or left of the landmark with the feature (static: +<-- WA, XB -->+, dynamic: +<--YC, ZD-->+), but not on LM-only (A-, B-, C-, D-) trials. Transfer tests (WB, XA, YD, ZC) revealed what looks like spatial occasion setting in both conditions, with a higher proportion of responses at the location signaled by the LM compared to that signaled by the OS during training. Total responses did not differ between feature-alone and transfer trials. Additional tests are needed to evaluate these mixed results.

Marine Mammal Cognition and Conservation

Gordon B Bauer, Peter F Cook, & Heidi E Harley (New College of Florida)

P51 Research on animal cognition has been applied to marine mammal conservation and management infrequently despite the manifest involvement of cognitive processes such as learning, memory, and decision making in maladaptive behavioral responses across a wide range of contexts. Previously published research with conservation applications include the influences of anthropogenic noise on hearing and vocal production, learning context in transfer of behavior from managed care facilities to the wild, and neurotoxin impaired spatial memory effects on navigation. Here we propose a variety of cognitive approaches to extant conservation and management issues produced at a conference workshop group we organized. Sample problems include boat strikes on manatees, loss of warm water refuges for manatees when power plants close, intervention in pinniped competition with humans for salmon, influence of anthropogenic noise on dolphin communication, and dolphin begging behavior in the wild. In each case we identify potentially relevant cognitive factors specific to species and conservation concern and discuss how these might be leveraged or worked around in amelioration efforts. We will welcome suggestions from CO3 colleagues for additional solutions.

Are cognitive and perceptual brain regions activated during flight of migratory songbirds?

Madeleine IR Brodbeck, Chloe A. Henry, Shenelle Rodrigo (The University of Western Ontario), Derrick JE Groom (San Francisco State University), Alexander R Gerson (University of Massachusetts Amherst), Scott A MacDougall-Shackleton, & David F Sherry (The University of Western Ontario)

P52 Every year, millions of songbirds migrate. Migration is a complex and multifaceted behaviour. Various brain regions are important during migration. Cluster N is a region of the visual forebrain of nocturnally migrating songbirds that supports the geomagnetic compass. The avian hippocampus has a functional role in spatial memory. During migration, birds do not only orient and navigate; they fly. A large body of research has examined migration physiology and fuel use, but less is known about the relationship between flight itself and neural structures. Yellow-rumped warblers (Setophaga coronate) are nocturnal migrants widely distributed through North America. We measured immediate-early gene (ZENK) activation as a marker of neural activity in Cluster N and the hippocampus of warblers that flew in a wind tunnel, and in warblers that did not fly. In flight groups, birds performed self-initiated flights for up to 6 hours. In rest groups, birds experienced the same environmental conditions as the flight birds but did not fly. Following this, brains were collected and processed to label ZENK. We will thus investigate differences in Cluster N and hippocampal activity between groups to determine if these brain regions that are important for spatial cognition and geomagnetic perception are upregulated during flight.

File, Save, Forget: Cognitive Offloading in Non-Human Primates

Stella Mayerhoff, Matthew Babb, Michael Beran, & Sarah Brosnan (Georgia State University)

P53 If you have written a to-do list, used a bookmark, or said, “Hey Google, set a timer,” you have used cognitive offloading. This term refers to the externalization of mental processes—through physical effort or external resources—to reduce cognitive load. The tradeoff, however, is reduced memory for offloaded information. While humans’ use of cognitive offloading is widespread, we have yet to find clear evidence of its use in other species. This study investigated whether tufted capuchins and rhesus macaques could use a “hint button” to offload in a memory task. Subjects' use of the button to offload would be indicated by reduced memory performance when the hint was unexpectedly absent. While subjects’ performance improved when shown a hint, there was no evidence that they used it to cognitively offload. With additional comparative research, we may better understand how this behavior evolved and how we can benefit from it.

Priming in Pigeons

Colin A. Scholl, Briana R. Galeota (Coastal Carolina University), Benjamin M. Basile, Emily K. Brown (Dickinson College), Muhammad A. J. Qadri (College of the Holy Cross), & Matthew S. Murphy (Coastal Carolina University)

P54 Priming is a process that draws on both implicit memory and perceptual representation. Although this is easy to demonstrate in humans, it is more difficult to show with animals. Brodbeck (1997) demonstrated picture priming in pigeons, but this has been difficult to replicate in this species. In our attempt to replicate Brodbeck's findings, pigeons will be tested using picture fragment completion. Pigeons will be shown a target stimulus, and then asked to make a categorical discrimination. If the target stimulus is from the S+ category, we predict higher accuracy due to priming from the target stimulus. Results will be discussed in terms of obstacles to replication, possible methodological considerations, and comparisons to human and primate priming studies.

A Test of Associative Class Expansion in Rats

Elijah Richardson, Madeleine Mason, Skylar Murphy, Rebeca Barba, Sophie Shea, Lauren Underwood, Mark Galizio, & Kate Bruce (University of North Carolina Wilmington)

P55 This study was conducted as part of the ongoing effort to develop a rodent model of associative concept formation. Rats were tested for evidence of functional equivalence and class expansion using two sets of olfactory stimuli. Twelve olfactory stimuli were arbitrarily assigned to two sets of six and rats were trained on a go no-go task to respond to members of only one set at a time. Reinforcement contingences for each set were reversed following accurate responding. After repeated reversals, probe sessions revealed that after encountering the reversed contingency with a few members of each class, rats then responded at above chance accuracy to the remaining class members, which demonstrated transfer of function within associative classes. Next, researchers tested whether rats showed evidence for class expansion. New scents were trained alongside one member of each of the original sets using the same repeated reversal procedures. Next, probe sessions were conducted with the new scents and the other original set members to assess whether they had become class members. Preliminary results were consistent with predictions of associative class expansion.

Non-Verbal Interoception: Emotion Labeling with Visual Stimuli

Sophia Jones, Jordan Nerz, Cheyenne Elliott, Marissa Melo, & Kenneth Leising (Texas Christian University)

P56 Emotion labeling involves the identification of endogenous sensations facilitated by external stimuli. The capacity to discriminate internal states is primarily understood through the paradigm of human language, despite evidence of interoceptive labeling in non-human animals (Colpaert, 1978). To further investigate non-verbal emotion labeling, the present study assessed whether pigeons could label naturally elicited internal states. Pigeons were trained to respond to events of reinforcement or nonreinforcement with corresponding emoticons. Opportunities to earn food were signaled by three discriminative stimuli (DS; A, B, and C), resulting in either 50% (DS A and B), or 100% (DS C) reinforcement. To ensure learning, blocks of each trial type with only one label replaced interspersed trials until performance improved. Visual labels were presented after DS A training trials, and DS B and C test trials. In Test 1, pigeons transferred labeling to untrained stimuli. In Test 2, the manipulation of associated stimuli (hopper sound, hopper light, vs. eating behavior) controlled labeling, not internal state. The results of the present study identified stimuli and procedures relevant to emotion labeling in non-verbal populations.

Limitations of Cognitive Flexibility in Rat Serial Pattern Learning: Poor Generalization Between Spatial and Temporal Phrasing Cues

Katherine Dyer, & Stephen Fountain (Kent State University)

P57 Pauses within serial patterns (i.e., phrasing cues) can facilitate rat pattern learning. We examined whether rats generalize across phrasing cue modalities from temporal phrasing to spatial phrasing and vice versa. Rats learned a 24-element pattern, 123-234-345-456-567-678-781-818, where digits indicate correct choices in an 8-key circular touchscreen array. Rats performed 50 patterns/day for brain-stimulation reward. Two groups experienced different phrasing cues, either a 3-sec temporal pause or a spatial response to a center key, represented by dashes in the pattern. These phrasing cues possessed varying stimulus properties, either time (temporal cue) or time+space (spatial cue). During acquisition, groups learned the pattern similarly. Phrasing cues were then switched between groups and pattern performance was assessed. While both groups showed impairments in performance of the elements immediately following phrasing cues, the temporal group displayed much poorer transfer of performance compared to the spatial group. Therefore, rats encountered difficulty generalizing performance across phrasing cue modalities, more so from temporal to spatial cues. Thus, rats attend to and encode stimulus properties of phrasing cues during serial pattern learning, which, perhaps counterintuitively, limits rats' cognitive flexibility.

Memories for Self-performed Actions in Dogs

Anna Hege, Allison Scagel, & Eduardo Mercado III (University at Buffalo: SUNY)

P58 Dogs are capable of reenacting recent actions on command suggesting that they maintain memories of what they were recently doing and can flexibly access those memories. Initial tests of action recall after varying delays revealed that dogs' accuracy decreased after delays of more than ten seconds. However, because dogs were initially trained with no delay, it is unclear whether this decrement was a consequence of forgetting or a generalization decrement related to novel task requirements. To clarify dogs' abilities to retain memories of recently performed actions, we introduced training with longer delays and compared performance recalling actions performed with objects (providing external cues) versus actions performed without objects. Task training regimens, environmental conditions, and the presence of distractors during performance and retention intervals appear to affect dogs' abilities to successfully recall past actions in ways that confound assessments of their memory capacities. Better understanding of the factors that contribute to successful action recall can clarify what dogs naturally retain from ongoing events as well as techniques that may heighten their ability to voluntarily recall past events.

Performance Under Pressure in Rhesus Macaques

Rael Sammeroff, Noah Willhite, & Robert R. Hampton (Emory University)

P59 Choking under pressure is the phenomenon in which one's performance suffers when it matters most. Monkeys were recently reported to "choke" on rare and valuable trials in a motor task (Smoulder et al., 2021). We attempted to reproduce these results in a modification of the task that would permit further investigation of the cognitive mechanisms responsible for "jackpot induced performance impairment" or JIPI. Five monkeys completed a difficult "bubble popping" task in which they had to contact a rapidly moving dot on a touchscreen to earn reward. The color of the bubble indicated the reward the monkey could earn. One color occurred only rarely and was associated with high reward. Monkeys susceptible to JIPI should perform worse on these high value trials

relative to lower values trials. One of five monkeys performed significantly worse on high value trials, indicating that the JIPI effect may not be common in rhesus monkeys. Further experiments are required to parametrically explore the conditions favoring JIPI in monkeys.

Episodic memory in a variation of the odor span task

Skylar Murphy, Sophie Shea, Alice Yaeger, Rebeca Barba, Kate Bruce, & Mark Galizio (University of North Carolina Wilmington)

P60 Episodic-like remembering is what, where, and when remembering associated with past experiences. This study used a variation of the Odor Span Task (OST), a non-matching to sample discrimination task, to test for episodic-like remembering in rats. At the beginning of each trial the rat was placed into an arena containing cups covered with scented lids. In OST trials, one odor was always novel for the session, and selecting it revealed an unflavored sugar pellet reinforcer. Embedded within the OST were trials reinforced with berry-flavored reward. Odors paired with berry reward replenished when they reappeared during the session. During Phase 1, the session began with OST trials with 20 different odors and ended with the last four trials as replenishing trials. During Phase 2, the four replenishing trials were randomly interspersed throughout the OST trials. In Phase 3, two odors were associated with the berry reward, but different contexts. Odors replenished only when they reappeared in the context in which they were first presented. Accurate performances required the rat to remember what, when, and where the scent was smelled, and which flavor followed it. Above chance accuracy was observed in some rats extending the analysis of episodic-like remembering in rats.

Positive Intonation Increases Dogs' Perceived Value of Smaller Rewards in a Quantity Discrimination Task

Erin Colbert-White, & Devin Anderson (University of Puget Sound)

P61 Like many other species, dogs have a natural quantity judgment system to help maximize resources. Dogs are also highly sensitive to, and influenced by, human social cues. Here, we assessed the influence of one such cue—high, rising intonation (i.e., positive "Oooh!")—on dogs' choice of two different quantities of food. Each subject received 16 randomized trials of four conditions: 1 v. 1, 1 v. 3, 1 v. 1 + "Oooh!" from experimenter looking at the plate, and 3 v. 1 + "Oooh!" from experimenter looking at the plate. As predicted, dogs chose the larger quantity more often in the 1 v. 3 condition, with female dogs choosing the larger quantity significantly more often than males. While subjects chose the 1 v. 1 + "Oooh!" at chance levels, pairing the smaller reward with a positive intonation in 3 v. 1 + "Oooh!" resulted in equal choice behavior. That is to say, without the presence of words, eye contact, or facial expressions, many dogs opted to forego a larger reward in favor of a smaller one that a stranger had deemed more valuable, further evidence of the ability of human cues to alter dogs' behavior.

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

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

P62 Assessment of educational practices is critical for evaluating the impact of zoos and other facilities on visitors. Few studies have focused on education outcomes at refuges and sanctuaries. This study utilized a pretest–posttest design to examine the efficacy of the current educational practices at Turpentine Creek Wildlife Refuge (TCWR). Participants included 95 visitors to TCWR between 18-82. Researchers administered a pre-visit survey, then participants chose to take a guided tour of the refuge or explore a self discovery area. At the end of their visit, participants completed a post-visit survey to assess whether they had a) learned factual information and b) exhibited a shift in attitudes regarding exotic animals in the United States and the wild as a result of their visit. Results suggest participants in both the guided tour condition and the self-discovery condition showed an increase in knowledge and a positive shift in attitudes. While the effect was not significant, the difference between guided tour participants and self-discovery participants did trend in the expected direction for both learning and attitude shifts. Unexpected gender differences also emerged. Overall, these results suggest that TCWR's education practices are effective in increasing fact-based knowledge and encouraging attitude change in their visitors.

Differential Lever Responses Do Not Facilitate Discrimination Learning in Rats

Taryn Pittman, Sara Bond, Jordan Nerz, Sophie Jones, Noemi Gallegos, Macy Lasater, & Ken Leising (Texas Christian University)

P63 The Differential Outcomes Effect (DOE) occurs when acquisition of a discrimination is facilitated by reinforcing different responses in the presence of two or more stimuli (e.g., a steady and flashing light) with unique outcomes (e.g., sucrose and pellets) compared to a group receiving the same outcome. In pigeons, a similar effect has been reported in match-to-sample tasks when different sample responses are required (DRE). One conclusion is that differential sample responses are analogous to differential outcomes. In the current study, rats were trained to discriminate between two different visual stimuli paired with the same outcome, but contingent on the same or different responses on two levers. For half of the rats (Group Control), discrimination of the correct response for each stimulus involved two levers that required a down-press response. For the other half (Group DRE), one lever required a down-press and the other an up-press response. It was hypothesized that differential responses would facilitate the acquisition of the correct response for each stimulus. Results revealed no main effect of group, indicating that both groups acquired the discrimination at a similar rate. The results will be discussed with respect to factors that influence differential outcomes and differential response effects.

P64 **Habituation and Pavlovian Conditioning in the "M. pudica" - A Call for Behavioral Frameworks and Rigorous Experimental Control in Plant Behavior Research**

Cyrus Kirkman (UCLA), Greg Jensen (Reed College), & Aaron P. Blaisdell (UCLA)

Although modern plant behavior research rarely utilizes psychology, Learning Theory provides an ideal logical framework in constructing an ecocentric foundation of plant behavior because of its analysis of behavioral patterns independent of mechanism. Recently, biologists have applied Learning paradigms to plant behavior experiments and found preliminary success (Gagliano 2014, 2016), but face skepticism stemming from incomplete and improper behavioral procedures and human bias. Our project utilized automated stimulus implementation and rigorous data collection by which Mimosa pudica plant subjects could be observed, uninterrupted for weeks without human contact. A photo-analysis algorithm blind to experimental conditions measured stimulus-elicited responses to investigate behavioral trends. Experiment 1 established a habituation protocol to an air flow stimulus and found a monotonic decrease in magnitude of response over 30d of data collection. Experiment 2 implemented a repeated associative contingency between changes in air flow and vibration stimuli and found a systematic difference in unconditional response magnitude across experimental and control groups over 28d, thereby suggesting preliminary evidence for Pavlovian conditioning in M. pudica plants. Highly regulated environmental conditions, mechanically automated stimuli, and algorithmic response measurement reduced the possibility for human error and maximized procedural effectiveness to create ideal conditions for observations of plant learning.

Does symbol learning help relational cognition in rhesus macaques (Macaca mulatta)?

Andres Sanchez, Barbara A. Church, & J. David Smith (Georgia State University)

P65 Humans and language/symbol trained apes can learn abstract relations. However, monkeys' relational performance is weak (e.g., Smith et al., 2013). Symbolic representation facilitates understanding abstract relations in humans and apes (Gentner et al., 2021; Smith & Church, 2021). Can it do the same in monkeys? We attempted to foster relational learning in monkeys by teaching monkeys symbols that denoted same-color and same-shape relations and then testing whether they would transfer this knowledge to a classic relational matching-to-sample paradigm (RMTS). Two monkeys saw three different trial types. In productive trials, stimuli matched based on color or shape, and the monkey picked the symbol denoting the match. In receptive trials, monkeys saw a symbol and then picked the pair matching on the correct dimension. In a third trial type, RMTS trials, the monkey saw a matching pair at the top (either color or shape) and then had to choose between two different pairs (one color match and one shape match). When complex stimuli (color-boxes with white-shapes inside of them) were used, neither monkey reached above chance performance. However, a monkey was able to successfully perform RMTS trials when simple stimuli (either color-boxes or white-shapes) were used.

Rhesus macaques generalize abstract rules within but not between stimulus categories

Angelle Antoun (Emory University), Rohini Murugan, & Benjamin Wilson (Emory National Primate Research Center)

P66 Comparative sequence learning experiments allow cognitive processes that are required for language in humans to be studied in nonhuman animals. We investigated Rhesus macaques' ability to detect abstract regularities in visual sequences, and their capacity to generalize to novel stimuli. In a three-alternative forced-choice task monkeys were presented with three visual sequences comprised of colored squares. On each trial, two colors (A and B) were randomly generated and arranged into three-element long sequences based on three rules ('AAB', 'ABA', 'BAA'). Monkeys were able to learn the rules and select appropriate sequences, and generalized this learning to the novel color combinations presented on each trial. To further assess generalization to different categories of stimuli, we presented probe trials using sequences comprised of randomly generated shapes, rather than colors. Monkeys showed no preference for the grammar they learned in the shape condition, providing no evidence for spontaneous generalization between stimulus categories. Subsequent testing confirmed that the monkeys showed no generalization between the color and shape categories. Our results demonstrate that monkeys are able to learn abstract rules governing visual sequences and that they generalize these to novel color or shape sequences but provides no evidence of generalization between these stimulus categories.

Automated Cognitive Testing System (ACTS) development in a squirrel monkey model

Lisa M. Pytka, Michele M. Mulholland, & William D. Hopkins (University of Texas Keeling Center for Comparative Medicine and Research)

P67 Touchscreens are utilized for behavioral testing with a wide variety of taxa and have become more prevalent as hardware has reduced in cost. Still, most investigations isolate single animals from their social groups. Here we present an Automated Cognitive Testing System (ACTS) that has been developed to test group-housed non-human primates. Subjects conduct all training and testing from touchscreen units available at the perimeter of their enclosures; animals are not captured or isolated for testing, which reduces staff handling time and increases welfare. ACTS have been deployed with a variety of NHP species at our facility (i.e. chimps, macaques, and squirrel monkeys); hardware and software settings are largely conserved between species, facilitating the investigation of comparative questions. Here we focus on adapting ACTS for a neotropical model: the squirrel monkey. 2-5 testing stations are available to each social group (n= 4-14 animals per group). Testing stations are networked together, allowing animals to resume testing at any open station. Animals have ad libitum access to food and water throughout the duration of the study and earn small juice rewards for correct responses. We will discuss our automated shaping procedure, the hardware configuration used, and review task performance data.

Environmental Changes do not Reduce Habituation of Wheel Running in Rats

Macy Lasater, Daniel Torres, Jordan Nerz, & Kenneth Leising (Texas Christian University)

P68 Habituation refers to a reduction in responding to a stimulus after prolonged exposure or repeated presentations of that stimulus. Current research shows that wheel running in rats habituates within daily sessions (Aoyama & McSweeney, 2001). We investigated whether we could attenuate the habituation effect in rats through the use of context changes across sessions of wheel running. All rats received 12 daily sessions of access to the wheel for 30-minutes in a specific context. The control group encountered the wheel in the same context (olfactory, visual, and tactile), whereas, the experimental group encountered two types of running wheels in two different contexts (four possible contexts). It was hypothesized that rats that received context changes would exhibit more wheel rotations within and across sessions than the control group. Contrary to our predictions, the total number of rotations did not decrease for either group, and within-session habituation occurred in both groups. These results are discussed with respect to the type of response.

How do dogs express joy? An examination of the behavioral correlates of positive affect in domestic dogs

Lindsey Johnson, & Heidi Lyn (University of South Alabama)

P69 The emotional experiences of non-human animals are poorly understood, especially positive emotional experiences. Our present study serves as pilot work for an international collaboration that aims to systematically examine positive emotions in several different species in order to identify if animals experience emotions like joy, surprise, and happiness the same way humans do. Specifically, we assessed whether the domestic dogs (N = 10) showed signals of positive emotion (e.g., tail wags, vocalizations, excitement) when they received a positive outcome they are not expecting: a large amount of a food reward in the "food-surprise task", or interaction with their owner in the "social-surprise task". To differentiate positive surprises, specifically, the dogs also experienced a "negative" surprise in each condition. They either received less food than they were expecting or interacted with a stranger when they were expecting an interaction with their owner. Results, to date, suggest that dogs show more signals of positive emotions after positive surprises, but that specific behaviors of positive affect are even more frequent in the social surprise condition.

A comparison of human trust in human and non-human agents

Anwyn Gatesy-Davis, Madeline H. Pelgrim, & Daphna Buchsbaum (Brown University)

P70 Trust is a key element in successful partnerships; prior work has explored both human-human trust and human-robot trust. In the human-dog partnership, we rely on a non-human agent (dog) for tasks ranging from emotional support to life-saving measures. It has even been suggested that robot-assisted therapy should be modeled after the human-dog relationship. In this study, we use an online survey to evaluate and compare humans' trust in humans, robots, dogs, and robot dogs. Participants were presented with 4 brief vignettes; each story describes a different trust agent (human/robot/dog/robot dog) performing a real-world job. Participants completed the Multi-Dimensional Measure of Trust (MDMT) after reading each vignette (baseline), and a second time after reading a modification to the vignette (manipulation). Participants' trust in the agent was manipulated in 2 directions (increase/decrease) along the 4 trust dimensions (reliable, competent, ethical, benevolent) captured by the MDMT. Results from this study allow for a comparison between humans' trust in other humans and three different non-human agents. Findings have the potential to inform the training and use of working dogs as well as contribute to the development of robot-assisted therapy interventions.

Relative Values of Food Reinforcers by Bottlenose Dolphins (Tursiops truncatus)

Wendi Fellner (University of St Andrews and Disney's The Seas), Christina Alligood (University of Kansas and Disney's Animals, Science, and Environment), Heidi E. Harley (New College of Florida and Disney's The Seas), & Vincent Janik (University of St Andrews)

P71 Bottlenose dolphins consume a variety of fish, but do they actively prefer one species over another? Dolphins swallow their prey whole without chewing, lack olfaction, and disproportionately consume soniferous fish that are easier to detect than silent fish that are more prevalent. We asked whether three aquarium-housed dolphins would expend differential amounts of energy to obtain one species of fish over another by using a progressive reinforcement task. Each dolphin was reinforced with a single fish type/quantity per session for touching successively higher numbers of targets between reinforcements. Two dolphins touched about twice as many targets for 2 capelin fish as 2 silversides (9.5 vs 4.7 and 8.1 vs 4.7), but the difference in the third dolphin was smaller (3.0 vs 2.5), even when increasing to 3 capelin (4.6 vs 3.1). Differences in weight and calories between fish species could not account for all results. Dolphins will exert more effort to obtain some fish species over others.

The Importance of Touch in Rough Tooth Dolphin Communication

Lily Collins, Erin E. Frick, Jordan Whitehead (Eckerd College), Evan Keim, Camelle Zodrow, & Kelly Martin (Clearwater Marine Aquarium)

P72 Rough-toothed dolphins (Steno bredanensis) are a pelagic species that reside in deep warm tropical waters, which makes them difficult to research leaving much unknown about their behavioral repertoire. Researchers investigated the function of tactile behaviors, such as pectoral fin contact and rubbing, both with conspecifics and with environmental enrichment devices between two male rough toothed dolphins housed at the Clearwater Marine Aquarium. Researchers coded each tactile interaction indicating the initiator and recipient of the action, and the body part utilized. Results from this case study allow us to better understand the importance of tactile communication in this understudied species of dolphin, and can be applied to conservation, training, and other aspects of their management and welfare.

We did the hard work so you don't have to: A suboptimal choice data set.

Margaret McDevitt (McDaniel College), Jeffrey Pisklak (University of Alberta), Roger Dunn (San Diego State University), & Marcia Spetch (University of Alberta)

P73 Animals sometimes choose options that provide less food over options that provide more food. This behaviour has been variously referred to as suboptimal, maladaptive, or paradoxical because it lowers overall food intake. A great deal of research has been directed at understanding the conditions under which animals and people make suboptimal choices and the mechanisms that drive this behaviour. We have compiled a data set containing key parameters and results of 37 avian, 12 rodent, and 6 primate studies, yielding more than 300 separate data points. Each choice procedure used probabilistic outcomes or probabilistic delays. Data was sourced via the various text, tables, and figures within each manuscript. We use this data set to illuminate the important role of variables such as delay duration on the degree of suboptimal choice. We describe the critical features of the data set, discuss how it can be used to test models of suboptimal choice, and encourage other researchers to use it as a resource to test existing models or develop new approaches. These data are publicly available on the Open Science Framework at https://osf.io/39qtj

The Signal for Good News (SiGN) model of suboptimal choice

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P74 As reported almost half a century ago pigeons, (Columba livia) sometimes choose options that provide less food over options that provide more food. Research has focused on the circumstances under which pigeons make these suboptimal choices and the mechanisms that drive this seemingly paradoxical behaviour. One early account of suboptimal choice (Dunn & Spetch, 1990) based on Fantino's delay-reduction theory assumed that signals for a reduction in delay to food reinforce choice. This model was later termed the signal for good news (SiGN) model. In a recent publication we mathematically formalized the SiGN model and showed that, without free parameters, the SiGN model provides an excellent fit to the data from a large set of conditions across studies from numerous researchers. Here we describe key features of this formalization and present predictions about the effect of parameters that characterize suboptimal choice. This approach may have general applicability to understanding how rewards and signals for reward combine to reinforce behavior.

Can We Understand Nonhuman Minds Without Folk Psychology?

Elizabeth Waldberg (York University)

P75 My presentation will analyze the role of folk psychology within the science of comparative psychology. This is best accomplished by understanding the debate over folk psychology as one embedded in a larger debate over the anti-anthropomorphism principle. Anti-anthropomorphism requires us to disavow "the attribution of human qualities to other animals, usually with the implication it is done without sound justification." (Shettleworth 2010). Supporters of this principle, referred to here as "anti-anthropomorphists," believe that anthropomorphizing nonhuman minds is unjustified and stems from the human "folk-psychological imagination." (Penn and Povinelli 2002). Those who claim the principle should be done away with, referred to here as "anthropomorphists," believe that "folk psychology plays an essential role in comparative psychology as the starting point, but not the end point, of our research." (Andrews 2020). I argue that the two positions are not mutually exclusive, although they may appear so at first - it is entirely possible that folk psychology is both necessary to doing comparative psychology while also damaging the science. I demonstrate how we can offset these harms by adapting the framework of "agnostic biosignatures," (Murray and Cronin, 2017) used for biosignature detection in astrophysics, to this theoretical problem within comparative psychology.

Characterizing the SLC17 gene family expansion in Cephalopoda: Neurogenomic insights into octopus intelligence

Taryn M. Gustafson, & Robert R. Fitak (University of Central Florida)

P76 Cephalopods are ideal for understanding the evolution of complex cognition, yet the genomic basis of cephalopod cognition is poorly understood. While the capabilities of the octopus nervous system are similar to those of vertebrates, cephalopod brains evolved independently of the vertebrate brain. The evolution of nervous system complexity in the octopus likely included several gene family expansions, such as the SLC17 family. The SLC17 family is composed of four clades of organic anion transporter proteins. While SLC17 proteins are involved in neurotransmission and are expanded in the octopus genome, their role in cephalopod evolution is unknown. In this study we characterized the evolutionary history of the SLC17 family across cephalopods and other major bilaterian groups. We found a significant expansion of SLC17s within the octopus lineage despite a loss of SLC17s in other cephalopods. Interestingly, the octopus SLC17 gene sequences also showed the highest levels of phylogenetic instability compared to other species analyzed. The rapid SLC17 family expansion and their instability suggest that SLC17s are under adaptive selection in the octopuses, perhaps for their suspected role in neural functioning. Future work aims to explore the relationship between SLC17 protein function and cephalopod cognition.

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