

33rd Annual International Conference on Comparative Cognition



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Comparative Cognition Society
April 15th to 18th, 2026

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Montréal, Quebec, CANADA

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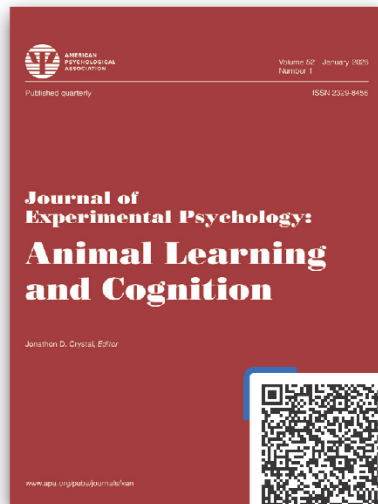
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PROGRAM NOTE Five minute talks are designated by a Talk Number with a grey background . They are five minutes in duration followed by two minutes for discussion. Ten minute talks are followed by four minutes for discussion.			

Optional Paid Event: Montréal Biodôme

This is an optional, recommended activity for those who arrive prior to Registration. CCS Members will be able to obtain a 35% discount off the regular entrance rates by presenting their conference badge at the ticket counter any time between April 14-18th (i.e., digital copy via CCS membership login in advance of the conference, OR the physical badge once the conference begins). Members can receive the preferential rate at the main ticket off of any of the five (5) of our museums (i.e., the Biodôme, the Planetarium, the Insectarium, the greenhouses of the Botanical Garden, and the Biosphere). Note: This is not a guided event and transportation is not included; public transportation can be found via the Metro (from "Place-des-Arts" station).

3:00- Registration & Poster Session I Setup (*in Foyer*)

6:00 Coffee and tea will be available. Please set up posters for the first session in appropriate room, as listed.

PM

Wednesday Afternoon

6:00 Opening Remarks: Noam Miller (*in Opus*)

PM

6:20 Associative Processes & Concept Learning (Chair: Lauren Guillette)

PM

How pigeons discriminate between paintings by different artists

Stephen Lea (University of Exeter), David Gordon (University of Exeter), & Lily Blower (New College Oxford)

Using multiple-stimulus presentation on touchscreens, pigeons were trained in a categorical discrimination between pictures painted by different artists. For 4 pigeons, the artists were Monet and Van Gogh; for 4 others, they were Monet and Manet. All pigeons learned the task to high accuracy, though the Monet/Manet discrimination was more difficult. The bases for the discrimination were explored by analysis of peck locations during acquisition, and by transfer tests after performance was asymptotic. During acquisition, the pigeons tended to peck pixel regions with higher than average intensity of the colours that distinguished the artists. In the case of some images and some pigeons, pecks were concentrated on distinctive details of the pictures. Transfer tests showed that new instances were discriminated well, though with some decrement in the Monet/Manet task. Monochrome transfer stimuli were not discriminated at all by the Monet/Van Gogh trained pigeons, but were weakly discriminated by the Monet/Manet group. Rotated images were discriminated without decrement by the Monet/Van Gogh group, but with some decrement by the Monet/Manet group. Spatial-frequency filtered images were well discriminated, though with some decrement especially for high-pass filtering.

1

Integration of appetitive features in the orbitofrontal cortex during economic choices

Rye Elizabeth (Concordia University), Gardner Matthew (Concordia University), Evan Hart (University of Maryland), Thomas Stalnaker (National Institute on Drug Abuse), & Geoffrey Schoenbaum (National Institute on Drug Abuse)

Understanding how the brain assigns value to potential rewards is central to neuropsychopharmacology, with implications for decision-making in both health and neuropsychiatric disorders. The orbitofrontal cortex (OFC) is thought to integrate sensory and contextual features of available food options to compute subjective values guiding choice. We investigated how OFC neuronal populations combine multiple appetitive features during economic decision-making. We recorded from 485 OFC neurons in rats performing a food-based choice task where offers varied in food type and quantity. Each session (~300 trials) enabled precise estimation of stable preferences. Neural coding of individual features, integrated value signals, and ensemble dimensionality were assessed during offer evaluation and decision execution. OFC neurons encoded both individual features (reward type and quantity) and emerging value signals during offer presentation. Dimensionality analyses revealed maximal integration of these attributes before choice commitment, followed by a shift toward value-dominated coding as decisions were finalized. Our findings highlight neural computations in the OFC that transform sensory and contextual information into subjective value estimates guiding behavior. These mechanisms provide insight into the neurobiological substrates of decision-making relevant to understanding altered valuation processes in neuropsychiatric conditions.

6:34
PM

2

6:41 A house from a heap of stones: Uniting forms of adaptive behavior under a single roof

PM *W. David Stahlman & Nicholas Smerlis (University of Mary Washington)*

3

A glance at most any undergraduate psychology textbook will tell the story: Pavlovian conditioning and operant behavior are stubbornly distinct categories of thing. The former produces relatively inflexible adaptive behavior as a function of the relationship between stimuli; the latter, flexible behavior as a function of its consequences. Scientists in the British associationist tradition have spent the bulk of their time working out theories of respondent conditioning, while behavior analysts have devoted even greater energy to the study of behavior as a function of reinforcers. Efforts to simplify the world—to describe one in terms of the other, thus halving the natural categories of interest—have largely failed. I suggest we can indeed talk about Pavlovian and operant behavior within the same dimensions by identification and quantification of the key contingencies between stimuli and responses. This is not done through interpretation of, say, respondent behavior in terms of operants or vice versa, but instead by drawing the lens back and considering each in the broader context in a natural, historical, selectionist science. I offer a plausible evolutionary history of specialized behavior from undifferentiated origins and provide useful examples.

6:55 Transfer of change detection across object property in pigeons

PM *Katie Cagney, Jordan Nerz, & Ken Leising (Texas Christian University)*

4

Detecting change in the environment is important for organisms. Objects can change in many dimensions: animals may detect that a predator has changed location, as well as perceived shape or size. Previous research has found unreliable transfer when pigeons were trained to peck a visual stimulus that changed in color or location, and then tested for transfer to novel changes in the other dimension (Elmore et al., 2011; Leising et al., 2013). If transfer of change detection to an untrained dimension was observed, then it could indicate learning to respond based on a more abstract relationship (i.e., change). Evidence for a general concept of change would align with evidence for concepts of “same” and “different” in many non-human animals. The current study investigated whether pigeons trained in a location change-detection task transferred to novel dimensions of change (color, shape, and size). After exhibiting poor transfer, pigeons were retrained with color-change and location-change trials, and tested for transfer to size and shape changes. Results revealed above-chance performance on novel location-, color-, and shape-change trials, but not for size-change trials. Lastly, pigeons demonstrated an additive effect when trained with trials where an object changed in all dimensions compared to each alone.

7:05 Numerosity (Chair: Stephen Lea)

PM

Numbers matter: Evidence for numerical bias in honeybees

Aurore Avargues-Weber (CNRS, Toulouse University), Elena Kerjean (CNRS, Toulouse University), & Scarlett Howard (Monash University)

5

Despite a growing body of evidence that a wide variety of animals can enumerate objects, the ecological relevance of possessing abstract concepts of number remains questioned in most species, in particular in invertebrates. Would individuals still rely on numbers if other cues, presumably less computationally demanding, were available to evaluate quantities? Could the use of number be dependent upon context? In primates, a numerical bias is present, i.e. individuals tend to preferentially use the number of items to categorize quantities rather than relying on correlating non-numerical cues. We evaluated whether free-flying honeybees would favor numerical over non-numerical cues when given the choice. We found that honeybees prefer to use numerosity to solve a quantity discrimination task rather than other cues such as density or cumulated surface of the items. Individual analyses revealed two main strategies: a "numerical bias" strategy, in which bees encoded numerical information while ignoring non-numerical cues, and a "generalist" strategy, where bees flexibly switched between cues. We further reported a left-to-right congruence effect, consistent with the number mental line, with improved discrimination when smaller quantities appeared on the left and larger ones on the right. Our results therefore support convergence across distantly related taxa for quantity evaluation.

7:19 Investigating social quantity discrimination in wild type zebrafish (*Danio rerio*) using biological motion stimuli

PM *Nawaf Abdul Majeed L, & Dr Bittu Kaveri Rajaraman (Ashoka University)*

6

Quantitative cognition, the ability to discriminate magnitude, is fundamental to survival behaviors such as shoaling, predation, and foraging. A major challenge in comparative cognition is decoupling numerical information from continuous physical variables (e.g., surface area, density) while maintaining ecological relevance. To address this, we

introduce a novel paradigm using biological motion stimuli. Biological motion isolates the kinematic patterns of conspecifics without providing form information, thereby offering a stimulus that is both controllable and ecologically relevant. Using zebrafish (*Danio rerio*), a model amenable to non-invasive whole brain imaging, we examined the ability to discriminate social quantities based solely on motion cues. We conducted social preference tests presenting zebrafish with biological motion stimuli of shoals of conspecifics differing in size (1 and 3). Our results demonstrate that zebrafish show a significant preference to spend time with dots that have conspecific biological motion characteristics, confirming the validity and ecological relevance of the method. However, wild type zebrafish did not show a significant preference for the larger of two shoals in a 1 vs 3 discrimination task. This study critically evaluates the utility of biological motion for quantitative cognition studies and provides insight into the sensory modalities required for social quantity discrimination in zebrafish.

7:26 Symbolic representation of numbers in bees: Evidence for associative symmetry

Laure Tosatto (Monash University, Université de Caen Normandie), Scarlett Howard (Monash University), & PM Aurore Avarguès-Weber (University of Toulouse III)

7

Complex cognitive skills play a crucial role in ecological adaptation, even in organisms with miniature brains. For example, European honeybees (*Apis mellifera*) demonstrate remarkable cognitive abilities, enabling them to forage efficiently despite their limited number of neurons. In particular, their capacity to recognize and manipulate numbers rivals that of primates, including the ability to associate numbers with arbitrary symbols. However, unlike humans, bees do not exhibit associative symmetry—that is, the spontaneous understanding of the reciprocal relationship between a symbol and its corresponding quantity. This divergence has often been interpreted as a fundamental cognitive divide between human and other animals, but recent evidence suggest that the observed divergence could be the result of methodological bias, e.g., verbal instructions in human studies. Our research explores the conditions under which bees might display associative symmetry in symbol-quantity matching task. Our findings indicate that bees can exhibit spontaneous associative symmetry and manipulate numbers at the same time, challenging existing perspectives on symbolic representation, number sense and more broadly intelligence in insect

7:42 Methods in Comparative Cognition (Chair: Stephen Lea)

PM

Progress and prospects for large-scale multi-species studies in Comparative Psychology

Gabriella Venable, & Brian Hare (Duke University)

8

Large-scale multi-species studies, particularly those using phylogenetic comparative methods, are among the most powerful tools for studying trait evolution in Evolutionary Biology. Although such studies remain rare in Comparative Psychology, they appear to be becoming more common. I will present data collected from articles published between 2018-2023 in five prominent animal cognition journals to examine to what degree three different barriers to such work persist: limited diversity of species studied, small number of comparative studies, and limited cross-institutional collaboration. Then I will present results from a broader literature survey of phylogenetic comparative cognition studies. With this broader survey, I summarize findings on the relationship between cognitive evolution, brain size, and socioecology across species. My results reveal a remarkable diversity of species studied (over 400 species!), but a low percentage of cross-species studies (<17%) likely due to limited collaboration. These findings suggest that the species diversity needed for more large-scale multi-species studies now exists, but more comparative studies and cross-institutional collaboration still are needed. Additionally, my broader literature survey results indicate that the role of absolute versus relative brain size differ across taxa and that the role of social vs ecological variables in natural selection may vary according to cognitive ability.

7:49 Porting open-source operant conditioning technologies to natural settings

Andrew McGregor (Oomvelt Research), Nicolas Hadacek (Oomvelt Research), Oliver Libaw (Oomvelt Research), & PM Aaron Blaisdell (UCLA)

9

Operant conditioning chambers are standard in most comparative cognition lab settings. We became curious about the possibilities of taking the functionality of an operant conditioning system into an animal's natural habitat. Our prototypes integrate machine learning and automation technologies yet with designs that are open-source and affordable. The goal is to be of service to existing researchers and citizen scientists. Citizen scientists have traditionally not been participants in operant conditioning chamber-based animal studies. We started by creating two different apparatuses for use with tree squirrels common to the Los Angeles area, including the Western Grey Squirrel (*Sciurus griseus*) and the Eastern Fox Squirrel (*Sciurus niger*). We chose tree squirrels because they are diurnal, commonly available, and they are a popular subject of internet videos. We showcase two apparatuses. One apparatus has an audio source, light cue, and food- dispenser that can all be manually controlled through a generic video game controller, mobile phone, tablet, or nearby computer. A second apparatus can operate completely

autonomously and uses computer vision to identify when a squirrel is near the apparatus and distribute a food reward based on researcher preferences.

8:05
PM *Break*

8:25 Symposium: Contemporary Methods and Mechanisms of
PM Conditional Discrimination Learning (Chair: Ken Leising)

What does a stimulus know? A comparison of the effects of various forms of stimulus control on behavior

Ken Leising, Cokie Nerz, Katie Cagney, John Solarzano-Restrepo, & Sara Bond (Texas Christian University)

10

A conditional stimulus, or occasion setter, modulates the probability of a learned response in the presence of another stimulus (conditioned or discriminative). We recently published a review in CCBR that identified several conditions and common tests for occasion setting, and extended the scope of response modulation. In this talk, I will present experiments using a spatial occasion-setting procedure as supporting evidence. In one experiment, pigeons were trained that a goal location was present only when a landmark (A) followed a particular screen color (X; X Δ A+/A-), and that the location of the goal relative to the landmark (left or right) varied based on the screen color (X or Y). Retraining of A alone (A+) did not erase spatial modulation by X and Y. In another experiment with pigeons, the timing and spatial stability of A and X influenced stimulus control by each stimulus. In an experiment with rats, the role of salience was evaluated in a task where one response (left lever) was reinforced in the presence of A and X, while another response (right lever) was reinforced in the presence of A alone. The significance of these findings will be discussed with respect to traditional notions of occasion setting.

8:40 **Context-gated predictions: Circuits and computations**

PM *Ron Keiflin (University of California Santa Barbara)*

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Flexible behavior depends on the ability to use contextual information to interpret ambiguous cues and respond appropriately. In associative learning frameworks, this takes the form of hierarchical associations in which context “gates” the retrieval of appropriate cue–outcome memories – effectively setting the occasion for context-appropriate behavior. In this talk, I will describe recent work examining the neural circuit basis of the contextual gating of reward predictions, with a focus on the orbitofrontal cortex. Using a context-dependent (biconditional) discrimination task in rats, combined with selective inactivations of the orbitofrontal cortex and its subcortical output pathways, we test how orbitofrontal circuits contribute to context-gated reward prediction. The behavioral effects of these circuit manipulations are interpreted using a connectionist model that contrasts elemental and configural learning. Together, this work links classic psychological/connectionist theories of occasion setting to identifiable neural circuits.

8:55 **Demystifying occasion setting: An overview**

PM *Charlotte Bonardi (University of Nottingham)*

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In learning circles the discovery that stimuli could control access to associative information introduced an exciting possibility – that there might be more to life than associative learning, and that stimuli might be able to function in ways independent of their associative strength. There followed a flurry of activity trying to determine how such stimuli might acquire these mysterious occasion-setting properties, and how these powers were exercised. But although occasion setting subsequently fell out of fashion, in recent years it has been revived, especially in relation to psychopathological disorders – which is lovely to see. Yet despite the many excellent reviews on the topic, something of their mystery remains, the principles underlying what defines an occasion setter and how it operates often being presented as dogma with little underlying logic. My aim in this talk is to try and demystify occasion setting, which I believe can not only be understood in terms of a few simple principles, but is also deeply integrated with existing literatures on discriminative and contextual control. Making this phenomenon more accessible will help to exploit its huge potential for understanding the many situations in which a cue's associative strength cannot provide an explanation.

13 9:10 **Some thoughts on connectionist network approaches to conditional discrimination learning and the special challenge posed by numerical processing**

PM *Andrew R Delamater (Brooklyn College and Graduate Center, CUNY), & Daniel Siegel (Graduate Center, CUNY)*

Conditional discrimination learning phenomena have generated much interest because the underlying learning mechanisms thought critical for their occurrence require associative structures that go beyond the formation of simple binary linkages between events. Instead, “hierarchical” associative structures seem required. For example, in a biconditional discrimination task one target cue (X) is reinforced but a second (Y) is not in the presence of one “feature” stimulus (A), whereas the reverse applies in the presence of a second feature stimulus (B) (A: X+, Y-, B: X-, Y+). In this case, each feature stimulus is said to act as a positive “occasion setter” for one target but as a negative occasion setter for the other target cue. We have shown that rats learn this discrimination problem most rapidly when two qualitatively distinct reward types are used than when they are not, a finding we derived from a multi-layered connectionist network model that can also be applied to several other so-called “non-linear discrimination problems.” Here I will present some new empirical data and discuss the theoretical challenge posed by a biconditional discrimination task when the feature stimuli, themselves, are abstract and based on a representation of numerosity (e.g., 1 vs 6 light flashes).

9:25 Contextual control, extinction, and occasion setting

PM *Mark E. Bouton & Travis P. Todd (University of Vermont)*

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Extinguished responding readily recovers (or “relapses”) when an extinguished CS is tested outside the context in which extinction has been learned (as suggested by renewal, spontaneous recovery, and other phenomena). But how does the context actually control extinction performance? Apparently not through conditioned inhibition, because the extinction context typically fails classic summation, retardation, and supernormal conditioning tests. Instead, it may operate as a negative occasion setter. However, whether the context’s control over responding to the extinguished CS can “transfer” and modulate performance to other similarly-trained CSs has not been well established. We report new data with rats on the subject.

Thursday

Mixed Models for Animal Models: A Quick, Practical

9:30- Introduction in R – with Olga Lazareva

10:30 *Mixed-effects models have become standard in psychology, but they remain underused in animal cognition despite being ideally suited to our data. This session offers a concise, practical overview of LMMs and GLMMs for analyzing learning trajectories, binary choice data, and latency patterns. Using R, we’ll explore how mixed models handle repeated measures, individual differences, and non-normal data far better than traditional methods. Participants will leave with ready-to-use R code and a clearer sense of how mixed models can maximize information from small samples and trial-level data. Note: Coffee and tea will be available for attendees.*

AM

11:00 FEATURE SESSION: Outstanding Student Presentation

AM Competition (Chair: Jennifer Vonk)

Influence of bias in nest-building decisions

Sofia C. Garrido-Villegas, Samuel Weetman-Gares, Brandon Neil, Walter Ibalio, Mylie Holmes, Tanishka Vadia, Simran K. Gill, Caitlyn Nguyen, Francesca Uy, Hassan Gulab, Aryan Kalra, Gimran Kaur, Mariam Moustafa, Steven Baker, Julia L. Self, Benjamin A. Whittaker, & Lauren M. Guillette (University of Alberta)

Cognitive biases —pre-existing inclinations for or against certain stimuli— may serve as shortcuts that improve the efficiency of information processing by streamlining decision-making and reducing energetic costs. However, empirical evidence for such benefits remains limited. We investigated whether biases influence the efficiency of decision-making in zebra finches (*Taeniopygia guttata*) by testing how colour preferences affect nest-building behaviour. Each bird’s preferred material colour (orange or pink) was identified as the colour of string with which it interacted most, and bias strength was calculated as the proportion of time spent with the preferred colour. Males and females with matching preferences and similar bias strengths were paired and given access to material to build a nest that either matched or conflicted with their preference. We found that pairs

15

building with their preferred colour initiated nest building sooner than those building with their non-preferred colour. Contrastingly, treatment and bias strength did not influence how long pairs took to complete the nest or the amount of time spent actively building. These preliminary findings suggest that biases might influence early decision-making but have limited effects on later nest-building behaviour. Faster nest initiation may offer ecological advantages in the arid, unpredictable environments zebra finches inhabit.

11:07
AM

Uncovering translational reward strategies in probabilistic reversal learning

Zahra Rostami (McGill University), Eshaan S Iyer (McGill University), Peter Vitaro (McGill University), Rebecca Boehme (Linköping University), Markus Heilig (Linköping University), R Becket Ebitz (Université de Montréal), Leah M Mayo (University of Calgary, Linköping University), & Rosemary C Bagot (McGill University)

Probabilistic reversal learning (PRL) tasks are commonly used to study reward sensitivity and cognitive flexibility in humans and rodents, yet it remains unclear whether the underlying strategies that guide choice in these tasks are conserved between species. We used a state-based model to characterize internal reward strategies in humans and mice. Human participants completed a computer-based two-choice PRL task with probabilistic monetary outcomes, and mice performed an equivalent operant version with probabilistic chocolate milk rewards. Choice sequences were analyzed using a generalized linear model–hidden Markov model (GLM-HMM) to infer latent behavioral states from recent outcomes. Across both species, a three-state model provided the best fit and revealed two reward-sensitive states: reward-achievement driven by recent reinforcement, and reward-learning reflecting rule acquisition. GLM weights were significantly correlated across species (reward-learning: $r = 0.99$, $p < 0.0001$; reward-achievement: $r = 0.92$, $p = 0.003$), indicating conserved behavioral strategies. In both species, engaging this strategy increased reward efficiency, and a contingency sensitivity index confirmed this most closely approximated optimal performance. These results demonstrate conserved strategies for reward-learning in mice and humans, supporting the use of PRL as a translational tool for studying reward-related behavior and its disruption in neuropsychiatric disorders.

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11:14
AM

Wagering decisions reveal metacognitive awareness in artificial grammar learning tasks in monkeys and humans

Rohini Murugan (Emory University), Angelle Antoun (Emory University, Villanova University), Tristan S. Correa (Emory University), & Benjamin Wilson (Emory University)

Humans not only know the grammatical rules of language, but in at least some cases, we also know that we know these rules, revealing metacognitive awareness of our own linguistic knowledge. Prior studies have demonstrated that rhesus monkeys also exhibit metacognition, for example in perceptual and working memory tasks. Separately, studies have also shown that monkeys can learn simple ‘artificial grammar’ rules, although this learning is often believed to occur implicitly. Here, we combine these two approaches, artificial grammar learning and a measure of metacognition (a wagering task), to assess explicit metacognitive awareness of artificial grammars. We first trained rhesus macaques to participate in a virtual token economy where they learned to associate virtual tokens with food rewards. We then introduced gambling options in conjunction with an artificial grammar task, in which monkeys could either choose a high-risk option leading to a large token gain or loss, or a low-risk option which always led to a small token gain. Monkeys, and in a parallel experiment, humans, were more likely to choose the high-risk option on easy trials and on trials in which they responded correctly in the artificial grammar learning task, demonstrating explicit, metacognitive awareness.

17

11:21
AM

Keeping it chill: incubation temperature impacts sociality in corn snakes

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

Ectotherms provide excellent models to examine the effects of developmental stressors on behavior. In snakes, incubation conditions have been shown to mediate traits such as aggression and environmental preference. Additionally, the sociality of snakes has long been suggested to hinge on thermoregulatory requirements: grouping slows heat loss and some snakes will forgo their preferred temperature in favor of aggregating. We thus have good reason to think that incubation temperature could bias thermally mediated aggregation. To examine this, 48 corn snakes (*Pantherophis guttatus*) were incubated in four different temperature conditions: 27, 29 or 31 degrees C, or alternating between extremes. The juveniles were divided into 6-snake aggregation groups, each comprising a mix of two incubation conditions (e.g., 3 hot + 3 cold) of all possible pairings. Snakes were then tested in a standard social assay for 6 days. We observed significant differences in when snakes were active; hot-condition snakes were most active in the evening, unlike the more nocturnal cold & lukewarm snakes, suggesting potential temporal partitioning to match preferred temperatures. However, cold and variable-condition individuals were more social, visiting crowded shelters for longer. These results suggest that snakes’ aggregation behavior is a careful balance between thermoregulatory and social needs.

18

11:28
AM

Causal understanding in chimpanzees (*Pan troglodytes*)

Sabana Gonzalez (University of California, Berkeley), Emily Sanford (University of California, Berkeley), Mariel Goddu (Stanford University), Josep Call (University of St Andrews), Hanna Schleihauf (Utrecht University), Thomas Icard (Stanford University), Bill Thompson (University of California, Berkeley), Snow Zhang (University of California, Berkeley), Alison Gopnik (University of California, Berkeley), Esther Herrmann (University of Portsmouth), & Jan Engelmann (University of California, Berkeley)

Many animal species show rudimentary causal understanding, while human causal understanding seems uniquely sophisticated. How did this capacity evolve? Human causal understanding emerges gradually over development: infants initially understand causal relations through only their own actions (first-personal), then by observing others' actions (third-personal), and finally from non-agentive causes (impersonal). We theorize that causal understanding developed gradually over phylogeny, mirroring its developmental trajectory. To test this hypothesis, we tested chimpanzees in a blinket detector paradigm. Eighteen chimpanzees at Ngamba Island Chimpanzee Sanctuary received first-personal, third-personal, or impersonal evidence as to which of two objects (target or distractor) activated the blinket detector. Chimpanzees chose the target object significantly above chance in all three conditions (first-personal: $p = 0.0413$; third-personal: $p = 0.0021$; impersonal: $p = 0.0002$). However, an experimenter was present in the impersonal condition; the mere presence of a social agent may have facilitated performance. In Study 2, we tested an ultra-impersonal condition where the experimenter was completely absent. Chimpanzees did not perform above chance ($p = 0.1250$), suggesting they may not be able to learn from truly impersonal causal events. Our results provide the first glimpse into the phylogenetic trajectory of causal understanding.

19

11:35
AM

Reversal learning as a paradigm for exploring recency-to-primacy shift effects in Asian elephants and Long-Evans rats

Scott J. Gulizio (Hunter College; Brooklyn College; CUNY), Taweepoke Angkawanish (National Elephant Institute), Chudapa Chadarat (Golden Triangle Asian Elephant Foundation), Yingboon Chongsomchai (Golden Triangle Asian Elephant Foundation), Sangpa Dittakul (Golden Triangle Asian Elephant Foundation), Marnoch Yindee (Akkhraratchakumari Veterinary College), Sydney F. Hope (Hunter College), Andrew R. Delamater (Brooklyn College; CUNY), & Joshua M. Plotnik (Hunter College)

Cognitive flexibility in animals is often studied using a variety of different measures, including reversal learning. We hypothesized that Asian elephants would demonstrate, for the first time, a capacity for reversal learning due to their proficiency for problem solving in human-dominated landscapes. Thus far, we have trained four captive elephants to discriminate between two "buttons" in an instrumental paradigm. After first learning to "tap" one button over the other to receive food, the elephants were presented with a reversed contingency so that the previously unrewarded button was now rewarded. Once proficient at this, we tested elephants' button preference under extinction conditions. 2 elephants were tested 24 hours after the last training session ("Immediate group") and 2 others were tested one week later ("Delayed group"). The "Immediate" elephants preferred the most recently reinforced button, while the "Delayed" elephants showed no preference. To explore if the Recency-to-Primacy shift effect may be conserved across distantly related taxa using this experimental design, we plan to run an analogous experiment with Long-Evans rats. We will also present preliminary data from a test of sequence reversal learning in one elephant and discuss our plans to expand our study of reversal learning in elephants and rats.

20

11:42
AM

The effect of chronic feed restriction on cognitive functioning in dairy calves

Jillian Hendricks, Thomas Leroy, Michael T. Mendl, & Benjamin Lecorps (University of Bristol)

Dairy calves are typically feed-restricted, which may affect cognition; depending on the severity, hunger can either improve or impair animals' cognitive performance in food reward-based tasks. Acute feed restriction disrupts calves' cognitive performance, but the effect of chronic feed restriction remains underexplored. We assessed whether chronically feed-restricted dairy calves (fed 6L milk/day) demonstrate impaired cognitive performance in a hole-board test compared to enhanced-fed calves (fed up to 12L/day). Calves were presented with 4 milk reward locations among 15 possibilities for 14 initial learning trials, followed by 6 re-learning trials after changing reward locations. We assessed calves' memory of locations visited within trials (working and general working memory) and of reward locations between trials (reference memory). Play was measured to explore trade-offs between foraging and playing in a space larger than calves' home-pen. Contrary to expectations, feed-restricted calves had better reference and working memory. Shorter latencies to the first bucket and trial durations indicated that they were highly food-motivated. However, enhanced-fed calves played more than feed-restricted ones, highlighting the importance of play in well-fed calves. While hunger alters anxiety-like and social behaviour (among others) in rodents, this study is among the first showing that hungry animals trade-off play to forage.

21

22
11:49 **Rats replay episodic memories in context**

AM

Siyun Xiong, Cassandra L. Sheridan, Tess Harrison, Evanelly Rosas-Victoriano, Jakob Meisner, Taylor Butts, Ryleigh Loper, Kobe Ross, & Jonathon D. Crystal (Indiana University)

Vivid episodic memories in people have been characterized as the replay of multiple unique events in sequential order. Prior research shows that rats remember multiple items and the contexts in which they occurred using episodic memory (Panoz-Brown et al., 2016, *Current Biology*) and replay the sequence of episodic memories (Panoz-Brown et al., 2018, *Current Biology*). However, whether rats remember the specific contexts in which event sequences occurred is not known. Here, we show that rats remember the flow of events and the contexts in which those events occurred. We trained rats to identify the third-to-last odor from lists presented in two distinct arenas using trial-unique odors of unpredictable lengths. We first established that rats remember (1) ordinal information about two lists and (2) the encoding context of the lists. Next, we showed that rats simultaneously remember the order of events and the contexts in which they occurred. Finally, by interleaving contexts at unpredictable points in the lists, we demonstrated that rats replay episodic memories in a context-specific manner, with memory performance remaining robust even when the interleaving of lists was interrupted by a 30-minute delay. We conclude that rats replay streams of episodic memories within specific contexts.

12:00

AM

5-minute Break

23
12:05 **FEATURE SESSION: Outstanding Student Presentation**

PM **Competition (Continued) (Chair: Jennifer Vonk)**

The importance of familiarity and genetics in kin recognition by giant pandas (*Ailuropoda melanoleuca*)
Miranda Trapani (Hunter College; CUNY), James Ayala (Chengdu Research Base of Giant Panda Breeding), Zhang Hao (Chengdu Research Base of Giant Panda Breeding), Sydney Hope (Hunter College), & Joshua M. Plotnik (Hunter College)

Kin recognition mechanisms used by a species should reflect their unique ecology. Giant pandas can discriminate kin from non-kin, but it is unknown whether they use phenotype matching or prior association to make discriminations. During a non-breeding season, we conducted repeated trials of a dichotomous choice task where giant pandas investigated two urine samples; one from an unrelated and one from a related donor. Familiarity to the subject varied across four conditions; either both were unfamiliar, both were familiar, only the related sample was familiar, or only the related sample was unfamiliar. Across all trials, giant pandas spent significantly more time sniffing unfamiliar compared to familiar urine, but sniffing time did not vary in relation to genetic relatedness. As expected, during the baseline condition where pandas were presented with an unrelated, unfamiliar sample and a related familiar sample, they spent more time sniffing the former. Interestingly, when presented with an unrelated familiar sample and related unfamiliar sample, pandas' preference for the related sample significantly increased compared to the baseline condition. These results suggest that pandas use prior association to make investigative decisions and that socially reared captive individuals might mistake familiar non-kin for kin due to experience.

24
12:12

PM

Vocal plasticity in a harbor seal (*Phoca vitulina*): Deep learning reveals formant dynamics

Melina Witt (University of Rome), Francesca D'Orazio (University of Rome), Yannick Jadoul (Vrije Universiteit Brussel), Denise Di Martino (University of Rome; University of Turin), Flavia Grenga (University of Rome; University of Palermo), Cristina Pilenga (Zoomarine Italia), Oliver Tab Bellmann (Austrian Academic of Sciences), Andrea Ravignani (University of Rome; Aarhus University; Sapienza University of Rome), & Teresa Raimondi (University of Rome)

Formants – resonance frequencies of the vocal tract – are crucial for both human and non-human vertebrate communication. Ultimately, cross-species comparisons between animals sharing traits important for language can provide insight into the evolution of human communication. One such trait is vocal learning, meaning that an animal can learn new, non-innate vocalizations. Previous research trained a vocal learning harbor seal (*Phoca vitulina*) to produce syllable-structured vocalizations through upper vocal tract movement. This revealed articulatory similarities with humans, such as an increasing effect of mouth opening on the first formant. We extended this approach by training another harbor seal and tracking the first three formants. Importantly, human articulation also influences these formants. Using a deep-learning video tracking technique to label points in the seal's upper vocal tract, we investigated whether mouth opening and body positioning influence formant frequencies. We found that formant parameters changed with wider mouth opening and body positioning, paralleling human articulation. This complements and extends previous evidence showing volitional formant modulation in harbor seals. Deep-learning video tracking provides an effective way to monitor upper vocal tract

movements during vocalization. We encourage building on this approach by tracking more animals' articulatory movements to ultimately study cognitive processes in sound production.

25 12:19 **Female, but not male, capuchins demonstrate transitive inference and the symbolic distance effect in a sequencing task**

PM *Matthew H. Babb (Georgia State University), Olga Lazareva (Drake University), & Sarah F. Brosnan (Georgia State University)*

Transitive inference (TI) allows individuals to draw novel conclusions about relationships that have not been directly observed. This ability is thought to be beneficial for animals navigating social hierarchies, and it has been demonstrated in several species. However, many existing tests cannot rule out simpler associative explanations. Here we tested whether capuchin monkeys (*Sapajus spp.*) use TI by using a recently developed method designed to control for associative explanations while providing a stringent test of the symbolic distance effect. Monkeys were trained on three overlapping 3-item lists (ABC, CDE, EFG) that together could be integrated into a 7-item sequence. During testing, subjects sequenced all possible item pairs from the learned lists, including both within-list and between-list pairs. Critical test pairs involved middle-position items (BD, DF, CE), which could only be solved by integrating the separate lists into a single ordered representation. Females, but not males, correctly sequenced these critical pairs, indicating successful integration. Females also showed a symbolic distance effect, performing better on BF than on BD or DF, whereas males did not. These findings suggest that some capuchins can make transitive inferences, but the degree to which they employ this ability may differ based on sex.

26 12:26 **Button-mediated choices as a measure of canine food preferences**

PM *Madeline G Meade (University of California, San Diego), Anna Valuska (Nestlé Purina PetCare) & Federico Rossano (University of California, San Diego)*

Augmentative interspecies communication (AIC) devices, or “talking” button systems, are increasingly popular among pet owners. However, few controlled experiments have tested how and when pets use such buttons to communicate. This study introduces the first known attempt to standardize AIC button learning within an experimental protocol, and evaluates whether button presses can serve as a reliable measure of food preference in dogs. Sixty-four dogs were enrolled in a home-based training program to associate two buttons with two corresponding baskets; nineteen advanced to testing. In the first test phase, dogs reliably used the trained buttons to request their preferred treat over a less-preferred option; performance improved across the three test sessions and reached ~70%. In the second phase, dogs used buttons to choose between two novel treats; they showed no consistent group-level preference, though individual preferences were strong for some subjects. The third phase used a direct two-bowl test and found a significant group-level preference for one novel treat. Cross-task comparisons found moderate rank-order consistency between button-based and bowl-based preferences. Thus, we present preliminary evidence that button presses can capture underlying food preferences, particularly at the individual level, supporting button-mediated choices as a future cognitive measure in home-based canine research.

27 12:33 **Individual differences in cognitive tactics for auditory learning in chickadees**

PM *Prateek K. Sahu, Alexandra D. Garcia, Moriah J. Deimeke, Sarah M.L. Smeltz, Katharine H. Stenstrom, Patrick Curiston, Onyinyechukwu Okocha, Oliver Akins, & Christopher B. Sturdy (University of Alberta)*

Variation in cognitive abilities can influence an animal's fitness. Quantifying these individual differences is essential for understanding the sources and extent of such variation. For vocal learners like songbirds, auditory perceptual abilities impact survival through mate recognition, territorial defence, and social interactions. Operant go/no-go discrimination tasks provide a controlled assessment of these auditory cognitive abilities, along with the mechanistic processes underlying learning and decision-making. Here, we tested black-capped chickadees (*Poecile atricapillus*), a territorial songbird, in a go/no-go auditory discrimination task to systematically characterize the variation in cognitive tactics during individual identity learning. Although there was individual variation in learning strategies, broadly, birds employed three distinct cognitive tactics revealed through clustering analyses of learning and transfer accuracy (1) Complete learners: who performed with high learning accuracy, (2) Incomplete learners: selective high learning accuracy, and (3) Inhibition-focused learners: high inhibitory accuracy. This cognitive diversity may reflect adaptive significance in various contexts with alternate solutions in response to the same task demands. The findings complement the traditional interpretations of operant conditioning task performance and consider mechanistic and biological contexts. Understanding how such variation is maintained would provide insights into the selection of cognitive abilities.

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12:40 **Common marmosets exhibit coordination in a rope-pulling task**
PM

Oviya Mohan, Janejira Chapoomee, Jude Mitchell, & Dora Biro (University of Rochester)

Coordination, in which two or more individuals align their actions to achieve a common goal, has been documented in several species using the cooperative rope-pulling paradigm. Nonetheless, the extent to which subjects understand their and their partner's role in facilitating successful coordination remains unclear. We tested five pairs of common marmosets (*Callithrix jacchus*) to address this question using successive phases that demanded increasingly more precisely timed coordination (decreasing rope length and introducing delays in one monkey's access to the apparatus). Three pairs failed to pass the first phase and did not progress further, while the other two succeeded on all rope lengths as well as a 5s delay phase but not a 10s delay. Behavioral analyses of successful trials showed that as the task difficulty increased, monkeys became increasingly better synchronized; however, in both successful pairs this was achieved largely through one monkey modifying its behavior to match its partner's consistent patterns of responding. These results suggest that individually learned behavior is sufficient to support coordination in the absence of joint intentionality, at least in the context of a physically intuitive task. Our study yields novel insights into the cognitive underpinnings of coordination in a cooperatively breeding species.

29

12:47 **Machine learning to study individual budgerigar vocalizations in a social setting**
PM

Zsofia Katona, Jinook Oh, Nicki Holighaus, Günther Koliander, & Marisa Hoeschele (Acoustics Research Institute, Austrian Academy of Sciences)

Artificial intelligence offers powerful opportunities for studying vocal communication within animal groups in naturalistic environments, where manual annotation of audiovisual data is often prohibitive. We are developing a pipeline to separate individual calls within a group of budgerigars (*Melopsittacus undulatus*) to investigate potential language-like structure in their vocalizations. Our approach includes a computer vision system built with minimal annotation effort, which reliably localizes individuals in group videos. In parallel, a microphone array provides acoustic data, which is combined with the video-derived positions of individual birds to isolate sound sources and attribute vocalizations to individuals via signal processing techniques, including beamforming, and deep-learning-based source separation. We are developing and testing these techniques using a synthetic corpus of group budgerigar recordings, which is generated by combining individually recorded songs with the room's measured acoustic parameters, so that a group of birds can be simulated to be singing from random positions within the aviary. This enables the creation of an arbitrarily large, fully labelled acoustic dataset. Overall, our pipeline supports analysis of non-human vocal coordination, low-level structure, and candidate perceptual units. Such an automated system is adaptable across species and offers a scalable tool for comparative research on animal communication and language-like systems.

1:00 **Snack Break**
PM

1:40 **Symposium: Unearthing the Mechanisms behind Plant Behaviour with Comparative Psychology**
PM
(Chair: Tanya Shoot)

What underlies the complexity of plant behaviour?

James Cahill (University of Alberta)

Although the expression of behavior in the plant kingdom represents evolutionary adaptations across millions of years, the formal discipline of plant behavior remains in its infancy. Recently, plant biologists have successfully employed behavioral ecology frameworks to understand how plants integrate diverse cues to navigate biological challenges. However, while we possess a clear understanding of behavioral complexity, there is substantial skepticism regarding "plant cognition," often stemming from the conflation of empirical evidence with anthropomorphic worldviews and an enthusiastic media landscape. In this presentation, I offer a historical perspective on this discipline and beseech help in developing robust approaches for understanding plant information processing. As sessile, modular organisms with indeterminate growth, plants function fundamentally differently from evolutionarily younger unitary organisms driven by a solitary brain. Instead, a single plant genet—the unit of selection—must integrate diverse types of information across thousands of potentially semi-autonomous modules. We currently lack a clear algorithmic framework for this distributed processing and empirical evidence is lacking. I propose that plants offer a powerful system that can

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fundamentally expand the boundaries of comparative cognition research beyond vertebrate-centric paradigms, without the involvement of animal care committees.

- 1:55 **Collective information processing in plants**
PM *Takao Sasaki (University of Rochester)*
- 31 Collective cognition—the ability of a group to process information and make decisions more effectively than any single member—has been investigated across a wide range of taxa. However, because cognition is commonly defined as “the process by which animals acquire, retain, and act on sensory information,” plants have traditionally been excluded from this field, even though they appear to possess analogous abilities. Collective cognition in plants has been especially understudied, despite the fact that many species grow in close proximity and can modify their root behaviors in response to social context. In this talk, I will first review studies of collective cognition in ants and pigeons and then discuss the possibility of conducting similar experiments using strawberry plants, which produce clonal daughter plants through stolon formation and may share information through these connections.
- 2:10 **Heard it through the strawberry vine: Information transfer across a genet**
PM *Tanya T. Shoot (Concordia University of Edmonton), Kaikai Fan (University of Alberta), Kenneth J. Oppon (University of Alberta), Thomas J. Beckingham (University of Alberta), & James F. Cahill (University of Alberta)*
- 32 When dispersing, both social and environmental information influence where the organism travels next. In animals, this process of extracting pertinent information from the environment involves cognition through spatial memory and recognition of social ties. Plants must make analogous decisions on where to find resources, but the mechanisms remain unclear. Plants, like animals, recognize neighbours and non-randomly grow in patchy environments. To unearth the mechanisms responsible for these behaviours, we start with investigating what information is used when making these growth decisions. Both soil nutrients and neighbour density were varied in the wild strawberry (*Fragaria virginiana*) to investigate how information is used. We then severed connections from daughter plants to their mothers, contingent on where the daughter was rooted, along with fully severed and unsevered conditions. Preliminary results show non-random growth not only in patchy soil, but also depending on whether the daughters were left connected to the mother plants. These results show there is information being transferred across the genet that impacts later dispersal. Extricating what environmental information plants use to make decisions is the first step to understanding how plants can perform the feats that the field of plant behaviour have shown them capable of.
- 2:26 **Problem Solving (Chair: Jenna Congdon)**
PM
- 33 **Flexible use of a multi-function tool by a cow (*Bos taurus*)**
Alice Auersperg & Antonio Osuna-Mascaro (University of Veterinary Medicine Vienna)
- Flexible tooling, defined as creating a body–object system that applies mechanical force adjusted to current task demands, is regarded as a demanding form of tool use. Here, we experimentally demonstrate flexible egocentric tooling in an Austrian pet cow (*Bos taurus*), Veronika. Across randomized trials, she preferred the bristled end of a deck brush to groom her back and flanks, yet she selectively switched to the stick end of the same tool when targeting the softer, more pliable areas of her lower body. She also employed distinct brushing techniques for different body regions. This adaptive use of tool features indicates a level of contextual selectivity not previously documented in non-primate mammals. Our findings extend the taxonomic range of flexible tool use and prompt a reconsideration of the technical capacities of livestock species, which are often viewed through a utilitarian lens.
- 2:40 **Cooperation and problem solving of red-necked wallabies (*Notamacropus rufogriseus*) on a rope-pulling task**
PM *Taylor Onufrichuk (Concordia University of Edmonton), Stephanie Nguyen (Edmonton Valley Zoo), & Jenna V. Congdon (Concordia University of Edmonton)*
- 34 The rope-pulling task is a well-established method for investigating social cooperation and problem solving. While this procedure has been conducted with a variety of species (e.g., wolves, domestic dogs, dingoes, Asian elephants, bottlenose dolphins), social cooperation has not yet been studied in marsupials. Red-necked wallabies (*Notamacropus rufogriseus*) are a species of macropod marsupials that, when living in zoo settings, exhibit a hierarchical social organization that is of interest to be further investigated using the rope-pulling task. A custom

apparatus was piloted with a social group of five red-necked wallabies at the Edmonton Valley Zoo. During the Training Phase, using successive approximations and positive reinforcement (i.e., food), the subjects learned to individually interact with the apparatus. Once each individual was consistently manipulating the apparatus to successfully access food rewards, the Testing Phase was initiated with a modified apparatus for pairs of wallabies. Each pairing of individuals was tested, with the prediction that success rates depend on their social bonds and rank. Methodology and success rates will be presented, demonstrating that wallabies problem solve and cooperate to successfully complete the task. This study provides the first insights into the cognition of wallabies, with implications for further understanding of marsupial species.

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2:54 **Are bold wolves better problem solvers? An investigation of how response to novelty shapes engagement in a multi-access puzzle box task**

PM

Yasmeen Ghavamian & Kristina Horback (University of California Davis)

Differences in the ability to adjust behavior when presented with a challenge can be highly variable among individuals. As compared to reactive individuals, proactive (i.e., bold-exploratory) individuals tend to be more successful in problem-solving paradigms. The link between personality and cognitive performance is an area of research that remains understudied in gray wolves (*Canis lupus*). To identify consistent individual differences in boldness and exploration, we evaluated the behavior of seven captive wolves towards two novel objects (NO) in a summer and winter season. To assess variation in problem-solving performance, we presented a multi-access puzzle box. Behavioral responses were recorded using all-occurrence focal sampling. In summer and winter, wolves demonstrated individual consistency in their frequency of visits as well as duration of proximity and investigation between each NO; suggesting that these metrics in NO tests could represent boldness and exploratory traits in wolves. However, behavioral responses to novelty did not predict engagement (i.e., visits, proximity, contact, investigate) with the baited puzzle boxes. Evaluating the problem-solving performance of a highly neophobic species, such as wolves, presents limitations, but understanding individual variation in human-managed settings holds significance for animal welfare and conservation research.

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3:01 **Persistence, not reactivity, determines problem solving in sows**

PM

Claire T. Jones & Kristina M. Horback (University of California, Davis)

Although individual variation on cognitive tasks is often assumed to reflect differences in cognitive abilities, personality can also influence performance. For instance, variation in reactivity to sudden environmental changes can decrease engagement with tasks due to heightened vigilance and arousal. We examined individual differences in reactivity and problem-solving in 20 adult female pigs (sows) across two time points. Success, latency to solve, and time spent engaging with puzzle box were measured. Individuals' reactivity in a startle test was measured via magnitude (meters fled) and vigilance frequency. It was found that reactivity in the startle test did not predict performance on the puzzle box, including latency to solve or puzzle box engagement. Instead, the best predictor of solving the task was time spent manipulating the puzzle box ($p = 0.038$). Those that did not solve the task contacted the box more frequently but spent significantly less time ($M = 4.5$ seconds, $p = 0.031$) manipulating the box during each interaction. Our results indicate that individual reactivity does not predict engagement with or success on puzzle box tasks in sows. We suggest that variation in persistence among sows, rather than vigilance toward environmental change, is more predictive of success in cognitive tasks.

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3:08 **Learning pathway sculpts tool-use motor strategies in hornbills**

PM

Elias Garcia-Pelegrin (National University of Singapore, Mandai Wildlife Group)

Although hornbills (*Bucerotidae*) are not known to use tools in the wild, they exhibit remarkable precision grasping and object manipulation with their large bills. This fine motor control, combined with flexible problem-solving abilities, makes them ideal subjects for investigating how different learning pathways influence both the acquisition and execution of a novel tool-mediated task. This study examined how exposure type affects learning and tool operation in a simple feeding task. Subjects experienced one of three learning pathways: observing a demonstrator, engaging in repeated interactions that highlighted behaviour-consequence contingencies, or receiving no prior guidance. Hornbills in both the social learning and associative conditions acquired the task, whereas birds without guidance failed to solve it within the testing window. Notably, learning speed differed significantly between the two guided conditions, with socially exposed birds taking longer to acquire the task. Moreover, analyses of action strategy revealed distinct operation styles associated with each learning pathway. These findings indicate that although multiple routes can support task acquisition, the mode of learning shapes how the tool is manipulated and how the behaviour unfolds. Together, they show that learning pathway influences not only whether a task is acquired, but also the movement strategy used to solve it, underscoring its role in avian motor flexibility.

3:25
PM **Memory (Chair: Bob Cook)**

Serial response time learning with midsession reversal by pigeons

Walter T. Herbranson (Whitman College)

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Pigeons readily learn to respond quickly to cued locations that appear according to predictable rules. Learning in such a Serial Response Time (SRT) task is procedural, indicated by 1) globally faster RTs and 2) local facilitation, in which more frequent inter-key transitions produce faster RTs. SRT learning is also flexible, and occurs even when variability is introduced. Another paradigm for studying flexibility is midsession reversal, in which one rule is correct during the first half of a session, and the opposite rule is correct thereafter. To combine these approaches, seven pigeons were trained on an SRT task, in which cues appeared across response keys in a repeating sequence. The sequence of locations reversed half way through each session. Pigeons' responses were fast up to the point of reversal, then immediately slowed and gradually re-accelerated and stabilized. Results imply that pigeons made perseverative, but not anticipatory errors around the point of reversal, and this differed from other midsession reversal experiments. Furthermore, stable RTs on both sides of the reversal were accounted for by local predictability. Results suggest that rule learning reversal may differ between tasks that rely on procedural and reference memory.

3:39
PM **Validation of item-in-context memory in rats**

Cassandra L. Sheridan & Jonathon D. Crystal (Indiana University)

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Episodic memory consists of vivid memories of unique personal past events, including the contexts in which those events occurred, whereas familiarity is the vague judgment that an item is known. Replicating a behavioral task validates a behavioral phenotype as an expression of an underlying neural mechanism. Panoz-Brown et al. (2016, *Current Biology*) documented episodic memory in rats by dissociating episodic memory and familiarity. Rats were presented with 16 trial-unique odors in one context and the same odors in a second context. Each odor was rewarded as a new item in each context. In non-diagnostic trials, familiarity and episodic memory are confounded, with both leading to above chance accuracy. In diagnostic trials, familiarity and episodic memory are dissociated, with episodic memory producing above chance and familiarity producing below chance performance. Here, we replicated Panoz-Brown et al's study. Rats' ($n = 21$) terminal accuracy in diagnostic (0.81 ± 0.04 SEM), non-diagnostic (0.84 ± 0.02 SEM), and all (0.85 ± 0.02) trials was high, as in Panoz-Brown et al. These results provide evidence for episodic memory in conditions that dissociate episodic memory and familiarity. Replication is a prerequisite to systemically investigating the neural mechanisms of episodic memory.

3:46
PM **Perception (Chair: Bob Cook)**

When Kiki turns round: A reversed Bouba–Kiki Effect in tortoises (*Testudo marginata*)

Maria Loconsole (University of Padova), Gionata Stancher (Rovereto Civic Museum Foundation), & Giovanna Marliani (University of Padova)

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Crossmodal correspondences, spontaneous links between sensory modalities, are well documented in humans. The Bouba–Kiki effect, a mapping of “Bouba” to round shapes and “Kiki” to spiky shapes, has recently been shown in baby chicks and adult dogs. We tested whether this bias appears in a nonvocal reptile, the marginated tortoise (*Testudo marginata*). Ten adult tortoises were exposed to repeated “Bouba” or “Kiki” sounds while placed in a rectangular arena containing a round and a spiky 3D object they could freely inspect. Tortoises displayed a reversed mapping, spending more time near the round object during “Kiki” playbacks and the spiky object during “Bouba”. This inversion provides a rare window into the diversity of crossmodal cognition. Ecological factors, particularly strong neophilia, combined with the unconstrained exploration task, may have prompted individuals to approach combinations that violated expected correspondences. Alternatively, tortoises may possess fundamentally different principles of perceptual organisation, challenging the assumption that sound–shape links follow a common pattern across vertebrates. By revealing spontaneous sound–shape associations in reptiles, albeit in an unexpected direction, our findings broaden the comparative landscape of multisensory research and underscore the need to integrate ecological pressures, neural architecture, and methodological design when investigating cognition across diverse taxa.

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Investigation of modal and amodal completion in pigeons (*Columba livia*)*Tomokazu Ushitani, Sakura Kobayashi, & Arii Watanabe (Chiba University)*

Many previous studies have failed to demonstrate amodal completion in pigeons, with only a few exceptions; likewise, evidence for modal completion—such as perceptual transparency—remains limited. To examine these two forms of completion in a single study, we trained four pigeons to match one symbol to a unitary rod and another symbol to a rod with a central gap (hereafter, "gap rod"). On probe trials following successful training, the pigeons were presented with four types of stimuli: a unitary rod partially occluding another rectangle (Overlap-1 condition); a unitary but transparent rod occluding another rectangle (Transparent condition); a rod whose center was occluded by another rectangle (Occlusion condition); and a gap rod partially occluding another rectangle (Overlap-2 condition). Across probe conditions, the probability of choosing the "unitary" symbol was highest in this order, although choice behavior for these probe stimuli approached chance level, in contrast to the clear discrimination observed with the unitary and gap rods during training. These results suggest that pigeons' responses to completion stimuli cannot be fully captured by a simple dichotomy between completion and total truncation. We discuss how these results caution against interpreting animal perception through frameworks that reflect biases originating from human perceptual experience.

3:55
PM *Break*4:15
PM **Canine Cognition (Chair: Anna Wilkinson)****Canine perspective taking: Anticipating the behavior of an unseen human***Ludwig Huber, Pauline van der Wolf, Machteld Menkveld, Stefanie Riemer (Messerli Research Institute, University of Veterinary Medicine Vienna), & Christoph Völter (Messerli Research Institute, University of Veterinary Medicine Vienna; Max Planck Institute for Evolutionary Anthropology)*

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While certain socio-cognitive skills such as interpreting others' attentional states are relatively widespread across the animal kingdom, the contentious debate persists regarding the extent to which animals can attribute mental states to others. Dogs have demonstrated remarkable proficiency in various perspective-taking tasks, including stealing in the dark, concealing information from others, and true/false belief differentiation. However, in all these cases, dogs might have simply used 'behavior reading' rather than 'mind reading' to solve the task. Consequently, to test whether dogs can attribute visual access to others without relying on observable cues, one needs to eliminate or control for all perceptual cues at the time of testing. In this study we required dogs to decide whether and where to steal food in the absence of a human who had prohibited them from doing so. The dogs could only infer the experimenter's presence through a sound they had perceived during a prior exploration phase, in which they also had the opportunity to observe from where in the room the person – or they themselves – could be seen. The dogs' performance provide evidence that dogs can anticipate the behavior of humans without relying on observable visual cues.

4:29
PM **Failure to replicate the guesser-knower paradigm in dogs (*Canis familiaris*)***Molly Byrne (Pace University), Selim Kolat (Boston College), Laura Furtado Fernandes (Pomona College), & Angie Johnston (Boston College)*

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The guesser-knower paradigm has been used in several species to assess whether animals understand that having visual access changes the knowledge state of the viewer. Past research has found that dogs were able to correctly choose the knower above chance, suggesting that they understand that seeing leads to knowing, a critical early component of theory of mind (Maginnity & Grace, 2014; Catala et al., 2017). These two papers are frequently cited, but have not seen much expansion or replication since their publication. We sought to expand on this work to see how dogs would respond to an demonstrator with ambiguous visual access, but we failed to replicate that dogs chose a knower above chance (mean = 0.525, $p = 0.58$, 95% CI: 0.44, 0.60). As a follow up we then ran a replication of Experiment 3 of Maginnity and Grace's original paper, and again failed to replicate their finding, instead finding that dogs chose the guesser significantly more than chance (mean = 0.40, $t(94) = -3.90$, $p < 0.001$). These two failed attempts to replicate the finding cast doubt into how robust dogs' ability is to understand the guesser-knower paradigm and suggests a need for further research.

- 44 4:36 **Inaccurate cue evaluation in Canids**
 PM *Carly F. Fisher (Brown University), Madeline H. Pelgrim (Brown University), Molly Byrne (Boston College, Pace University), Shennai Palermo (Boston College), Angie M. Johnston (Boston College), & Daphna Buchsbaum (Brown University)*
 Canids follow both social (e.g., human point) and asocial (e.g., novel marker) cues to locate a food reward. But how do they fare when these cues are inaccurate? Our study examines the influence of domestication on inaccurate cue learning by comparing two canid species, domestic dogs (*Canis familiaris*, n = 18) and non-domestic Australian dingoes (*Canis dingo*, n = 8), on a two-alternative forced choice paradigm where inaccurate cues were presented either socially or asocially. The social cue was a point presented by an experimenter using ostensive signaling (e.g., calling their name). The asocial cues were (i) the color of the bowls and (ii) a novel marker. Dogs were shown three cues, while dingoes were only shown the social point and asocial color. Our results suggest that both dogs and dingoes are more likely to follow inaccurate social cues, versus inaccurate asocial cues. Compared to dingoes, dogs were worse at avoiding inaccurate cues of all types. Dingoes may experience a smaller difference between social and asocial cues compared to dogs, but this finding is limited by the current sample size. These results support the theory that domestication may have altered canids' problem-solving abilities, making dogs worse at independent learning.
- 45 4:43 **Training the “Self-Control Muscle”? Testing the effects of the “It’s Yer Choice” game on Canine inhibitory control**
 PM *Ellen Furlong (Transylvania University), Rebecca Singer (Berea College), Katherine Judy (Transylvania University), & Julia King (Transylvania University)*
 Dog trainers often suggest that impulse-control training leads to improved impulse-control behavior across contexts. However, previous research casts doubt on this assertion. We evaluated the effects of It’s Yer Choice, a foundational “impulse-control” training game, on four measures of canine impulse-control. Shelter dogs with minimal prior training completed a pretest battery assessing their ability to move away from food (cylinder, V-detour) and to break a pattern (A-not-B, middle cup). Dogs then received three days of It’s Yer Choice training during which the trainer held a treat in a closed hand. As long as the dog attempted to access it, their hand remained closed. When the dog voluntarily withdrew, the trainer’s hand opened, and if the dog continued to refrain, the dog was rewarded. Following training, dogs completed a post-test using the same four tasks. Consistent with our previous findings that training does not uniformly enhance self-control, we did not find that It’s Yer Choice produced broad improvements across tasks. This study contributes to a growing body of evidence suggesting that self-control in dogs may involve multiple, context-specific processes that are not easily strengthened through generalized training.
- 46 4:50 **Can sniffing make you optimistic? The effect of olfactory enrichment on cognitive bias and inhibitory control in dogs**
 PM *Alisa Tananaeva & Monique Udell (Oregon State University)*
 Chronic stress is known to impair executive functions and induce pessimistic cognitive bias, likely due to the dysregulation of the prefrontal cortex and hippocampus. While olfaction is the primary sensory modality for canines, its potential to modulate affective states and cognitive processing remains under-explored. This study investigated whether a 3-week structured olfactory intervention (sniffing games and sensory room exposure) could mitigate cognitive deficits associated with chronic stress. Thirty-eight companion dogs (N=38) participated in a pre-post experimental design. We assessed affective state using a spatial Judgment Bias Task (Cognitive Bias) and executive function using the Cylinder Task (inhibitory control) and a Spatial Reversal Task (cognitive flexibility). Data collection is complete, and analysis is currently underway. We hypothesize that increased olfactory engagement will result in a "pessimism-to-optimism" shift, manifested as reduced latency to approach ambiguous stimuli, and improved performance in inhibitory control tasks compared to baseline. We will discuss the implications of these findings for understanding the link between sensory foraging behavior and cognitive resilience in non-human animals.
- 47 4:57 **Developing skilled handlers and canines for research and outreach: A collaborative, student-led team approach**
 PM *Sarah Nadler (Eckerd College, Green-Grey Spaces, LLC), & Amanda Crossen (Kings Bay Naval Submarine Base)*
 Student-led dog training programs can provide a powerful, scalable avenue for supporting canine cognition research while simultaneously developing undergraduate skills in animal handling, research methods, and community engagement. This presentation outlines the structure and outcomes of a faculty-sponsored, student-run dog training team developed at Eckerd College. Our model centers on collaborative training sessions in which students work together to design husbandry strategies, training plans, support one another’s handling skills, and receive regular guidance and feedback from a sponsoring faculty member. Students train one or more

pet dogs who participate daily in cognitive research, enrichment, behavioral rehabilitation, and educational public-facing events on campus. We will describe the process through which our current model emerged, including early challenges, structural refinements, and lessons learned across multiple semesters. Insights will be presented from the perspectives of both the faculty sponsor and a recent graduate who served as Team President and lead handler during key periods of program development. The presentation will conclude with recommendations for adapting this model to varying institutional contexts, highlighting benefits such as reliable availability of canine participants and a well-prepared cohort of student handlers to support ongoing research needs.

5:12 Symposium: Novel Methods for Studying Dog Behaviour & Cognition (Chairs: Tiago Monteiro & Nathan Hall)

48

Following the gaze: What stationary and mobile eye-tracking reveal about dog-human communication
Andrea Somme (Messerli Research Institute, University of Veterinary Medicine of Vienna), Maleen Thiele (Max Planck Institute for Evolutionary Anthropology), & Christoph J. Völter (Messerli Research Institute, University of Veterinary Medicine of Vienna, Max Planck Institute for Evolutionary Anthropology)

Dogs' capacity to interpret human attentional cues provides a solid basis for exploring the cognitive processes behind dog-human communication. Combining mobile and stationary eye-tracking highlights how dogs assess human focus and how communicative signals influence their encoding. A mobile eye-tracking setup records dogs' gaze as they observe two toys, one familiar and one unfamiliar to a human experimenter, and then hear an enthusiastic, referential exclamation without an explicit gesture. Analysing gaze distribution, search patterns, and first approach choices evaluates whether dogs use pragmatic cues and exclusion to determine which object the human is excited about, and whether they distinguish situations where the human has prior experience with both toys from those where only one is familiar. Stationary eye-tracking complements this by revealing a memory bias induced by communication: after ostensive eye contact, dogs tend to encode object identity rather than location, mirroring patterns seen in human infants. Collectively, these methods demonstrate how dogs interpret human communicative signals, how ostension affects information encoding, and how contextual knowledge guides understanding of ambiguous referential expressions, advancing broader questions about intention reading and the development of socio-cognitive abilities in dogs.

5:27 Making good dogs better: Using animal cognition to improve the performance of detection dogs

PM

Anna Wilkinson, Holly Root-Gutteridge, Adele Spain, Mollie Holmes, Claire Ricci-Bonot, Daniel Mills & Helen Zulch (University of Lincoln)

49

The ability to identify a novel stimulus as a member of a known category allows an organism to respond towards it in an appropriate way. Categorization can thus be considered an essential tool for processing and responding to unknown stimuli in nature. It is therefore likely to be a valuable approach to harness for training detection dogs, whose success relies on their ability to detect and alert to variations of the stimuli on which they have been trained. This study used pet dogs to investigate the impact of using a categorical training approach, comparing it to standard detection dog training. Categorization group dogs were trained on multiple targets with variations and adulterants whereas Standard group dogs were trained using a restricted stimulus set designed to replicate common industry practice. The results revealed no difference in training time between the groups, however, tests with novel versions of the stimuli revealed a significant difference in generalisation between the two groups, with the Categorization group performing significantly better than the Standard group. Given these findings we recommend that a categorical approach to training should be investigated in working dogs.

5:42 What can we learn about dog cognition through buttons and soundboards?

PM

Federico Rossano (University of California, San Diego)

50

In the late 20th century, Animal Language Studies attempted to teach non-human animals human-like communication. Early efforts with apes, dolphins, and parrots using sign language, or lexigrams had some success, but were criticized for small sample sizes, poor methodology, and lack of ecological validity. Recently, research in canine cognition has shown that dogs outperform non-human primates in understanding human cues such as pointing and facial expressions, and they live naturally with humans, making them ideal subjects for large-scale, long-term studies in more ecologically valid scenarios. Modern advances in citizen science and video technology have enabled distributed studies across many households, addressing the limitations of earlier single-subject experiments. In this talk I report on the project we launched in 2021 that has become the world's largest citizen science project on interspecies communication, involving 10,000 participants across 47 countries. Pets were trained by their owners through augmented interspecies communication (AIC) devices composed of buttons that when pressed reproduce prerecorded human words or phrases. Our project collects survey data about

the dogs and households, automated logging of button use, video recordings from households, both in-person and remote experimental protocols that are preregistered and tests training protocols to investigate dog cognition at scale.

51 5:57 **Olfactometry to investigate canine olfaction**
PM *Nathaniel Hall (Texas Tech University)*

Olfactory stimuli are rarely used in animal learning studies, even when olfactory stimuli are highly salient for the species. This is true in canine cognition research, which infrequently uses olfactory stimuli. One potential reason is the challenge associated with presenting consistent odorant stimuli amenable to automation or operant chambers. This talk will discuss the concept of olfactometry to make odor presentation consistent, reliable, and automated. I will show how they can be implemented, easily built, and used to advance canine cognition research.

52 6:12 **Using touchscreens to study dogs' learning and memory of artificial sensory information**
PM *Siqi Yang-Fu (University of Veterinary Medicine Vienna), Christian Menne (University of Veterinary Medicine Vienna), Chiara Canori (University of Parma), Friederike Range (University of Veterinary Medicine Vienna), & Tiago Monteiro (University of Veterinary Medicine Vienna)*

Touchscreen-based methods have been widely adopted across diverse species to investigate perception, learning, and working memory, for their precise experimental control and automated data collection. However, their application to dogs remains limited (n = 14 studies). To address previously identified issues, we developed a portable touchscreen apparatus and trained pet (n = 15) and laboratory dogs (n = 7) to perform on a matching-to-sample task using artificial coloured shapes. The apparatus includes a 17-inch monitor with an infrared touch frame mounted at an adjustable height, an automatic food dispenser, and custom software for controlling trial contingencies and logging timestamped task events and coordinates for all screen interactions. Task parameters, such as stimulus placement, timings, and reward contingencies, were fully automated to reduce handler effects and maximise experimental control. The resulting touch dataset enabled detailed analyses of learning curves, error patterns, individual variability and touch dynamics, extending beyond the traditional binary-choice outputs of more common manual tasks. Our findings demonstrate that dogs can reliably learn, remember, and interact with abstract stimuli presented on a touchscreen, supporting the feasibility of touchscreen-based methods for adaptable and reproducible cognitive and behavioural research in dogs.

7:00-8:00 **EDI Event**
PM *This event, titled "Allyship and EDI", will serve as a safe space for discussing Equity, Diversity, and Inclusion. All are warmly welcomed. Snacks will be available for attendees.*

8:00-10:00 **Poster Session I**
PM *With cash bar available.*

See poster abstracts starting on page 40.

***Note for Poster I Presenters: Please set up your posters between 3:00-6:00PM on Wednesday afternoon.**

Friday

9:00-
11:00
AM

Poster Session II Setup

Please set up posters for the second session in appropriate room, as listed.

9:30-
10:30
AM

CO3 Mentoring Session

Details regarding this session will be announced prior to the conference. Snacks will be available for attendees.

11:00 AM FEATURE SESSION: Early Career Award Winner - Stephen Ferrigno (Chair: Jennifer Vonk)

Monkeys and humans use queue-like memory for hierarchical sequences

Stephen Ferrigno (University of Wisconsin-Madison, Harlow Center for Biological Psychology)

The ability to represent hierarchical sequences was long thought to be uniquely human. However, recent findings in artificial grammar tasks have shown that humans, non-human primates, and crows can all learn to represent center-embedded hierarchical sequences and generalize them to novel strings (Ferrigno et al., 2020; Jiang et al., 2018; Liao et al., 2022; Malassis et al., 2020). Here, I will talk through a recent study that tests monkeys' ability to represent hierarchical sequences beyond the traditional center-embedded AnBn sequences. We test if monkeys can represent and generalize cross-serial sequences (e.g., A1A2A3B1B2B3) to novel strings and then compare performance to center-embedded sequences (e.g., A1A2A3B3B2B1). Even though cross-serial sequences are more complex (in terms of Formal Language Theory), monkeys and humans show better performance on cross-serial sequences compared to center-embedded sequences. These results suggest that the memory structures used to represent these sequences are not push-down stacks, the memory structures assumed to represent center-embedded sequences. Instead, it suggests that both monkeys and humans use a queue-like memory structure for both center-embedded and cross-serial sequences. This work suggests that monkeys not only have the ability to represent recursive sequences but do so in a way that is similar to humans.

53

11:20 AM Symposium: Inventing Joy? The Challenge of Eliciting and Measuring Positive Affect (Chair: Heidi Lyn)

Temperature and Hormones: Challenges and insights of the physiological signals of kea joy

Alexander Grabham (University of Canterbury), Alex Taylor (Universitat Autònoma de Barcelona, University of Canterbury), & Ximena Nelson (University of Canterbury)

Physiological measures offer objective markers of affective states, yet their application to avian positive affect is limited. We investigated periorbital temperature and hormonal correlates of positive affective states in kea (*Nestor notabilis*), a highly playful and neophilic New Zealand parrot. We recorded infrared thermography on the eye region during trials where kea received food items under different reward paradigms, either creating positive windfalls (unexpected preferred peanut butter) or negative windfalls (unexpected less-preferred carrot). We compared sampling intervals (5, 10, and 15 s) and extraction methods (single versus triplet frames with outlier exclusion) to assess trade-offs in temporal resolution and quality of data. Generalised Additive Models revealed (1) symmetrical habituation signals to pre-windfall trials of expected rewards, yet (2) asymmetry in positive versus negative surprise signals: positive windfalls elicited significant warming (+0.5-0.6°C peak) exceeding responses to expected preferred rewards. Negative windfalls produced only modest, non-significant responses. We also collected faecal samples throughout novel snow exposure to assess hormone levels. Corticosterone showed expected diurnal decline and correlated inversely with male dominance status. Mesotocin analysis is ongoing, unexpectedly requiring solid-phase extraction with spike recovery validation. Our findings highlight the novel challenges and insights of thermal imaging and hormone analysis for measuring joy-like states.

54

11:35 **What vocalizations do bottlenose dolphins use in positive affect contexts?**

AM *Vincent Janik, Tom Jenks, & Julie Oswald (University of St Andrews)*

55

Bottlenose dolphin communication has been studied primarily in the context of individual recognition and group cohesion. Much less is known about how they communicate other contents. Burst-pulsed sounds have been identified as potentially important in the transmission of affective states in dolphins. Here, we studied the use of these sounds in a variety of contexts of different affective valence to understand how dolphins encode emotional state. We analysed the vocalisations of seven zoo-housed bottlenose dolphins in 104 behavioural events, across three affect ratings: Positive (socio-affiliative, toy, and food related), neutral (1-2 dolphins independently swimming in a pool), and negative (socio-aggressive interactions). Burst pulses were categorised by their click repetition rates and overall duration. A hydrophone array localised 1815 of burst-pulse sounds to behavioural contexts. Mixed-effect models revealed that positive and negative context burst pulse rates were comparable but that burst pulses consisting of clicks trains with decreasing inter-click intervals were significantly more common in positive affect contexts. Our results show that acoustic parameters can identify the affective valence of behavioural contexts and that the shared use of vocalization parameter changes might be used to communicate affect between individuals.

11:50 **Looking at joy: Attention biases for facial signals of joy in bonobos (*Pan paniscus*)**

AM *Daan W. Laméris (Indiana University, Antwerp Zoo Centre for Research and Conservation), & Erica A. Cartmill (Indiana University)*

56

Positive affective states are considered the social glue of group living, facilitating coordination and affiliation during social interactions. In many primate societies, facial expressions are a salient mode through which such affective states are communicated. In the present study, we investigated how bonobos allocate attentional resources to facial expressions (play faces, rest, bared teeth) associated with positive, neutral and negative interactions. Twelve zoo-housed bonobos participated in four touchscreen-based cognitive tasks targeting different components of attentional processing: orienting, disengagement, and socially mediated attentional shifts via gaze cueing. Preliminary results find that all three facial expressions attract attention, more strongly than asocial control images, supporting the validity of the facial stimuli. Play faces selectively engaged attentional systems associated with sustained processing, as bonobos were slower to actively disengage from play face stimuli. In contrast, bared teeth expressions captured attention more rapidly, but only when directly competing with neutral stimuli for attentional resources. No evidence for gaze cueing effects was found for any facial expression. By demonstrating that positive and negative facial expressions differentially bias multiple components of attention in bonobos, these results provide insight in the proximate cognitive mechanisms through which social signals may shape perception and responses during social interactions.

12:05 **Measuring positive affect across species - how do we find the Joy?**

PM *Heidi Lyn (University of South Alabama)*

57

As a collaboration, our project – Joyful by Nature – focuses on finding new ways to measure positive affect. Our species of interest present some clear evolutionary and behavioral parallels to humans (great apes) and some clear divergences (dolphins and kea parrots). How, then, can we find common measures and unified conclusions? We proposed 5 themes. Theme 1 was the starting place – identify candidate behaviors observationally, for example, vocalizations associated with play in apes and kea. For dolphins, candidate vocalizations still needed identification. For Theme 2, we aim to experimentally elicit these candidate behaviors to confirm their association with positive affect. One example methodology for this is the windfall paradigm. Theme 3 seeks to explore the internal state of the animal during hypothesized positive affect. To “measure” internal states, we rely primarily on behavioral responses, but we are also exploring biometric options including hormonal responses and thermal readings. Themes 4 and 5 ask about the effects of positive affect on cognition, learning, attention (4) and social cohesion (5). By exploring the question of positive affect in disparate species and from multiple routes, we hope to create a method for “measuring” joy that is both broadly applicable and robust.

12:22 **Auditory Discrimination (Chair: Chris Sturdy)**

PM

58

Tale of two tseets: the perception of species difference in a shared contact call

Moriah J. Deimeke, Sarah M. L. Smeltz, Katharine H. Stenstrom, Prateek K. Sahu, Patrick E. R. Curiston, Alexandra D. Garcia, Andres Camacho-Alpizar, & Christopher B. Sturdy (University of Alberta)

The closely related black-capped chickadee (*Poecile atricapillus*) and mountain chickadee (*Poecile gambeli*) each produce a one-note call: the tseet. Akin to chick-a-dee calls, tseets differ acoustically based on species. We used an operant go/no-go discrimination task to investigate whether black-capped chickadees could perceive these differences between black-capped chickadee- and mountain chickadee-produced tseets. We assigned birds to TRUE GROUPS, one trained to respond to black-capped chickadee tseets and one trained to respond to mountain chickadee tseets, and a PSEUDO GROUP, which were trained to respond to an equal number of tseets from both species. While TRUE GROUPS learned the species discrimination in fewer trials than the PSEUDO GROUP, TRUE GROUPS demonstrated unequal generalization in subsequent transfer and probe trials. TRUE GROUPS did not initially transfer discrimination learning when trained on a new set of tseets but did generalize discrimination learning to novel tseets during probe trials. Additionally, when probed with spliced tseets (i.e., tseets made from a combination of both species), TRUE GROUPS responded more to those containing the section belonging to the previously rewarded species identified by acoustic analyses as potentially encoding species information.

12:29 **African Savanna and Asian Elephants vary in behavioral responses to dynamic acoustic enrichment**
PM *Robbie Ball (Hunter College), Cathleen Cox (Los Angeles Zoo and Botanical Gardens), Eliana Eisenberg (Half Hollow Hills High School), Shifra Goldenberg (San Diego Zoo Wildlife Alliance), & Joshua M Plotnik (Hunter College)*

59 Providing animals in human care with choice and control over enrichment considers both the animals' welfare and cognition in their management. Effective enrichment should engage an animal's dominant sensory modality to encourage active, dynamic interactions. Elephants, both African savanna and Asian species, have exceptional acoustic perception, and use it in a variety of physical and socio-cognitive contexts. We investigated how African elephants at the San Diego Zoo and Asian elephants at the Los Angeles Zoo responded to tactile, acoustic enrichment devices. These devices played high- or low-frequency tones with variable patterns and could be activated through proximity or physical contact. Sound conditions alternated across three devices in each enclosure, and we aimed to determine whether elephants spent more time near specific devices based on the acoustics or location. Using remote-sensing video cameras, we observed behavioral interactions with devices, movement between locations, feeding behaviors near devices, and the impact of present conspecifics on these behaviors. We will present our findings, which will show differences in how elephants interact with dynamic acoustic stimuli, and we will highlight the importance of considering tailored enrichment to an animal's individual preferences. This approach promotes higher quality welfare and cognitive enrichment for animals in human care.

12:36 **Vibration into vision: Symbol-to-numerosity cross-modal matching in honeybees**
PM *Elena Kerjean (CNRS, Toulouse University), Laure Tosatto (Monash University), Scarlett Howard (Monash University), & Aurore Avarguès-Weber (CNRS, Toulouse University)*

60 Cross-modal encoding of numerical information in humans is a key argument to support an abstract representation of numbers independent of object properties. Despite extensive reports of a "number sense" in non-human animals, evidence of an ability to encode numerical information across sensory modalities remains surprisingly rare. Honeybees have recently emerged as a key model for comparative numerical cognition, with various competences including proto-arithmetic and symbol-to-numerosity matching. As bees also possess cross-modal representation of objects, they are an ideal model to test for cross-modal representation of numbers. Honeybees were thus trained to match vibrational cues to visual numerosities. Vibrational signals, inspired by the waggle-dance, differed only in tempo (fast vs. slow) and indicated which numerosity to choose. Bees succeeded only when the signal tempo was congruent with the numerosity (fast = large; slow vibration = small). Our results reveal cross-modal symbol-to-numerosity matching in honeybees and uncover a cross-modal congruency effect between vibrational tempo and visual numerosity. This provides the first demonstration of cross-modal magnitude interactions in a non-human species, while further demonstrating the abstract nature of number representation in bees.

12:43 **Multiple approaches to characterizing vocal communication in North American chickadees**
PM *Alexander J. Muth (University of Western Ontario), Alessia L. Costa (University of Western Ontario), M. Zachariah Peery (University of Wisconsin-Madison), Connor M. Wood (Cornell University), & Carrie L. Branch (University of Western Ontario)*

61 Vocal signals used in animal communication vary within and between species and often map onto functional differences in how individuals interact. Thus, the development and maintenance of vocal variation are key questions in evolutionary biology. Multiple hypotheses have been proposed to explain this variation, including character displacement and social complexity. Multiple approaches must be considered to test these hypotheses, including spectrottemporal analyses and information-theoretic approaches. I applied both approaches to test these hypotheses in Chestnut-backed (CBCH) and Mountain Chickadees (MOCH) across sympatric and allopatric

populations in the Sierra Nevada. Chick-a-dee calls consist of independent note types that follow syntactical note ordering rules (e.g., A > B > C > D). I predicted that spectrotemporal analyses would show vocal divergence in sympatry driven by character displacement, while information-theoretic analyses would reveal greater syntactical complexity in sympatry associated with increased social complexity. Preliminary data suggests that spectrotemporal characteristics of A notes diverge in areas of sympatry, while D notes display a mixed pattern of divergence and convergence. Additionally, syntax combinations vary between allopatric and sympatric regions. This research sheds light on the evolution of vocal variation and provides valuable information for monitoring ecosystem health.

62 12:50 PM **Auditory discrimination learning increases new neurons in songbird caudomedial nidopallium (NCM)**
Nicole St. Jacques (CUNY Graduate Center), Kristena Newman (CUNY Graduate Center), Alexis Xanders (Queens College), Antonio Tan (Queens College), Andreas Pappasopoulos (Queens College), Brianne Nichtenhauser (Queens College), & Carolyn Pytte (CUNY Graduate Center, Queens College)

In adult mammals, new neuron survival increases after learning challenging tasks, suggesting a relationship between cognitive demand and neurogenesis. In songbirds, higher-order auditory processing regions caudomedial nidopallium (NCM) and caudomedial mesopallium (CMM) receive new neurons in adulthood. However, the relationship between effortful auditory discrimination and neurogenesis remains unknown. Using adult zebra finches, we tested whether completing an auditory Go/No Go discrimination task using highly similar song pairings (“Hard”) would increase new neurons in NCM and CMM compared to a version using dissimilar songs (“Easy”) and matched controls who heard, but did not learn, discriminations. In both the Easy and Hard tasks, learning birds had more new neurons in NCM than matched controls, but learning the Hard task did not increase new NCM neurons relative to learning the Easy task. In CMM, females had more new neurons than males, but neither task difficulty nor learning increased new neurons. In NCM, males learning the Hard task had more new neurons in the left hemisphere relative to males learning the Easy task. Together, these results suggest that learning, independent of task difficulty, increases new neurons in the NCM, whereas in CMM, females have more new neurons than males, regardless of learning, highlighting divergences in new neuron survival in the avian secondary auditory pathway.

63 12:57 PM **Dam it! Predator sounds do not deter beaver activity**
Jennifer Vonk, Sandra Troxell-Smith, Brittany Greene, Gina Montalto, Koi Stellman, & Thomas Raffel (Oakland University)

We observed whether a pair of wild beavers would respond differentially to predator versus non-predator sounds when damming culverts. A motion activated sound device played 20 second clips of ~100db sounds above the culverts when the beavers approached. Sound types were changed and culverts were unplugged every two to three days, allowing us to observe the beavers' activity when the culvert had and had not been unplugged for each sound. We cycled through two blocks of eight sounds presented in random order; indigenous predators (wolf, fox, coyote, domestic dog) and non-predators (e.g., squirrel, duck, domestic cat, heron). We recorded approach, flight, startle, and dam packing behavior in response to the sounds. Beavers spent more time visible and packing the dam when the culverts had been unpacked. They were slower to approach when sounds played versus when no sounds played but they did not categorically differentiate predator and non-predator sounds. They approached more quickly after coyote and fox sounds and returned more quickly after coyote sounds even though coyotes and fox are natural predators.

1:05 PM *Snack Break*

1:45 PM **Communication (Chair: Madeleine Brodbeck)**

64 **Budgerigar song is rhythmic**

Marisa Hoeschele (Acoustics Research Institute, Austrian Academy of Sciences), Jeroen van der Aa (University of Vienna), Günther Koliander (Acoustics Research Institute, Austrian Academy of Sciences), & W Tecumseh Fitch (University of Vienna)

The propensity for rhythm is one of the biological predispositions that underlie the human drive for music. Parrots are of interest when it comes to rhythm because they are uniquely flexible and self-motivated in responding to rhythmic structures. For example, parrots spontaneously track the beat in music and dance to it. At past conferences I presented data showing that female budgerigars, a small parrot species, will choose to

listen to rhythmic sounds when given the choice between rhythmic, arrhythmic, and silence. We argued that this preference for rhythm might be related to the male courtship display, because males sing and bob their heads similar to the typical behaviour of parrots when dancing to music. In the current study, we showed that budgerigar song does in fact have rhythmic properties that are more similar to human music than language. In doing so, we developed a novel method to assess rhythmicity in animal vocalizations more generally, controlling for the fact that vocalizations tend to appear rhythmic if some timings between elements are more common than others (i.e., the distribution has peaks). Overall our results support our previous argument that rhythm is important in the natural courtship behaviour of budgerigars.

65 1:52 **Imitate that one: Dolphins spontaneously interpret human pointing gesture in a novel context**

PM

Hannah Salomons (Dolphin Research Center, Duke University), Emily Guarino (Dolphin Research Center), & Kelly Jaakkola (Dolphin Research Center)

Understanding whether non-human animals interpret human pointing as cooperative communication remains a central question in comparative cognition. Pointing is a foundational aspect of human communication, yet success in traditional object-choice tasks may reflect conditioned responses rather than comprehension of communicative intent. Recent work therefore focuses on testing flexible, spontaneous use of gestures in novel contexts. Here, we examined whether bottlenose dolphins (*Tursiops truncatus*) could interpret a human point to solve a new problem in a modified “do-as-I-do” task. In this version, subjects (n = 3, proficient in imitating a single model) observed two models simultaneously performing different behaviors while the trainer gave the signal to imitate and pointed to one of the models. All dolphins imitated the indicated model significantly above chance, and performance did not improve across trials, indicating spontaneous rather than learned interpretation. These findings demonstrate that non-language-trained dolphins can flexibly apply the meaning of a familiar gesture in a novel context and respond with different behaviors accordingly. This suggests an understanding of pointing as cooperative communication rather than a simple discriminative cue, paralleling results in dogs and raising the possibility that dolphins’ abilities evolved through self-domestication and/or conspecific distal referencing systems such as echolocation.

66 1:59 **Confidence in cognition: Urgency, complexity and sex impact decision-making in wild great tits**

PM

Shana Caro (Adelphi University, University of Texas at Austin, Wageningen University and Research), Rebeca Villareal (University of Texas at Austin), Adara Velasco (National Museum of Natural Sciences of Madrid), Tjomme van Mastrigt (Wageningen University and Research, Netherlands Institute of Ecology), Kees van Oers (Wageningen University and Research, Netherlands Institute of Ecology), Camilla Hinde (Wageningen University and Research), & Hans Hofmann (University of Texas at Austin)

When animals make decisions, they accumulate evidence, reach a decision threshold, and execute their choice. Sometimes the correct choice is obvious and easy. Other times, the evidence may be less clear or the stakes may be higher. In humans, this difference in difficulty affects self-reports of confidence and changes decision-making strategies on subsequent choices. However, we have little data on whether wild animals experience differences in “confidence,” nor whether this confidence affects decision-making strategies. We address this gap through a non-invasive, naturalistic experiment on decision-making confidence in 62 wild great tit, *Parus major*, parents. We analyzed how confident parents were when deciding which of their offspring to feed, measured by how many times they moved food from one nestling’s mouth to another nestling before executing their final decision. We manipulated the information nestlings provided (begging and body size) and the stakes of this choice by supplementing some nests with extra food. We found that confidence predicted whether parents continued gathering evidence about nestling’s need for food after executing their choice, and also predicted how long parents took on their next decision. Our study suggests that birds exhibit some of the complex metacognition typically associated only with humans.

67 2:13 **Monkeys interpret prepositional phrases compositionally**

PM

Angelle Antoun (Emory University, Emory National Primate Research Center, Villanova University), Logan Brownell (Emory University, Emory National Primate Research Center), Rohini Murugan (Emory University, Emory National Primate Research Center), Tristan S. Correa (Emory National Primate Research Center), & Benjamin Wilson (Emory University, Emory National Primate Research Center)

The capacity for language represents a stark difference between the cognitive abilities of humans and other animals. Minimally, language requires integrating the meaning of words and the grammatical rules which dictate the order in which they appear in a sentence. Here, we presented rhesus macaques with iconic analogues of English prepositional phrases (e.g., ‘circle on square’). Monkeys were able to reliably identify the correct spatial arrangements of shapes from other incorrect configurations (such as a circle under a square or a circle to the left of a square). Critically, different shape stimuli were used on every trial, requiring the generalization of this process. This required integrating the meaning of the preposition (e.g., ‘on’) with the identity of the shapes, as well as the order in which they were presented. This work suggests that a core cognitive component of language

in humans, the compositional integration of meaningful stimuli with ordinal information, may not be unique to humans, and may predate the emergence of language.

2:20
PM

Endogenous oxytocin manipulation in tufted capuchins (*Sapajus apella*) decreases intergroup aggression but does not affect cooperation in a group paradigm

Gitanjali E. Gnanadesikan (Emory University), Nicole M. Furgala (Emory University), Arianna Mistry (Emory University, Arizona State University), Sarah F. Brosnan (Georgia State University), & Marcela E. Benitez (Emory University)

Both wild and captive capuchins have demonstrated remarkable success on cooperative paradigms. The oxytocin system is hypothesized to be an important mechanism underlying the expression and evolution of cooperative behavior, but its role is uncertain, with conflicting results across studies and species. Oxytocin may promote within-group cooperation and prosociality while also contributing to inter-group hostility; however, many of oxytocin's effects may instead be side effects of its anxiolytic properties. We utilized a unique oxytocin manipulation—non-pharmacologically stimulating endogenous production through fur-rubbing with onions—to assess the effect of oxytocin on within-group cooperation in a loose-rope paradigm and inter-group aggression. We manipulated food monopolizability (clumped vs. dispersed), outgroup presence (alone vs. observed), and endogenous oxytocin (fur-rubbing vs. control). Preliminary results suggest that cooperation success is predicted most strongly by food monopolizability, likely because females participate less when the food is clumped and thus monopolizable by the male. We also observed an interaction between outgroup presence and food monopolizability, with observed-clumped conditions resulting in the lowest levels of cooperation. Fur-rubbing did not have a significant effect on cooperation, although it dramatically decreased rates of inter-group vocal aggression; together, this suggests an anxiolytic rather than prosocial role for oxytocin in this context.

68

2:27
PM

Hearing the dance: Vibro-acoustic communication of the dance signal in honeybees

Sajesh Vijayan & Natasha Mhatre (University of Western Ontario)

Honeybees communicate the spatial location of a resource through a behavior called the waggle dance. Follower bees are thought to detect the dance through antennal deflections caused by the particle velocity component of the dance sound. The active sound field of the waggle dance is believed to be limited to a small area around the dancer since air particle velocity diminishes rapidly with distance. To overcome this, some insects possess active amplification to enhance vibrations generated by low-amplitude signals. Here, we measured the sound field around a vibrating honeybee wing and the associated response of their antenna. We mapped the sound field around 'dancing' bees and found that the particle velocity emanating from the wing decays rapidly over 10-20 mm (approximately one bee length). Moreover, antennal deflections of live honeybees showed none of the features commonly associated with an actively amplified acoustic system. On the other hand, structural properties of the antenna showed resonance like behaviour and passive filtering of sound frequencies close to the dance frequency. Our findings indicate that the acoustic sensory system of honeybees is not tuned towards the dance sound, and the restricted sound field requires followers to remain close to the dancer.

69

2:38
PM

Mazes & Detours (Chair: Caroline Strang)

When gravity flips the script: Upside-down rats abandon map-based (allocentric) navigation

David Eilam, Hadar Hayun, Alex Dorfman, & Noa Truskanov (Tel-Aviv University)

Disorientation is a serious threat for a fighter pilot pulling Gs, an astronaut floating in space, or a scuba diver deep underwater. It happens distortion of visual cues, inner ear balance system (vestibular and gravity sense), and body position sense (proprioception). To crack the code on this problem, we used a unique model: wild rats navigating while hanging upside down in an unfamiliar arena. Upside-down rats seemed lost. They drifted to wander in circular meandering paths while ignoring the arena walls and corners. Such egocentric navigation, based only on bodily information, is also typical of humans and other animals that get lost in the dark or in featureless environments. This contrasts upright rats that used allocentric navigation (based on landmarks), sticking to the arena walls and reliably heading back to a "home" corner. Our conclusion is that distorted vestibular/balance input is powerful enough to override visual and tactile landmarks, forcing a switch to a body-centered wayfinding method. This insight is vital for wayfinding in extreme environments, like space or deep water, and even in treating common balance problems in age-related balance decline.

70

- 71 2:45 **The impacts of maze design, stimulus salience, and motivation manipulation on amphipod escape behavior and learning**
 PM *Joshua Wolf, Madison Fanning, Allison Scholl, Aalaiya Jacklin, Amelia Miner (Carroll University)*
 Amphipods, *Gammarus pseudolimnaeus*, have demonstrated their ability to escape a wide variety of aquatic mazes but have not successfully demonstrated their ability to learn to escape faster or more efficiently with training. While it is possible that amphipods may not be able to learn how to escape, we believe it is more likely that the correct conditions for a demonstration of learning have not yet been pieced together. The current research combined many of the maze modifications from previous studies with new modifications to assist in the amphipods' discrimination of the maze arms (e.g. arrow maze, and visual stimuli) and the motivation to escape the maze (e.g. a longer maze, safer escape, and safer ITI). We recorded the time to escape and number of errors during each trial.
- 72 2:59 **The target matters: A spider-eating spider's inclination to take detours**
 PM *Fiona Cross, & Robert Jackson (University of Canterbury, International Centre of Insect Physiology and Ecology)*
 Jumping spiders (family *Salticidae*) have unique, complex eyes and a capacity for spatial vision exceeding that known for any other animals of similar size. *Portia africana* is a spider-eating salticid spider known to execute pre-planned detours for reaching its prey and for representing the number of spiders in a scene, with evidence from previous research showing that *P. africana* experiences expectancy violation when the number seen at the end of a detour differs from the number seen at the beginning. However, results from new research show that *P. africana* males also take detours to reach potential mates. Males show greater tendency to detour after seeing two (but not one) prey spiders (*Stegodyphus*) in a web and after seeing one (but not two) potential mates in a web. In addition, males will launch into courtship display when approaching the end of the pathway if a potential mate is at the end, but never if prey is at the end of the pathway. This is important new evidence that *P. africana* individuals identify what they see from a distance and then, based on this, choose to take a detour to get closer, with an expectation of what they are about to see.
- 73 3:15 **Animal Welfare & Conservation (Chair: Caroline Strang)**
 PM **Supporting manatee conservation through cognition**
Heidi E. Harley (New College of Florida, Disney's EPCOT's The Seas), Lisa G. Carbery (New College of Florida, Disney's EPCOT's The Seas), Nicole Bartlett (New College of Florida, Clearwater Marine Aquarium Research Institute), & Monica Cross (Clearwater Marine Aquarium Research Institute)
 Species have evolved to adapt to their surroundings across environmental changes, and one particularly flexible system for real-time adaptation is the ability to learn and employ other cognitive tools. The Florida Manatee (*Trichechus manatus latirostris*) is threatened and faces daily challenges including accessing food and warm water. For a variety of reasons, some manatees have trouble managing these vital tasks across an ever-changing landscape and are rescued, rehabilitated in human care, and released, although not all animals adapt after release. Is there a way in which comparative psychologists can work with others (including the manatee) to help wild and rehabilitating manatees use their flexible cognitive tools to perceive, attend, remember, and navigate their world in order to avoid the need for rescue and re-rescue? Here we outline a multidisciplinary plan that takes manatee agency and cognition into account and present preliminary data on (1) factors relating to manatee choice of appropriate habitats and (2) behavioral and physiological indicators of stress in manatees pre- and post-environmental changes. We find that considering a species' cognitive processes offers a path that can help them engage in their own conservation.
- 74 3:27 **The effects of education at Turpentine Creek Wildlife Refuge: Assessing change in visitors' knowledge and attitudes regarding conservation, legislation and wildlife in captivity**
 PM *Kate M. Chapman (University of Arkansas), Beckie Moore (Turpentine Creek Wildlife Refuge), & Laura McGehee (University of Arkansas)*
 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.

75

3:34 **Sensory perception and learning as tools for manatee (*Trichechus manatus latirostris*) conservation**

PM

Gordon B. Bauer, Athena Rycyk, Heidi E. Harley (New College of Florida, Disney's EPCOT's The Seas)

Cognition is largely absent from discussions of manatee conservation. We address this omission with three lines of action: 1) We integrate laboratory-produced audiograms and estimates of critical bands with field acoustic data to generate information important for setting vessel traffic guidelines to minimize boat-related injury and mortality. 2) We use the distinction between goal-directed behavior and habit to explain why some, but not all, manatees might remain at power plants, warm-water refuges critical to survival during cold weather, even after warm water has been terminated, a potentially lethal manatee decision. Furthermore, we suggest that by shifting manatee attention from cues that signal warm water to warm water, itself, we might influence these remaining manatees to seek other refuges. 3) In a policy-oriented example, we challenge federal resistance to training and requirements for extinction of all trained behaviors before release from managed care, by bringing to light research that shows instrumentally conditioned behavior does not transfer well across disparate settings and extinction is especially context dependent. Removal of the constraints on manatee training in managed care can in turn facilitate research such as determination of audiograms that can provide management guidelines to protect manatees in the wild.

3:50

PM

Break

4:10

PM

Reasoning (Chair: Olga Lazareva)

Do Asian elephants plan for mutually-exclusive outcomes?

Sydney F. Hope (Hunter College), Sangpa Dittakul (Golden Triangle Asian Elephant Foundation), Marnoch Yindee (Akkharatchakumari Veterinary College; Walailak University), Taweepoke Angkawanish (National Elephant Institute), & Joshua M. Plotnik (Hunter College)

76

Although the ability to contemplate future scenarios and develop contingency plans was once thought to be unique to humans, recent studies provide some evidence that non-human animals can plan for two mutually-exclusive future events. Here, we investigated this in Asian elephants (*Elephas maximus*) using a paradigm adapted from one used with children and nonhuman apes. Before we dropped a food reward down an inverted Y-shaped tube, elephants could prepare for the mutually-exclusive possibilities that food could exit from either end of the tube by simultaneously covering both openings. One elephant (out of 12) learned to manipulate her trunk to cover both openings, and performed this behavior relatively consistently to obtain the reward at a rate significantly greater than chance; although, she sometimes only covered one opening. We also investigated whether pairs of elephants could collectively prepare for both outcomes. We found that some pairs coordinated their behavior to obtain the reward at a rate significantly greater than that at which individuals could by chance, although others competed and were less successful. This is the first study to experimentally test future planning in elephants, and calls for further research to understand how future planning may have evolved convergently across species.

4:24

PM

Chimpanzees (*Pan troglodytes*) exhibit flexible modal reasoning about mutually-exclusive future events

Elizabeth Warren (Johns Hopkins University), Esther Herrmann (University of Portsmouth), Richard Mann (University of Leeds), Dora Biro (University of Rochester), & Christopher Krupenye (Johns Hopkins University)

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Chimpanzees (*Pan troglodytes*) have historically failed to demonstrate logical reasoning about future events when presented with an inverted Y-shaped apparatus, in that subjects typically cover one end of the apparatus, but not both, in anticipation of food which may fall from one end or the other. We presented 24 chimpanzees with three variations on the classic inverted y-tube task, challenging their flexible use of the logical "OR" operator and ability to distinguish certain, possible, and impossible outcomes. In stark contrast to previous findings, eight chimpanzees covered both ends of a Y-shaped apparatus, a behavior consistent with logical reasoning about mutually exclusive future outcomes (Exp 1). Four subjects did so flexibly with a modified, 3-

outcome, Y+S apparatus - using one or two hands depending on the number of possible (vs impossible) outcomes (Exp 2). Two subjects were further able to distinguish certain from possible outcomes, covering the appropriate two of three apparatus ends when both the Y and S components were baited (Exp 3). These findings suggest that, without language, apes can deploy modal reasoning concepts of certainty, possibility, and impossibility to prepare for future events.

78

4:38
PM

Can bonobos reason by exclusion about the location or identity of hidden rewards?

Justine Griego (Johns Hopkins University), Peter Mazalik (Johns Hopkins University), Esra Turan-Küçük (Boston University), Melissa Kibbe (Boston University), Justin Halberda (Johns Hopkins University), & Christopher Krupenye (Johns Hopkins University)

Inferring through exclusion is fundamental to everyday problem-solving, from locating misplaced keys to reasoning which route to drive home when there's a detour. Numerous species pass 2-cup exclusion tasks in which a reward is hidden in one of two cups, one cup is revealed to be empty, and the subject must infer that the reward remains in the other cup. However, a recent study showed that chimpanzees do not pass a more controlled 2-item 4-cup task (Engelmann et al., 2023). Although these failures may reflect genuine limitations in logical reasoning, they could also stem from task designs that hinge on representing uncertainty about where an object is located rather than uncertainty about what the object is. Recent work demonstrates that children show markedly improved performance on structurally equivalent four-cup inference tasks when the ambiguity concerns object identity instead of location (Mazalik et al., under review; Kibbe & Turan-Kucuk, under review). Building on this insight, we report data from bonobos tested on analogous what- and where-ambiguity paradigms to evaluate whether great apes likewise benefit from this redesigned inferential structure. Preliminary analyses replicate apes' general difficulty with the four-cup paradigm, and do not provide evidence for improvement when reasoning about object identity.

79

4:45
PM

The curious case of TI and TR: How many engines does it take to drive this train?

Olga F. Lazareva (Drake University)

Transitive inference (TI) and transitivity (TR) have long served as the primary non-verbal procedures thought to parallel verbal transitive syllogisms. TI is typically presented as a measure of inferential ability, whereas TR is situated within the stimulus equivalence tradition emphasizing formation of emergent relations. Although both tasks are often treated as interchangeable measures of "relational reasoning", they differ markedly in structure, theoretical lineage, and putative mechanisms. This raises a central question: Do TI and TR draw on the same cognitive processes or do they reflect fundamentally different kinds of relational learning? In this talk, I will review the theoretical assumptions underlying each task, examine behavioral evidence across species, and summarize the limited neurobiological data available to date. I argue that current data do not clearly support either a unified account or a strict two-process account. Finally, I will outline key research directions that will be essential for determining whether TI and TR tap into a common cognitive domain or represent separate forms of relational learning.

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5:02 Symposium: Donald R. Griffin, The Question of Animal Awareness and Beyond (Chair: Carolyn Ristau)

Introduction to Symposium: Donald R. Griffin, "The Question of Animal Awareness and Beyond"

Carolyn A Ristau (Barnard College of Columbia University)

Based on animals' evolutionary continuity with humans, Griffin proposed, in his revolutionary book, that animals might have mental events; they might be aware, think and feel. Griffin defined mental events as the ability to think about objects and events remote in time and space. "The presence of mental images, and their use by an animal to regulate its behavior, provide a pragmatic, working definition of consciousness." (Griffin, 1976, p. 105). In later writings, he suggested that a neutral stance in investigating animal consciousness should be the probability of awareness or $p(A) = 0.5$, i.e., assume that we do not know if an animal is aware. Evidence can increase or decrease $p(A)$. Extreme behaviorists assume $p(A) = 0$ as a null hypothesis. Griffin suggested three lines of evidence, noting the value of converging lines of evidence to bolster an attribution of likely consciousness: 1) finding Neural Correlates of Consciousness, 2) observing Versatile Adaptability in Meeting Novel Challenges, and 3) exploring both Natural and Artificial Communication, particularly two-way communication with humans, as "windows" into an animal's mind. In his time, evidence included hunting strategies of animals, even insects, the honeybees' communicative dance, and likely symbolic communication of some primate alarm calls. More evidence has accumulated.

- 5:17** **The “zombie interregnum” between Charles Darwin and Donald Griffin**
PM *Stevan Harnad (McGill University)*
- 81** Darwin’s views on whether animals feel are as clear as his views on natural selection: “The senses and intuitions, the various emotions and faculties, such as love, memory, attention, curiosity, imitation, reason... in man and the higher animals differ in degree and not in kind.” Griffin echoed this 1992 “Are animals consciously aware of anything, or are they all ‘zombies’ incapable of conscious thoughts or emotional feelings?... The evidence now available strongly suggests that many animals have mental experiences that differ from our own mainly in degree rather than in kind” Some reasons for the zombie interregnum: in the behaviorist era in psychology, animal feeling was not so much denied as declared impossible to study scientifically because unobservable. Neuroscience did the same, focusing instead on reflexes which are observable. The license for ignoring unobservable phenomena came from Philosophy, where it was declared not just “unscientific” to study what is unobservable, but meaningless. It is of course not true that feeling is unobservable (we each know we feel). And the correlates of feeling (behavioral and neural) in other species are observable. It would have helped if Nagel’s famous article had been “What does it feel like to be a bat?”
- 5:32** **What it is like to be a bat**
PM *James A. Simmons (Brown University)*
- 82** In 1974, Thomas Nagel observed that we cannot imagine the alien perceptual world of echolocating bats. However, Nagel offered the indirect approach of measuring the objective phenomenology of the bat’s perception and its neural mechanisms. This effort began with the discovery of echolocation by Griffin and Galambos in 1940 and has continued since. The big brown bat, *Eptesicus fuscus* (“brown house-flier”), emits ultrasonic biosonar sounds covering 20 to 100 kHz. They perceive objects as having distance, direction, size, and shape, all in the context of the surrounding sonar scene. The acuity of these perceptions comes from the timing of different frequencies in echoes as these are represented by the neural responses they evoke. By registering coherence of responses across different frequencies, percepts become sharply defined. When the bat aims its sonar at a target, to pay attention, it ensures response coherence. Echoes from objects not being attended to are weaker at high frequencies. Neural processes then disrupt the coherence of responses, causing percepts to lose sharpness—in effect, to defocus. Loss of sharpness reduces the capacity to interfere with the attended target. However, this description is couched in visual terms, whereas bats hear, not “see,” their surroundings.
- 5:47** **Griffin’s two types of evidence for animal consciousness, and a third**
PM *Kristin Andrews (CUNY Graduate Center, York University)*
- 83** Griffin proposed that there are two types evidence for consciousness in animals, neurophysiological and behavioral. On the physiological side of things, Griffin argued that we have to examine the similarities and differences of neural structure and functioning between humans and the target animals. On the behavioral side of things, Griffin argued that behavioral flexibility offers evidence of consciousness, since flexibility allows an organism to modify behavior without either biological inheritance or training (Griffin, 2002). I revisit the two types of evidence, suggesting that a focus on neurophysiological evidence has resulted in some fruitless debates about, e.g. the kinds of brains needed for consciousness, and the focus on behavior has resulted in some fruitless debates about, e.g., what kind of causal contribution consciousness adds to flexible behavior. I suggest another line of evidence that starts with a consideration of the functions of consciousness. While this approach may eventually lead to roadblocks as well, it also suggests novel tests grounded in theories such as the social function of consciousness theory (Andrews & Miller, 2025). I will describe the theory and tests that can be run with a wide range of animal species.
- 6:02** **Griffin’s astonishing conjecture: The need for consciousness in small brains**
PM *Colin Allen (University of California, Santa Barbara)*
- 84** Donald Griffin suggested that consciousness might help organisms such as honeybees compensate for the limited processing power afforded by their relatively small nervous systems. This suggestion seems odd in light of evidence suggesting that consciousness is a phenomenon arising from large, interconnected networks of neurons that are vastly bigger than a honeybee brain. I will describe the explanation that Griffin gave me when I asked him why he took such an extreme position, and I will offer a more sympathetic interpretation than I have previously provided of his astonishing conjecture.

7:00-
8:00
PM **Event on Undergraduate Engagement**
The CCS Committee on Undergraduate Engagement is hosting an open meeting, titled "Engaging Undergraduate Students in Comparative Cognition", to discuss how we can better engage undergraduate students in our field of comparative cognition. We will discuss how the committee can further support undergraduate educators, ways we can get students involved in the field, how we can effectively share resources, and ideas for future work by the committee. This gathering is aimed at faculty, post-docs, and graduate students who are interested in undergraduate education.

8:00-
10:00
PM **Poster Session II**
With cash bar available.

See poster abstracts starting on page 52.

*Note for Poster II Presenters: Please set up your posters between 9:00-11:00AM on Friday morning.

Saturday

9:30-
10:30
AM **Business Meeting (*in Opus Room*)**
All are welcome!

10:45
AM **Group Photo & Closing of Silent Auction (at 10:45AM)**
The location of the group picture will be announced.

11:00
AM **Decision Making & Learning (Chair: Kate Chapman)**

Social vs. non-social inhibitory control in a highly social cichlid

Océane Ferreira (University of Bern), Renée Massip (University of Toulouse), & Barbara Taborsky (University of Bern)

Response inhibition is essential in animals, enhancing both survival and reproductive success. Response inhibition can occur in both non-social contexts, such as delaying migration in response to climatic conditions, and social contexts, such as abstaining from aggression toward dominant conspecifics. While there is growing interest in assessing cognitive consistency across tasks, few studies have examined whether response inhibition is consistent across social and non-social contexts. We used the highly social cichlid *Neolamprologus pulcher* to explore this question. We assessed response inhibition in (1) a social context by measuring the latency of individuals to surrender a contested territory to a dominant opponent ('hierarchy test'); and in (2) a non-social context using the latency to bypass a transparent cylinder to access a food reward ('detour task'). Eight individuals were tested in both contexts. Performance across tasks was negatively correlated: individuals showing strong inhibition in one context performed poorly in the other. This suggests that response inhibition may not rely on a single general mechanism, but instead reflects context-specific processes shaped by opposing ecological demands or motivational systems. These findings contribute to our

understanding of the modularity of cognitive traits, and raise important questions about the neurobiological bases of inhibitory control.

11:07 Experimental rank dynamics in parakeets and quail

AM Elizabeth Hobson (University of Cincinnati)

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Many group-living species live within structured dominance hierarchies, but the ways that rank is achieved and maintained can vary widely across species. The basis of rank can be an individual characteristic that makes it more competitive than others in the group (like body size). In other groups, rank may emerge as a product of the social history in the group, where individuals win and lose against specific opponents and remember the identity of their opponents and the outcomes of the fights. These methods differ in the underlying cognition required: individual characteristics likely requires lower cognitive demand as competitiveness can be assessed directly from observing an individual's characteristics, while social history requires individual recognition, memory, and inference. Experimentally manipulating social groups across different species can provide insight into the amount of cognition underlying rank. Experiments with monk parakeets (*Myiopsitta monachus*) and northern bobwhite quail (*Colinus virginianus*) demonstrate that body size cannot explain achieved rank in either species. Instead, reactions to social perturbations provided evidence that memory underlies at least part of rank dynamics. High-ranked parakeets removed from the group were unable to immediately re-take their ranks, but high-ranked quail were usually able to rejoin their groups at their previous social position.

11:21 Sex differences in the use of cognitive strategies in brown-headed cowbirds (*Molothrus ater*)

AM David J. White & Nicole E. Robinson (Wilfrid Laurier University)

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Owing to the spatial memory demands associated with brood parasitism, female cowbirds are hypothesized to have better spatial abilities than males. We report here on our many failures to find such a cognitive difference. Females and males repeatedly performed similarly on a simple learning task. Over the course of experimentation, however, we discovered that males and females used different strategies to learn the task; females used global features of their environment to track food locations, whereas males prioritized local features. We assessed the breeding success of the subjects in outdoor aviaries. Females' cognitive performance related to their abilities to find nests in the breeding season. In addition, we found that males' tendency to use local cues in the cognitive tasks related positively to their copulation success. In sum, our findings supported the adaptive specialization function of spatial cognition in both sexes of cowbirds. Our initial inability to find sex differences stemmed from our failure to fully consider the potential adaptive benefits males may gain from spatial cognition – specifically, we argue, to track mates.

11:35 Birds of a feather build together: partner preferences influence nest-building decisions

AM Benjamin A. Whittaker, Simran K. Gill, Samuel Weetman-Gares, Brandon Neil, Caitlyn Nguyen, Francesca Uy, Walter Ibalio, Mylie Holmes, Tanishka Vadia, Hassan Gulab, Aryan Kalra, Gimran Kaur, Mariam Moustafa, Julia L. Self, Sofia C. Garrido-Villegas, & Lauren M. Guillette (University of Alberta)

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Collaboration occurs when two or more individuals adopt complementary roles and coordinate their actions towards achieving a shared goal: a socio-cognitive process that forms the foundation of human society. Yet relatively little is known about collaborative mechanisms in non-human taxa, leaving the evolutionary drivers that shape societies unclear. Nest building provides an ecologically salient system for testing the cognitive mechanisms underpinning collaboration, as partners: (1) share the goal of creating a nest, (2) exhibit specific building roles, and (3) differ in individual preferences for nest properties. Captive zebra finches (*Taeniopygia guttata*) build nests using their preferred string colours, wherein the male primarily deposits string but both sexes can remove string from the nest. After measuring individual colour preferences, we paired birds that either shared the same preference (agree group, n = 16) or held conflicting preferences (disagree group, n = 15). All pairs had access to both string colours during nest construction. Agreeing partners were more efficient collaborators. Disagreeing pairs removed more string and took longer to complete nests, with females in disagreeing pairs depositing more string. These results demonstrate that partner preferences impact collaboration during nest building, with mutual agreement promoting greater coordination, clearer roles, and faster goal completion.

11:49 Collective dynamics resist the decoy effect in zebrafish

AM Mélisande Aellen (University of Rochester), Rithwik J. Cherian (University of Rochester), Joe Morford (University of Rochester), Charlie Pilgrim (University of Leeds), Elizabeth Warren (Johns Hopkins)

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University), Richard P. Mann (University of Leeds), Christopher Krupenye (Johns Hopkins University), & Dora Biro (University of Rochester)

Context-dependent choice biases, such as the decoy effect, are well documented in species ranging from ants to humans. However, the expression and evolutionary significance of these biases in vertebrates remain poorly understood. Here, we investigated whether individual zebrafish and shoals differ in susceptibility to the decoy effect when choosing among habitat options. Individual fish consistently displayed decoy-driven preferences, whereas shoals remained unaffected, despite relying on the same exploration strategy. This divergence parallels patterns observed in ants, where individuals fall for the decoy, but colonies do not. However, unlike eusocial insects, whose collective resistance arises from distributed assessment, zebrafish shoals may achieve bias-resistant outcomes through simple interaction rules such as leader following and spacing. Our results indicate that collective behavior in zebrafish promotes more rational decision-making in comparison to isolated individuals. From an evolutionary perspective, the convergence of decoy-resistant group outcomes in fish and ants suggests that efficiency in collective choice can emerge through distinct but functionally comparable mechanisms across taxa.

12:03 **Collective associative learning in ant colonies**

PM

Kissai Adam (University of Rochester), Mateer Abigail (University of Rochester), Gildea Matthew (Arizona State University), Gutierrez Brissa (National Autonomous University of Mexico), Usui Ayana (University of Rochester), Sanabria Federico (Arizona State University), & Sasaki Takao (University of Rochester)

For some animals, group living is key to their survival; however, their learning performance is seldom tested in social contexts, with experimenters presenting animals with associative learning tasks in isolation. Social animals can rely on cues from group members to gain valuable information about their environment, thereby facilitating learning. These social cues may also afford greater flexibility to detect changes in fluctuating environments. Flexibility that, as shown by reversal-learning paradigms, animals often find challenging. To examine how social context impacts learning performance, we conducted associative and reversal learning assays on ants, obligately social animals. Both isolated individuals and colonies of the rock ant, *Temnothorax rugatulus*, were exposed to a two-corridor task where food was paired with colored Lego blocks, followed by a reversal of the contingencies after a set number of trials. Colony-trained ants learned the association significantly more quickly than isolated ants and also reversed their associations faster, exhibiting greater flexibility. Potential mechanisms underlying the collective learning advantage observed in our experiment will be discussed.

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12:12 **Development (Chair: Mélisande Aellen)**

PM

Stimulating Minds: Investigating the motivation of calves to engage with cognitive enrichment through participation measures

Georgiana Amarioarei (McGill University), Marjorie Cellier (McGill University), Nadège Aigueperse (INRAE, VetAgro Sup, UMR Herbivores, McGill University), Tania Wolfe (McGill University), Elise Shepley (McGill University), Abdoulaye Baniré Diallo (McGill University), & Elsa Vasseur (McGill University)

Introducing cognitive enrichment early in life may strengthen an animal's ability to learn simple and complex tasks, promote neural plasticity, and support cognitive development. This is particularly relevant for young cattle, who are in a critical developmental stage and may benefit from how cognitive enrichment shapes their behavioral expression. This study explored the effects of cognitive enrichment on weaned dairy calves by assessing voluntary participation and short-term behavioral responses. Five pairs of weaned calves were included (n = 8 treatment; n = 2 control). Treatment calves received three variations of a puzzle box with distinct challenges (push, slide, pull), presented twice daily for nine days in an isolated corridor behind their pen. We hypothesized that motivated calves would consistently engage with the enrichment and express directed natural behaviors across repeated trials. Results showed that calves reliably visited the cognitive enrichment area, with an average latency of 75.7 ± 47.0 s from the pen. They spent 65% of trial time within the enrichment zone (870.1 ± 21 s). All calves displayed a wide range of natural exploratory behaviors, and puzzle-box calves showed significantly longer behavioral durations than controls ($F = 11.7, p < 0.0001$). Altogether, these findings highlight strong, sustained motivation in calves to voluntarily participate in cognitive enrichment.

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12:26 **Beyond Words: A framework for understanding narrative selfhood in non-linguistic animals**

PM

Amber Ross (University of Florida)

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Here I present a theory of animal selfhood according to which certain non-linguistic species possess varying degrees of complex self-awareness and selfhood that reflect the degree to which they are capable of engaging in narrative thought. At root, a narrative is a story: a means of deriving significance from a series of related events. Narrative thought requires certain conceptual capacities, including the ability to conceive of episodes or events that have a causal and/or temporal structure, and to see the world as containing goals, purposes, intentions, and agents (see Garcia-Pelegrin et al., 2021). I suggest that philosophers have failed to understand robust non-human animal selfhood because we have assumed that narrative must take linguistic form. Narratives can be presented through silent movies, graphic novels, or pantomime. Narrative is a conceptual—rather than linguistic—construction. Infants can understand and impose story-structure on a series of events (Heider and Simmel, 1944), young children can create stories, and research has shown that certain non-human animals have the conceptual resources necessary to create and understand stories as well. As such, I argue that it is appropriate to understand these animals as possessing differing degrees of selfhood as characterized by the narrative theory of self.

12:42 PM *Snack Break*

1:22
PM **Animal Emotion & Personality (Chair: Gita Gnanadesikan)**

Are definitions and concepts consistent across personality studies?

Émile Brisson Curadeau (Montpellier University), Christina Petalas (McGill University), Marianne Gousy-Leblanc (McGill University), & Melanie Guigueno (McGill University)

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Animal personality has become a prominent framework for explaining individual variation in ecological research over the past two decades. However, the concept remains debated, particularly regarding how personality traits are defined, measured, and distinguished from context-dependent behaviours. To assess whether methodological recommendations proposed in key review papers (e.g., Réale et al., 2007; Carter et al., 2012; Perals et al., 2017) have been adopted in recent ecological studies, we conducted a meta-analysis of personality research published over the last ten years. We focused on three central questions: (1) How do authors ensure that they measure personality rather than situational behaviour? (2) How do researchers choose which personality traits to investigate? (3) How do they validate that the measured behaviours accurately represent the intended personality traits? Our analysis highlights substantial variation in how these issues are addressed across studies. Based on these patterns, we offer recommendations aimed at improving standardization and coherence in the design, measurement, and interpretation of personality traits in ecological research.

1:36
PM **If you're happy and you know it...: Identifying behavioral correlates of positive affect in bonobos (*Pan paniscus*)**

Lindsey Johnson & Heidi Lyn (University of South Alabama)

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Positive emotional experiences in nonhuman animals remain poorly understood, in part due to methodological challenges and concerns about anthropomorphism. As a result, research on positive affect has lagged behind work on negative affect. Our study is part of an ongoing international collaboration aimed at operationalizing behavioral indicators of positive affect across multiple species, including bonobos. Specifically, our goal was to assess whether we could identify specific vocal and/or non-vocal behaviors that may be indicative of a bonobo experiencing positive affect by observing their reaction to receiving an unexpected high-value outcome (e.g., a large amount of a preferred food item or a video call with a familiar caretaker). To piece apart behaviors associated with experiencing a surprise from those specifically associated with experiencing a positive surprise, we also included a condition in which individuals expected a high-value outcome but instead received a low-value outcome. We previously reported findings from 10 bonobos living in one managed-care population. For this presentation, we expand on that work by incorporating data from an additional seven bonobos housed at a separate facility. Behavioral commonalities and differences between the two populations will be discussed, as well as the broader implications for identifying species-appropriate markers of positive affect.

1:43 **Paw-spective Shift: Human moods influence perception of dog emotions**
PM *Clive Wynne (Arizona State University) & Holly Molinaro (Animal Wellbeing Solutions)*

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It is well-established that people's moods influence their perception of neutral human faces and other stimuli. In this study we tested how people's primed moods influenced their perception of dog emotional states in two experiments. Participants were primed into positive, neutral, or negative moods using validated visual stimuli before they evaluated the valence and arousal of dogs in video clips displaying positive, neutral, or negative emotional states. Experiment 1 utilized visual primes unrelated to animals: Experiment 2 employed dog images as primes. Although mood priming significantly influenced participants' self-reported emotions in Experiment 1, it did not affect their interpretation of the dogs' emotional states. Dog-specific primes influenced participants' interpretation of dog emotions in Experiment 2, however the effect was a contrasting one, with participants in the positively induced group rating dogs as sadder and those in the negative group rating them as happier. These findings challenge previous assumptions about mood-congruence effects in cross-species emotional perception, suggesting a more complex interplay of factors than anticipated. The study has implications for improving animal welfare and human-animal interactions.

1:59 **Mental States & Imagery (Chair: Gita Gnanadesikan)**
PM

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The pluralistic evolution of mindreading

Gavin Robert Foster (Purdue University)

Recent research in social cognition has shifted focus from non-factive mental states (beliefs) to factive mindreading, with "Knowledge-First" (KF) theorists arguing that a general capacity to attribute knowledge evolved phylogenetically early. KF theorists contend that this general sensitivity is the default mode of social cognition due to its broad adaptive utility. This paper argues against the KF view, proposing instead a "pluralistic account" of factive mindreading. Drawing on evolutionary principles, I demonstrate that the inference from success in specific tasks to a general capacity is unwarranted. Because cognitive abilities emerge to solve specific ecological challenges, species likely evolved to track narrow slices of knowledge, such as knowledge-where or knowledge-how, rather than a unified natural kind. I support this claim by analyzing comparative studies of scrub jays, primates, and lemurs, showing that species possess disconnected knowledge-attribution abilities based on distinct behavioral patterns (e.g., line-of-sight versus competency). The paper concludes that non-human animals are likely "naïve anti-reductionists," possessing specific factive state concepts without a superordinate category of knowledge, suggesting that the domain-general capacity to attribute knowledge is likely unique to humans.

2:06 **Studying mental state attribution to animated shapes in great apes using a modified Frith-Happé animations test**
PM *Hanling Yeow (Max Planck Institute for Evolutionary Anthropology), Christoph Völter (Max Planck Institute for Evolutionary Anthropology), Hyowon Gweon (Stanford University), Hannes Rakoczy (University of Göttingen), & Daniel Haun (Max Planck Institute for Evolutionary Anthropology)*

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Humans automatically attribute mental states to abstract animated geometric shapes. When presented with the Frith-Happé animations which depict two interacting triangles that appear to be reacting to either each others' mental states (theory of mind, ToM, condition) or physical goals (goal-directed condition), humans reliably interpret and categorize them accordingly. This study uses eye tracking to examine if nonhuman great apes (N = 39, data collection underway) also exhibit this automatic attribution. To ensure that gaze patterns are not confounded with kinematic properties of the animations themselves, we introduce new control animations which were manipulated to retain the same trajectory and velocity properties, but without any interpretable interaction between shapes. A validation experiment with adult human participants (N = 60) confirmed their ability to verbally distinguish between the ToM, goal-directed, and novel control conditions. Critically, gaze patterns also aligned with scores from their verbal descriptions, indicating that these measures captured more than just basic movement properties. As predicted, preliminary analyses showed both mean fixation durations and looking times increased significantly from the control to the goal-directed to the ToM conditions. These results validate the stimuli, showing that they can be a useful tool to study mental state attribution without language.

2:13 **Animal Awareness**
PM *Thomas Zentall (University of Kentucky)*

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According to Griffin (1982) awareness implies that there is an internal representation of an event to which one can respond (e.g., the ability to imagine). I describe three lines of research with animals that when studied in humans have been thought to result from some degree of awareness: (1) a form of imitation in which the observer is thought to imagine that its own unseen behavior matches that of the demonstrator, (2) episodic memory, the ability to travel back in time to recover a memory of an event (an unexpected request for information about a personal experience that was not explicitly encoded, and (3) acquired equivalence, the understanding that if two stimuli, A and B, are both associated with a common stimulus, C, that they may become equivalent, such that learning something new about stimulus A transfers to stimulus B. This process is analogous to the function of words and the objects that they represent. When something new is learned about a word it may transfer to the object that the word represents. These examples suggest that some form of awareness or imagination may occur in animals, analogous to what humans demonstrate when they show similar behaviors.

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2:27 **Gaze following during a dichotomous choice task in capuchin monkeys**

PM

Nicole Furgala (Emory University), Matthew Babb (Georgia State University), Benjamin Wilson (Emory University), Sarah Brosnan (Georgia State University), & Marcela Benítez (Emory University)

Gaze following, considered a prerequisite to perspective taking, allows for the acquisition of social and ecological information in group-living primates. Some evidence suggests that capuchin monkeys (*Sapajus apella*) follow human gaze and consider human attentional states, yet their ability to direct or exploit these states remains contested and their ability to follow conspecific gaze remains unknown. Here, we combined non-restrained eye tracking with a computerized dichotomous target choice task to test whether capuchins spontaneously follow and utilize conspecific gaze. Capuchins viewed videos of 1) conspecifics, 2) asocial stimuli, and 3) asocial stimuli with dots simulating eyes, “looking” toward one of two target icons. We assessed whether capuchins would look toward the target the stimulus oriented to and if they correctly chose that target using a joystick. Preliminary data suggest that while capuchins do not follow conspecific gaze, they do learn to use social and asocial cues in the choice task, with capuchins learning from social stimuli faster than asocial stimuli. Although they did not spontaneously track conspecific gaze, this suggests that capuchins use other social cues, such as gaze direction, which accelerates learning. Understanding how capuchins monitor and utilize these cues during social maneuvering requires further study.

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2:34 **Many reasons we thought monkeys have imagery, and one reason they might not**

PM

Robert Hampton (Emory University), Mackenzie Webster (Emory University, Loyola University of Maryland), & Brooke Jackson (Emory University)

Nonhuman animals might be highly dependent on visual imagery for memory because they lack the option of representing information linguistically. Monkeys readily perform visual memory tasks like matching-to-sample that require some mental representation of the sample image to afford matching to the correct choice at test. Monkeys actively hold these representations in working memory, demonstrated by the effects of concurrent cognitive load on memory and performance in directed forgetting paradigms. Monkeys are metacognitive about visual memory, discriminating between trials where they remember the sample and those on which they have forgotten. Monkeys mentally rotate images, and in doing so demonstrate a correspondence between the degree of rotation and the latency of their response, consistent with imagery use in humans. Together, these performances led us to believe that monkeys also use visual imagery. But human aphantasics, who deny visual imagery, also have all these cognitive capacities, indicating that this initially impressive evidence of imagery in monkeys is insufficient. We used a new pupillometry measure, shown effective with humans, to assess whether or not monkeys have imagery. Our initial evidence does not provide strong evidence for imagery in monkeys.

2:50

PM

Break

3:10 **Symposium: In Honour of the Contributions of Bob Cook
(Chairs: Muhammad Qadri & Suzanne Gray)**

PM

Effects of line orientation on texture discrimination in pigeons

Jeffrey S Katz (Auburn University) & Robert G Cook (Tufts University)

In a texture discrimination task, seven pigeons trained to locate and peck a target region were administered visual stimuli consisting of line-based textures that systematically varied in orientation between the target and

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distractor regions. Evidence for vertical, horizontal, and diagonal channels, as well target categorical attributes (e.g., steepness), and search asymmetries were found. Humans tested with similar stimulus displays to those tested with pigeons demonstrated similar search functions and asymmetries. However, humans and pigeons had different categorical processing. The comparative implications of these findings for the perception of the features of line orientation in regard to orientation channels in early vision will be discussed.

3:25 Organizing Visual Search: Mechanisms of Attention Across Species

PM *Suzanne L. Gray (Villanova University)*

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Bob Cook's contributions to comparative cognition are defined by a mechanistic approach to complex behavior. This talk reviews a collaborative research program examining how attention and behavior are organized in multi-target visual search tasks across species. Using open-ended designs that require successive selection, this research reveals systematic differences in how species structure their behavior. Humans reliably organize search into dimensionally-sensitive "runs," prioritizing reducing costs of switching attention between tasks. Pigeons, by contrast, consistently prioritize stimulus discriminability, selecting the most obviously reinforced targets first regardless of dimensionality. Although pigeons show striking flexibility when external cues guide attention, their spontaneous search behavior rarely reflects sustained endogenous control of attention—or "planning"—across successive choices. Extending this framework to nonhuman primates reveals intermediate patterns, including stable individual differences and some sensitivity to the benefits of dimensional organization. These results underscore how task structure, response requirements, and species-specific constraints shape apparent cognitive strategies, highlighting that complex behavior emerges from, and must be revealed by, the tasks used to study it.

3:40 Impacts of Sequence Organization, Information Accumulation, and Memory Capacity on Auditory Same/Different Discrimination in Pigeons (*Columba livia*)

PM *Matthew S. Murphy (Coastal Carolina University), Muhammad A. Qadri (Villanova University), & Robert G. Cook (Tufts University)*

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Sequential same/different (S/D) processing is a form of relational learning, which is a fundamental component of understanding non-human cognition. Using a go/no-go design further allows us to see on-going processing of information as a trial progresses. In these experiments, we investigated auditory sequential S/D in pigeons. One experiment examined how the organization of mixed sequences impacted changes in discriminative responding. Another experiment tested the impact of accumulation of information and mid-trial changes in sequence organization. Both experiments suggested that pigeons continuously evaluated the sequences as they progressed and responded to the most recent 3-4 items in the sequence. Implications for animal working memory and comparisons across modality are discussed.

3:55 Adaptive Experimentation – Past and Future Promises

PM *Muhammad Qadri (Villanova University)*

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Bob Cook's contributions to comparative visual cognition benefited from his skill in using computers to great effect, creating large sets of visual search arrays, rendering 3D objects and scenes in exact detail, and manipulating stimuli in creative and precise ways. One such effort used Genetic Algorithms (GAs) in combination with stimulus generation techniques to investigate visual cognition. GAs are typically a form of machine learning in which gene evolution concepts like random variation and probabilistic survival are applied to minimization problems, with the goal of allowing the "best inputs" to "survive". In the Adaptive Experimentation approach, the animal determines what the "best input" is, thus exposing the cognitive processes for researchers' examination. This talk will review three published manuscripts using GAs, focusing on improvements in the methods and highlighting the utility of the approach for comparative cognition. Additional unpublished work with GAs and potential future contributions will also be discussed.

4:10 Professor Pigeon Schools Dr. Blaisdell: How a Bird Brain Punches Above its Weight Class

PM *Aaron P. Blaisdell (University of California, Los Angeles)*

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Across 25 years of laboratory research with pigeons, I have repeatedly found that behaviors often labeled "higher cognition"—spatial inference, behavioral variation, and even apparent insight—can emerge from, and be constrained by, core associative processes. In this talk, I synthesize this work into an organized set of "lessons" learned from pigeons that brings clarity to how I interpret complex behavior. I begin with spatial cognition, using recent developments in higher-order path integration (HOPI) to illustrate how map-like

competence can arise from learned relations among cues, movements, and outcomes. This account is further supported by classic cue-competition and inhibitory-learning phenomena (e.g., blocking/overshadowing; extinction and recovery). Next, I argue that variability is not noise but an adaptive control variable modulated by inhibitory control processes, leading to the development of a Modified Law of Effect. I end with a discussion of empirical evidence that inhibition is an underappreciated driver of cognition, as demonstrated in the Partial Reinforcement Extinction Effect (PREE), suboptimal choice, and novel problem solving.

4:25
PM Closing Remarks

4:45 FEATURE SESSION: Master Lecture by Robert Cook
PM (Chairs: Muhammad Qadri & Suzanne Gray)

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Robert G. Cook (Tufts University)

7:30-
10:30
PM Banquet (*in Opus Room*)
With cash bar available. Tickets required.

Posters

Poster Session I - Thursday Evening

Poster Locations:

#1-13 in **Opus**

#14-24 in **Beethoven**

#25-35 in **Tchaikovsky**

#36-46 in **Vivaldi**

Investigating neophobia as a personality trait across sensory modalities in Asian elephants (*Elephas maximus*)

Emma K. Lam (Hunter College), Sydney F. Hope (Hunter College), Sarah L. Jacobson (Hunter College; Saint Xavier University), Matthew S. Rudolph (Hunter College), Robbie Ball (Hunter College), Chudapa Chadarat (Golden Triangle Asian Elephant Foundation), Yingboon Chongsomchai (Golden Triangle Asian Elephant Foundation), Sangpa Dittakul (Golden Triangle Asian Elephant Foundation), Marnoch Yindee (Akkharatchakumari Veterinary College, Walailak University), Taweepoke Angkawanish (National Elephant Institute, Forest Industry Organization), & Joshua M. Plotnik (Hunter College)

P1

Neophobia, an individual's fear of novelty, can influence how animals forage and avoid threats. Growing evidence across taxa suggests that neophobia is an ecologically relevant personality trait, or a behavior that is consistent within individuals across time and contexts. However, it is unknown whether responses to novelty are consistent between sensory modalities (e.g. visual, auditory, olfactory). This may be particularly relevant for Asian elephants (*Elephas maximus*) as they have highly developed acoustic and olfactory senses and may have a stronger response to sounds or odors compared to visual stimuli. The aim of this study is to determine whether neophobia in elephants is consistent within individuals and across sensory modalities (visual, auditory, and olfactory). We presented captive elephants with two novel objects (a cattle brush and a woven firehose), two novel sounds (dolphin calls and a UFO sound effect), and two novel synthetic perfumes (aldehydes and blue aqua). Neophobia was evaluated by measuring the latency to eat food (banana) after exposure to the novel stimulus. Understanding how neophobia differs between individuals and how different types of stimuli might attract or deter certain elephants can be used in the development of strategies to deter elephants involved in human-wildlife conflict.

Unison and Uniqueness: Dual forces shaping chickadee calls in a new captive colony

Sarah M.L. Smeltz, Moriah J. Deimeke, Prateek K. Sahu, Katharine H. Stenstrom, & Christopher B. Sturdy (University of Alberta)

P2

The black-capped chickadee (*Poecile atricapillus*) chick-a-dee call is variable functionally and structurally. A predominant function of this call concerns the mobilization and coordination of flock activities. It is believed these functions are supported by plastic change early during flock formation known as vocal convergence, whereby flockmates' calls become more similar, forming distinct microdialects. Vocal convergence has previously been demonstrated in wild and free-flying aviary flocks, and is suspected in individually-housed colonies. We recorded a newly assembled group of individually-housed captive chickadees over 6 weeks to better understand if and how their calls change during this period. Among-individual differences, convergence, and divergence were observed in features of the chick-a-dee call. In some features plastic behaviour differed between males and females, sometimes resulting in convergence or divergence between the sexes. Additionally, in some features variables not assessed, possibly dominance, may serve as stronger predictors than individual or sex. These results reveal the complexity of identity signalling and vocal plasticity within a single vocalization of the black-capped chickadee, and highlight the role individuality, group cohesion, sex, and perhaps other features, play during flock formation.

Laboratory-based dominance assessment for black-capped chickadees

Katharine Stenstrom, Moriah Deimeke, Prateek Sahu, Sarah Smeltz, Patrick Curiston, & Christopher Sturdy (University of Alberta)

P3

Black-capped chickadees (*Poecile atricapillus*) are small, non-migratory songbirds that live across much of North America. In the non-breeding season, chickadees form social groups called flocks which have a linear dominance hierarchy. Dominance is typically determined by observing how a pair of chickadees engage with each other at a shared food source, where a dominant bird will have preferential access to feeding and may supplant a more subordinate individual. Traditionally, dyadic dominance assessments between songbirds are performed either in free-flight arenas or in the field, where birds have physical access to each other. While chickadees do not tend to have overly aggressive dominance encounters, by minimizing physical contact between individuals while assessing dominance in the lab, we hope to reduce

the risk of injury and stress during experimental sessions. We have designed a novel, limited-contact set up to test dyadic dominance interactions with laboratory housed black-capped chickadees. This study seeks to establish whether captive black-capped chickadees 1. establish behavioral dyadic dominance ranks and 2. use the same behavioral methods of communicating dominance rank as wild/field populations. We found that chickadees readily engaged in easily distinguished dominance related behaviors, and that methods of communicating dominance rank were similar to wild populations.

Who's A Good Dyad? Examining the Perceptions and Dynamics of Undesirable Behaviour in Dog–Guardian Pairs

Hannah M. R. Burrows & Valerie A. Kuhlmeier (Queen's University)

P4 We adopted a dyadic framework to examine how guardians' beliefs about their dogs relate to interactive regulation during shared tasks. Study 1 developed and validated the Perception of Undesirable Pet Behaviours Survey (PUPS), a guardian-report measure assessing concern, comfort, and confidence across everyday behavioural contexts. Psychometric analyses revealed a reliable four-factor structure (public behaviour, obedience/training, fear/anxiety/separation distress, and behaviour in the home) and convergent and discriminant validity in relation to Dog Impulsivity Assessment Scale (DIAS) factors. Study 2 tested whether these perceptions correspond to behaviour within the dyad. Dog–guardian pairs completed a Surprise Self-Control Task, and both partners' behaviours were coded using ethograms of gaze, intervention/disengagement, and affective responses. Guardians reporting greater concern about fear/anxiety on the PUPS were more likely to let their dog take prohibited food during the task, suggesting that they predicted and wished to avoid conflict. In contrast, guardians who used gestural commands reported fewer perceived behavioural difficulties on the PUPS. These results suggest that “undesirable behaviour” and self-control do not solely reflect characteristics of the dog but instead emerge from co-regulation within the dyad. Integrating guardians' pre-existing beliefs into the study of dog-human interaction advances a relationship-centred approach to interspecies cognition, welfare, and cohabitation.

Paws, Patience, and Payoff: How Dogs Weigh Delayed Rewards

Rebecca Singer (Berea College), Ellen Furlong (Transylvania University), Nika Davenport (Berea College), Baylie Dixon (Berea College), Simon Drake (Berea College), Michael Gonzalez (Berea College), & Elaena Stemann (Berea College)

P5 Delay discounting tasks assess preferences for smaller immediate rewards over larger delayed ones, providing a framework for evaluating impulsivity that may better reflect real-world self-control challenges in dogs. We tested 71 dogs on a task where the dog had to choose between an immediate low value reward (LVR) and a spatially distant high value reward (HVR). Forty-nine of the dogs tested showed a strong initial preference for a HVR over their own kibble (LVR) and advanced to the test phase. During testing, we moved the high-value reward progressively farther away each time the dog selected it, allowing us to evaluate the maximum distance each dog willingly traveled for the HVR. Dogs varied substantially in the distances they tolerated for the HVR before switching to the immediate LVR. However, their performance did not correlate with owner reports on the Dog Impulsivity Assessment Scale (DIAS) nor the cylinder task, a classic self-control test. Methodological differences produced significant effects: dogs traveled farther when rewards initially began close and HVR moved back compared to when rewards began far and LVR moved close. These findings highlight the sensitivity of canine delay discounting performance to subtle procedural variations and underscore the need for further methodological refinement.

Does object ownership affect spatial memory in the domestic dog?

Em Sundby & Valerie Kuhlmeier (Queen's University)

P6 In humans, there are robust cognitive effects for owned objects; for example, the objects are remembered better than other objects. We investigated whether *Canis familiaris* (the domestic dog) has improved memory for objects that they “own.” Study 1 built from the premise that dogs are subject to their guardians' beliefs and behaviours regarding object ownership, and examining guardian beliefs regarding dogs' object ownership may reveal reasons for individual differences in dog behaviour towards owned objects. Thus, we developed the Perceptions of Object Ownership in Dogs' Lives (POODL) survey. Results of the survey suggested that guardians (n = 99) believe that dogs can own objects. In Study 2, we examined whether dogs (n = 53) exhibited improved memory for hidden “owned” objects compared to novel objects across three retention intervals (0s, 30s, 60s). In this spatial memory task, we did not find a significant difference between dog performance for owned and novel objects. Further, guardian beliefs about ownership were not related to dog memory performance. However, there was significant decrease in performance across retention intervals in the novel object condition (p = .02), but not the owned object condition (p > .05), suggesting owned objects may offer a small protective effect in memory for dogs.

Systematic Operant Conditioning for Canine Experimental Video Enrichment (CEVE) Use in a Domestic Dog

Maya Davis (Eckerd College), Caroline Simpson (Eckerd College), Allison Kenawell (Eckerd College), Amanda Crossen (Eckerd College), Sarah Nadler (Eckerd College), Kelley Winship (Navy Marine Mammal Program), & Lauren Highfill (Eckerd College)

P7 The process of training animals to interact independently with computerized enrichment devices requires strategic shaping, a defined reinforcement contingency, and an interface design that is appropriate for different animal species. Building on Winship's Enclosure Video Enrichment (EVE), we have developed and applied a systematic operant conditioning protocol

to teach Orlo, a domestic dog, how to use the Canine Experimental Video Enrichment (CEVE) device, a four-button, non-touch screen gaming interface originally designed for sea lions. Over 11 months and 66 training sessions, Orlo progressed through sequential shaping phases that included target training, stationing, paw-target shaping on individual buttons, discrimination learning with gradually increasing stimulus complexity, and full CEVE game trials with efficiency criteria. We evaluated Orlo's learning style, motivation, and training history to determine our teaching technique. This method helped us pace sessions and make tasks harder or easier. Positive reinforcement, errorless learning, and handler consistency are also important. These improvements took into account how canines and marine mammals think and move and helped Orlo use the four-choice interface more precisely, independently, and consistently. This training-based proof-of-concept indicates dogs can use complex digital enrichment systems and highlights the time commitment required to adapt EVE-style enrichment across species.

Behavioral asymmetries in dogs are context dependent

Daniel J. Horschler & Jessica N. McAlpin (Hill's Pet Nutrition)

P8 Motor lateralization in dogs, thought to reflect hemispheric specialization, has been linked to various behavioral phenotypes, emotional traits, and guide dog training outcomes. Importantly, many cognitive tests for dogs employ laterally presented stimuli, raising the possibility that behavioral asymmetries may bias test responses. Our study sought to determine if individual-level side preferences may be observed within or across different behavioral tests. We tested 12 dogs on a two-bowl task measuring side preference via food consumption, and two cognitive tasks requiring lateralized responses: a reversal learning task and a short-term memory task. We show that individuals may exhibit side biases within tasks, as initial side preference significantly predicted subsequent preferences within the reversal learning task ($p = .02$). However, we found no evidence of individual-level side biases across tasks, suggesting that side preferences are context dependent. Taken together, our findings substantiate prior work documenting behavioral asymmetries in dogs, and additionally suggest that individual-level side biases do not systematically influence responses across behavioral tests.

Evaluating a Four-Button Computerized Gaming System for Cognitive Engagement in Dogs

Caroline Simpson (Eckerd College), Maya Davis (Eckerd College), Allison Kenawell (Eckerd College), Amanda Crossen (Eckerd College), Sarah Nadler (Eckerd College), Kelly Winship (National Marine Mammal Foundation), & Lauren Highfill (Eckerd College)

P9 Cognitive enrichment is essential for improving the welfare of animals in kennels, shelters, and laboratories. Touchscreens have been used to engage dogs cognitively, but they are limited in functionality. This study tested whether a domestic dog could use a four-button computerized gaming system adapted from the Enclosure Video Enrichment (EVE) system originally designed for sea lions. We trained Orlo, a therapy dog in training, to operate the Canine Experimental Video Enrichment (CEVE) system, the first known instance of a dog engaging with a non-touchscreen gaming interface. Over 11 months, Orlo completed the Cursor Training Game (CTG) in 66 training sessions (~21 total hours), demonstrating steady improvement in response time and accuracy. He consistently met the button press efficiency criterion but had longer latencies than sea lions, which appeared to reflect active engagement rather than misunderstanding. Since July 2024 he has worked on the Maze Training Game (MTG), progressing through the Intro-Maze and regular MTG phases by meeting criteria of two sessions above 80% correct in a row. Orlo is now in the pre-test phase. This study provides proof-of-concept that dogs can operate a four-button gaming interface, though substantial training may limit immediate applicability in some settings.

The Effects of Aging on Dog Olfaction

Lane Montgomery, Sarah Krichbaum, Jeffrey S. Katz, Lily Hillman, Lauren Taylor, Emma Cox, Courtney Collins-Pisano, & Lucia Lazarowski (Auburn University)

P10 The impact of aging upon various dog cognitive abilities has been increasingly studied. However, few studies have sought to quantify the influence that aging can have upon dog sensory domains, such as olfaction. In the current study, the effect of age on dog olfaction was examined. Adult and senior dogs ($n = 42$) completed a form of the Natural Detection Task, an odor detection task that allows examination of dog olfaction without prior training in the task. The task included four levels, three measuring odor sensitivity via varying levels of odor concealment, and one measuring odor selectivity via the addition of a secondary odor. Measures of accuracy, hit rate, and false alarm rate were calculated for each task condition and overall (i.e., collapsed across conditions). Notably, dog age impacted the odor selectivity condition and overall task performance, but this effect was dependent upon the prior training history of the dog. Age did not directly impact the odor sensitivity conditions. These results indicate that dog olfactory detection can be impacted by age but, importantly, effects may be protected against by certain factors and may only appear when examining odor selectivity.

Puzzles and Persistence: Long-Term Memory in Domestic Dogs

Dylan Davidoff (Eckerd College), Dawn Melzer (Sacred Heart University), Deirdre Yeater (Sacred Heart University), &

P11 *Lauren Highfill (Eckerd College)*

Long-term memory in canine subjects has been previously studied using tasks such as odor recognition, individual human recognition, and inanimate object recognition. Furthermore, other species (e.g., otters) have also been observed using novel

foraging tasks to demonstrate a capacity for long term memory. The goal of this study was to evaluate long-term memory in *Canis lupus familiaris*, using four novel puzzle feeders varying in difficulty. Canines were evaluated for latency: time taken to solve the puzzle, retrieving the food reward, at both the initial and one-month follow-up sessions. Sex, age, personality traits, time spent engaging various body parts with the puzzle, and behavioral strategies used were also assessed. Preliminary analysis of our results suggest that canines have a faster latency and use different behavioral strategies to solve the puzzle tasks in the one-month follow-up, providing evidence of long-term memory in canine subjects.

How does domestication shape responses to communicative cues? Evidence from a novel marker task in dogs and dingoes

Ava Cahill (Johns Hopkins University, Boston College), Molly Byrne (Pace University, Boston College), Shennai Palermo (Boston College), & Angie Johnston (Boston College)

P12 Dogs (*Canis familiaris*) are unusually flexible in following human communicative cues due to domestication, and comparing them to dingoes (*Canis dingo*), a remnant proto-dog, can provide unique insight into the early stages of speciation and how domestication has influenced dog cognition. We investigated how domestication plays a role in understanding human communicative cues, namely if the ability to follow a novel communicative marker is a product of domestication and thus present in dogs but not dingoes. Study 1 compared dogs' and dingoes' ability to follow a contralateral point and a marker. We hypothesized that dogs would follow both cues, while dingoes would only follow pointing. We found that both species followed a marker, while only dogs followed pointing. In a follow-up study assessing how dogs and dingoes used the marker, we compared performances in communicative and noncommunicative contexts. We found that dogs' performance in the marker task was more dependent on communicative context than that of the dingoes. These findings together suggest that domestication has fine-tuned dogs' sensitivity to human communication, but both species were able to use the marker effectively, suggesting that the task might not be as strong a test of communicative ability as previously thought.

ManyOtters: Navigating the Complexities of a Big Team Science Project

ManyOtters, Heather Manitzas Hill (St. Mary's University), Caroline M. DeLong (Rochester Institute of Technology), & Deirdre Yeater (Sacred Heart University)

P13 ManyX groups take the big team science approach to investigating animal cognition (e.g., ManyPrimates, ManyDogs, ManyFishes). We have initiated a ManyOtters group to promote studies with larger sample sizes and a variety of species of otters, while developing a collaborative network of scientists and facilities. ManyOtters project 1 focuses on long-term memory. We successfully completed a pilot study with three facilities and three species of freshwater otters: North American river otters (*Lontra canadensis*), Asian small-clawed otters (*Aonyx cinereus*), and African spotted-necked otters (*Hydrictis maculicollis*). We now have started the main study and are experiencing challenges getting some facilities to start or complete their data collection process. Some examples of the challenges include: slow submission process of proposals, composition of team members, adapting materials for different species, and project execution. We will discuss problems and potential solutions to conducting a big team science project in animal cognition. We would like to engage others involved in big team science projects or those conducting work at zoos and aquariums to explore these issues with us.

Self-recognition and Social Stimulus Interest in Corn Snakes

Zimri Prutschi, Maggie-Rose Johnston, & Noam Miller (Wilfrid Laurier University)

P14 Self-recognition has been observed in a wide range of species, from ants to chimpanzees. Self-recognition is usually tested using the mark test: if an animal investigates marked areas of themselves more than control stimuli, they are considered to have passed the test. Recently, odour-based versions of the test have been used with species that are not primarily visual. We exposed 14 corn snakes (*Pantherophis guttatus*) to scent stimuli (themselves, a marked version of themselves, snake oil, a same-sex conspecific, several conspecifics, or a heterospecific) one at a time, in a within-subjects counterbalanced design. Attention to the stimuli was assessed by filming the trials and recording the snake's tongue flicks when close to the stimulus. We found that snakes spent significantly less time next to the marked version of their own scent than their own unadulterated scent. No other comparisons were significant. Though this result is the opposite of what we predicted, as snakes appear to pay less attention to their own scent when it is modified, it nonetheless suggests that they possess self-recognition abilities.

Human emotional odours collected in situations of disgust or sadness modulate horses' behaviour and physiology

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P15 Human emotional odours, particularly those released when people experience fear or joy, have been shown to influence the behaviour and physiology of several domestic species, including dogs and horses. Building on these findings, this study investigated whether human odours collected in two other emotional contexts — sadness and disgust — could affect horses' behavioural and physiological responses when presented alongside corresponding visual and auditory emotional cues. Fifty-nine Welsh mares were exposed to human sweat odours obtained under controlled emotional conditions while watching videos of human facial expressions displaying the same emotions. Heart rate and behavioural indicators such as posture and

locomotion were recorded. Results showed that exposure to sadness odour induced lower arousal: horses spent more time with a low neck posture and exhibited a significant decrease in heart rate compared with a neutral odour, indicating a calmer state. Conversely, disgust odour triggered higher arousal, with increased movement and elevated heart rate relative to neutral conditions. These findings demonstrate that human emotional odours can modulate horses' emotional state in a multimodal context, highlighting olfaction as an important channel in human-horse communication.

Individual Acoustic Variation and Acoustic Behaviour Responses of the American Pika (*Ochotona princeps*)

Alice Rainville & Shannon Digweed (MacEwan University)

P16 Acoustic communication is a valuable way for animals to engage in conspecific social interactions due to its low-energy cost and long-distance transmission. Individual identity characteristics in conspecific calls can be used to discriminate between neighbours and more threatening strangers, which influences the assessment and subsequent behaviour of perceivers to that call. This is generally observed as higher aggression to stranger versus neighbour calls. The communication system of the American pika (*Ochotona princeps*) is surprisingly diverse for a solitary non-aggressive lagomorph. Most commonly, they produce a single short squeak with intense frequency in the summer months. This call hypothetically facilitates recognition of conspecifics and territorial protection. Based on our analysis of calls from multiple individuals, individual identity characteristics are present in this call. We also conducted playback experiments with conspecific stranger, heterospecific non-predator, and predator calls to better understand behaviour and acoustic pattern responses. While the pika attended to both conspecific and predator calls, they were only vocally responsive to a specific predator call. While this suggests that the American pika can recognize each other based on their unique call, a perceiver's assessment and response to the single squeak may be influenced by environmental contexts beyond recognition of strangers.

Behavioral coping mechanisms of stress in wild savanna dwelling chimpanzees (*Pan troglodytes*)

Leah T. Williams (Hunter College), Emma G. Thurau (Lehman College), Jessica M. Rothman (Hunter College), & Kirsty E. Graham (Hunter College)

P17 Numerous studies support that coping mechanisms of stress and anxiety are evolutionary conserved across animals. Humans and nonhuman primates exhibit a wide range of emotions, including behaviors associated with self-soothing to ease stress. However, stress may vary by contexts as a result of environmental and social factors. Here, we investigated how coping mechanisms differed in various stressful contexts. Specifically, we scored 271 videos of wild chimpanzees (*Pan troglodytes*) in Fongoli, Senegal different contexts (e.g., aggression, sexual, tool-use and traveling). These videos spanned over 4 hours of footage and were taken between May 2020 to June 2023 with an average video time of about 2 minutes. We observed stress-related behaviors (including self-scratching, avoidance, and grooming) to evaluate how stress behaviors varied by context. Our results will include a behavioral analysis on what coping mechanisms chimps engage in the most, what contexts do chimps often need to cope from, and from each of those contexts which is the more strongly correlated stress coping strategy.

Too toasty for toads? Investigating how developmental temperature impacts brain size and cognitive abilities in American toads across life stages

Ella Parkinson, Chiara Alfinito, & Frederic Laberge (University of Guelph)

P18 With global temperatures rising, understanding how developmental temperature impacts brain development and behavioral flexibility is of critical importance. We investigated the effects of developmental temperature on brain size and cognition in larval and juvenile American toads (*Anaxyrus americanus*) hatched from eggs collected in southern Ontario, Canada. Temperature treatments were chosen to represent pre-industrial temperatures at the egg collection site, present conditions, projected global warming and extreme warming scenarios. Larvae were exposed to their respective temperature treatment from two weeks post-hatch until metamorphosis. A subset of larvae were sampled just before metamorphosis (Gosner stage 42) to measure relative brain size. The remaining larvae were raised through metamorphosis for cognitive testing, for which we used color discrimination, reversal learning, and a detour task. Our findings indicate that larvae raised at extreme temperatures have relatively smaller brains. Cognitive testing is currently being conducted, allowing us to determine if the reduction in brain size observed in the larvae is associated with lower cognition post-metamorphosis. Following cognitive testing, we will be able to discover if the reduction in brain size is carried over from the larval stage, or if there is compensatory growth post-metamorphosis. These data will all be available for presentation at the conference.

Do Goldfish Visually Discriminate Between Achromatic 2D Stimuli?

Rose Khoobyar, Maya Garaway, Anna Sofia Hege, Sasha Markle, Jo Clore, Riley Heckman, Lumi Poysa, Hope Hebert, Julia Zelvinsky, & Caroline M. DeLong (Rochester Institute of Technology)

P19 Object constancy is the ability to recognize objects at various aspect angles. We have found that goldfish can recognize chromatic stimuli at all aspect angles but find achromatic stimuli more difficult to recognize in an object constancy task. This study presented ten goldfish (*Carassius auratus*) with a pair of achromatic 2D stimuli depicting objects made of black LEGO® blocks rotated at different aspect angles (0°, 90°, 180°, or 270° in the picture plane and two depth planes). Only four subjects learned to discriminate between the stimuli at 0°, three of whom were experimentally naïve. In the first test phase, stimuli were rotated in the picture plane. Two fish performed well (M = 81%) and two fish performed poorly (M =

59%). Thus far, one fish has completed the second test phase in which stimuli were rotated in a depth plane ($M = 65\%$). The same task with a different pair of black LEGO® stimuli was previously presented to seven goldfish, but only one fish succeeded ($M = 74\%$). This study and others indicate that most goldfish struggle to achieve object constancy without color cues. However, some individuals (particularly subjects who have not previously viewed color stimuli) can learn this task.

An Investigation of Visual Pattern Perception in Goldfish (*Carassius auratus*)

Maya Garaway, Anna Sofia Hege, Logan Brownell, Rose Khoobyar, Jo Clore, Julia Zelvinsky, Sarah Borkowski, Riley Heckman, & Caroline M. DeLong (Rochester Institute of Technology)

P20 Pattern perception is an important cognitive skill that supports learning and prediction for many species, but fish have not often been tested. Our two experiments examined the ability to discriminate between stimuli with a regular pattern and stimuli lacking a pattern in goldfish using a two-alternative forced-choice task. In the first experiment, the stimuli were regular and irregular sine waves. All seven goldfish failed to discriminate between the stimuli. In the second experiment, the stimuli were sequences of blue triangles, red squares, and/or yellow circles presented in a regular pattern or a random sequence. Two out of seven goldfish learned to discriminate between the training stimuli in three stimulus pairs and were tested with novel stimuli. One subject's performance exceeded chance, and one subject's performance was not better than chance ($M = 55\%$). The current study does not provide strong evidence for pattern perception in goldfish, but we will continue to explore this ability in future experiments with different stimuli. Understanding the pattern recognition capabilities of goldfish could provide insight into other cognitive processes in goldfish, including conspecific recognition and an understanding of abstract rules.

Is Inference by Exclusion Accessible to Metacognition in Rhesus Macaques (*Macaca mulatta*)?

Brooke N. Jackson, Zina Alsheklee, Mackenzie Webster, & Robert R. Hampton (Emory University)

P21 Metacognitive information seeking involves recognizing knowledge gaps and acquiring missing information. Inference by exclusion involves identifying correct solutions by eliminating alternatives. Combining these phenomena raises the question of whether metacognitive awareness extends to knowledge derived through inference, or is limited to directly observable information. Rhesus macaques performed a computerized, color-based match-to-sample task, with some response options concealed. In Phase 1, all monkeys successfully used inference by exclusion, selecting concealed icons above criterion when visible alternatives were incorrect. In Phase 2, monkeys learned to use an info-peek button to sequentially reveal concealed colors, seeking information only until the target appeared. We are now testing whether monkeys integrate both abilities. Critical test trials present two out of four icons concealed, one being the target. Efficient search involves one reveal and then use of inference, whereas insufficient search involves zero reveals, and excessive search involves two reveals. If inference by exclusion is accessible to metacognitive control, then monkeys will favor efficient over insufficient or excessive strategies. Such results would demonstrate that macaques treat inference as knowledge for guiding metacognitive decisions.

Enacted Accountability in Dolphin Cooperation: A Minimal Theory of PRNR

Steven Clark (University of Florida)

P22 This project advances a minimal, practice-first framework for identifying enacted accountability in dolphin cooperation. Proto-Rational Norm Responsiveness (PRNR) isolates four observable dimensions that jointly realize accountable coordination: shared task layout (SSD), targeted correction of task-relevant deviations (EC), role-guided contribution (MER), and restorative control that returns the group to the same ongoing activity after mistakes (SRR). PRNR functions as a homeostatic profile of jointly stabilizing markers, which explains variation across settings without appeal to strict identity conditions. I propose a provisional sufficiency rule: SSD and EC plus at least one of MER or SRR under social maintenance; I also specify "routes to unconfirmed evidence" to reduce over-attribution from surface order alone. A compact suite of indices and perturbation tests (conformity, audience effects, repair latency, role-disruption cost) operationalizes the profile. Applying the framework to coordinated mullet-herding at Cedar Key, Florida, reveals parameter-specific corrections, role-sensitive timing, and rapid restoration consistent with accountable practice rather than mere synchrony. The result is a philosophically precise, empirically tractable standard for recognizing nonlinguistic accountability, with clear predictions for field and laboratory tests and practical implications for conservation that protects partnership histories and the contexts that sustain cooperative practice.

Is Innovation Repeatable? Problem-Solving in Wild Asian Elephants (*Elephas maximus*) Across Two Puzzle Paradigms

Danielle R. Antonellis (Hunter College), Sarah L. Jacobson (Hunter College), Sydney Hope (Hunter College), Sangpa Dittakul (Golden Triangle Asian Elephant Foundation), Yingboon Chongsomchai (Golden Triangle Asian Elephant Foundation), Marnoch Yindee (Akkharatchakumari Veterinary College), & Joshua M. Plotnik (Hunter College)

P23 In the face of rapid anthropogenic change, the ability to innovate can improve foraging outcomes for animals in increasingly fragmented habitats. For elephants, this cognitive flexibility results in crop raiding and conflict involving humans in landscapes where elephants have habituated to or learned to circumvent deterrents. Wild Asian elephants in the Salakpra Wildlife Sanctuary in Thailand previously showed individual variation in problem-solving while interacting with a multi-access puzzle box. The current study provided the same population with a second version of the box, requiring three new

solutions to access food. We aim to validate associations between innovation and behavior observed previously in this population and assess whether individuals who have interacted with both puzzle boxes will innovate consistently over time and between the two boxes. We will present elephants' neophilia, persistence, and exploratory diversity scores when interacting with the new puzzle box, as well as associations between these behaviors and their problem-solving performance. To determine whether performance is repeatable, we will present a comparison of innovation scores for the individuals who interacted with both versions of the puzzle box. These results could help establish innovation as a personality trait in elephants and inform mitigation strategies targeted towards highly innovative elephants.

Do colored novel objects impact cichlid aggression?

Madison Fanning, Amelia Keeseey, Joshua Wolf, & Susan Lewis (Carroll University)

P24 Fish within a zoo setting are often exposed to stimuli in the form of shirts that the guests are wearing which could potentially impact the behavior and stress of the fish in the tank. Because cichlids tend to engage in aggressive behaviors (e.g. fin flares, fighting) towards conspecifics of the same coloration, it is possible that extra-tank visual stimuli from zoo patrons may impact cichlid behavior, specifically aggression. Two species of cichlids (*Haplochromis piceatus* and *Haplochromis degeni*) within the Lake Victoria tank were observed at the Milwaukee County Zoo. Before the two-minute interval, there was randomization of the color of stimuli that would be presented. Novel stimuli were introduced by affixing colored paper (i.e. red, black, white, or green) to the outside of the tank. Focal animal sampling was used to record the behaviors of the focal fish within the interval, and scan sampling was done every thirty seconds to assess the proximity of the fish within a body length of the paper. We recorded the frequency of fin flares, approaches, and fighting during the intervals. We expected to see more aggressive behavior during the intervals with red paper. However, the observed difference between colors was not significant.

Extremes in Suboptimal Choice: Pigeons Prefer 10% over 100% Food

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

P25 Pigeons and other animals sometimes prefer an alternative that provides a lower probability of food over one that provides a higher probability of food. This choice, often referred to as suboptimal, occurs when the delivery of food or no food is differentially signaled by stimuli during a delay only on the leaner (suboptimal) alternative. Choice of either alternative led 10% of the time to a short (10 s) delay and 80% of the time to a long (40 s) delay. The suboptimal alternative provided food only after the short delay, but the optimal alternative provided food on every trial regardless of delay. In the first condition, neither alternative provided differential signals during the delays, and pigeons strongly preferred the optimal alternative. When short and long delays on the suboptimal alternative were signalled by distinct delay stimuli, preference reversed and the suboptimal alternative was strongly preferred. These results are consistent with predictions of the Signals for Good News (SiGN) model.

Waiting for Reward: Preference for Signalled Delays Increases With Average Wait Time

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

P26 When rewards occur after a delay, signals that the wait will be shorter than average can be valuable. A recent study by Macias et al. (2024) found that pigeons preferred an alternative providing signals for a short or long delay to food over an alternative that provided no signals about delay. Preference for the signalled alternative increased with increases in the ratio of the long to short delay, with the average delay held constant. Here we report a preregistered experiment that tested the effect of changing the average delay, with the ratio of long to short delays held constant. Pigeons preferred the signalled alternative, and this preference was higher at longer delays (20 s and 40 s) than shorter delays (2 s and 4 s). This finding is opposite to the predictions from the modified Delta-Sigma model proposed by Macias et al., but fits well with predictions of the SiGN model, which assumes that signals for a reduction in delay to reward reinforce choice.

Got Self-Control? Investigating Inhibitory Control in the North American Red Squirrel (*Tamiasciurus hudsonicus*)

Marko Muselin & Shannon Digweed (MacEwen University)

P27 The detour task is commonly used in comparative cognition to explore abilities related to motor self-regulation, inhibitory control, social learning, and route planning. These tasks generally involve presenting individuals with a situation in which the direct route to a goal is blocked and a detour must be made to obtain it. Our study explores the use of a locomotor detour task in the North American red squirrel, in a field setting. Each individual was presented with a detour apparatus that required a locomotion detour around a clear barrier in order to obtain a valued reward. Results indicate that squirrels can successfully navigate the task within the allowed time period and random apparatus orientation. Thus, our preliminary results may suggest that red squirrels may have motor-self control in a foraging related task and thus require further exploration with other detour and motor-control related tasks.

P28 Sex differences in spatial memory persistence of brood-parasitic brown-headed cowbirds

Kieran Guimond & Mélanie Guigueno (McGill University)

Many fitness-related behaviours in wild birds depend on spatial cognitive abilities, such as migration, food caching, and nest site selection. When a sex difference in spatial cognition exists in animals, it is usually male-biased (e.g., most polygynous rodents). In brood-parasitic brown-headed cowbirds, however, females are predicted to have better spatial cognition as they search for host nests unaided by males. Studies have shown that female cowbirds have improved short-term spatial memory compared to males but have not yet addressed the long-term spatial memory of cowbirds and how males and females compare at increasing scales of memory retention. To address this gap, male and female cowbirds were trained on two spatial tasks to find one rewarded location and then repeated the test 24 hours, three days, and three months later. We predicted that a female-biased sex difference would only persist during the length of the breeding season (about two months). We present initial results and discuss how our research deepens understanding of the role of sex-specific selection on spatial cognition, and more broadly, how ecology can shape cognitive traits.

Demonstrating spatial cognition and free-choice through human-animal interactions with cownose rays (*Rhinoptera bonasus*) in a touch tank environment.

Riley Stoppa (Eckerd College, ZooTampa at Lowry Park), & Kerry Gray (ZooTampa at Lowry Park)

P29 Public touch tanks provide unique opportunities to examine animal learning and behavioral flexibility in dynamic, choice-based contexts. This study assessed whether cownose rays (*Rhinoptera bonasus*) at ZooTampa's Stingray Shores exhibit individual differences in engagement that may reflect learned responses to human behavior. Using focal sampling and the ZooMonitor app, behavior was recorded for 12 rays to quantify approach, ignore, or avoidance responses to visitor actions categorized as calm, unexpected, or chaotic. Results revealed significant individual variation in approach and ignore behaviors, but consistent rates of avoidance across rays, suggesting stable individual patterns rather than random responses. These findings indicate that stingrays can discriminate between types of guest behavior and may adjust their responses based on prior experience or comfort level. Furthermore, more interactive rays spent their time in areas where interactions were more likely to happen, whereas less interactive rays occupied themselves elsewhere. Such behavioral flexibility highlights the potential for learning processes to shape voluntary participation in human-animal interactions. The results emphasize the importance of designing free-choice environments that recognize individual differences in engagement and provide opportunities for animals to exercise control in interactive settings.

Does Belief in Animal Cognition And Emotion Mediate The Effect of Human Value Orientations On Ethical Behaviour Towards Animals

Ezekiel Gading, Suzanne MacDonald, & Adrienne Perry (York University)

P30 What drives humans to treat animals well? As scientific evidence for animal sentience gathers, it is important to include stakeholders (e.g., farmers, people who live in rural areas) in conversations to ensure positive outcomes for animal well-being. The theory of planned behaviour predicts that values influence beliefs, which in turn influence attitudes and behaviours in humans. Thus, productive conversations that result in behavioural change entail understanding how human values and beliefs drive ethical behaviour (Fulton et al., 1996). The purpose of this research was to understand the relationship between value orientations (domination/mutualism), human beliefs about animal cognition and emotions and ethical behaviour. We surveyed participants from rural Ontario and Costa Rica about their beliefs about animal cognition and emotion, their behaviour towards animals, along with a modified Wildlife Value Orientation questionnaire (Vaske, 2011). We found relationships among value orientations, beliefs about animal cognition and ethical behaviour. We explored whether and in what way beliefs about animal cognition and emotion mediate the effect of value orientations on ethical behaviour towards animals. The findings have implications for the application of animal cognition research to animal ethics as well as the social influences on our expectations about how animals think and feel.

Investigating individual differences in behavior: an experimental approach to human-elephant conflict mitigation

Matthew S. Rudolph (Hunter College), Robbie Ball (Hunter College), Chudapa Chadarat (Golden Triangle Asian Elephant Foundation), Yingboon Chongsomchai (Golden Triangle Asian Elephant Foundation), Sangpa Dittakul (Golden Triangle Asian Elephant Foundation), Sydney F. Hope (Hunter College), Sarah L. Jacobson (Hunter College, CUNY), Marnoch Yindee (Akkharatchakumari Veterinary College; Walailak University), & Joshua M. Plotnik (Hunter College, CUNY)

P31 Asian elephants (*Elephas maximus*) face multiple challenges, including habitat loss, which pushes them to forage in farms and other human-dominated landscapes. Whether elephants and other wildlife species engage in negative interactions with humans in these agricultural environments may depend on individual differences in behavior and cognition. Over the past six years, our team has collected behavioral data – across acoustic, olfactory, and visual sensory modalities – on wild Asian elephants living in the Salakpra Wildlife Sanctuary. The results of behavioral experiments on boldness and neophilia were integrated into a single playback apparatus, the Targeted Personality Device (TPD); this is a transportable device that can be installed in agricultural landscapes and programmed to deliver different combinations of lights, sounds, and odor based on individual, behavioral 'profiles'. Following baseline observations, the device was programmed on the most common personality profile of elephants observed approaching the crop field and deployed for several weeks. To measure effectiveness, we compared elephant behavior (i.e., crop raiding frequency and responses to the TPD) between baseline and experimental periods. We will present data from this deployment and plans for the future, as well as discuss how individual variation in behavior and cognition can be applied to conservation practice.

How do capuchin monkeys distract themselves from rewards for self-control?

Yui Sugimoto, James R. Anderson, & Hika Kuroshima (Kyoto University)

P32 In delay-of-gratification tasks—where individuals can obtain a larger reward by waiting—diverting their attention away from the reward facilitates self-control and promotes longer waiting. Because waiting often requires individuals to tolerate immediate temptation, self-distraction is considered a key mechanism that enables successful delay of gratification. We tested nine tufted capuchin monkeys using an accumulation task in which the amount of available food items increased over time until the monkey reached to take items. Three of the nine monkeys successfully waited, and they showed behaviors that appeared to divert their attention from the rewards. These findings suggest that, in some capuchins, self-distraction behaviors may occur even in the absence of potential distractors. We then conducted the accumulation task again, providing visual stimuli that could potentially serve as distractors, in order to test whether monkeys that did not exhibit self-control in the first experiment without distractors might show self-control when distractors were present. This study is the first to investigate self-distraction abilities in a nonhuman primates species other than humans and chimpanzees, asking whether cognitive capacities related to self-control are shared more broadly across species.

Altered Causality Perception in Parkinson's Disease

Hadi Choubdar Parvin (Shahid Beheshti University of Medical Sciences), Zahra Rostami (Shahid Beheshti University of Medical Sciences), Mehri Salari (Shahid Beheshti University of Medical Sciences), Arash Soltani (Shahid Beheshti University of Medical Sciences), & Maryam Vaziri Pashkam (University of Delaware Newark)

P33 Causality perception, the ability to infer causal relationships from dynamic visual events, is a fundamental aspect of cognition. Here, we investigated whether and how this process is disrupted in Parkinson's disease (PD), a neurodegenerative disorder marked by both motor and cognitive impairments. Using a psychophysical paradigm based on Michotte's launching effect, we compared visual causality judgments in 15 PD patients and 15 age-matched healthy controls. Participants judged whether one object appeared to launch another or pass through it, across trials with systematically varied spatial overlaps. PD patients showed a robust shift in perceptual bias away from causal interpretations, reflected in significantly lower points of subjective equality (PSE) and shallower psychometric slopes, indicating reduced sensitivity to overlap cues. Two control experiments ruled out alternative explanations based on basic visual differences: (1) spatial overlap perception was intact in PD, and (2) in healthy controls, causality judgments remained stable across multiple stimulus speeds. Together, these findings suggest that PD is associated with a specific impairment in processing visual causality, not attributable to low-level perceptual deficits. These results highlight disrupted integration of sensory input and cognitive inference in PD and suggest that altered perceptual processing may contribute to broader cognitive symptoms in the disorder.

Foundation for comparative psychology in plants

Brody Nagtegaal (University of Alberta), Ximena Nelson (University of Canterbury), Tanya Shoot (Concordia University of Edmonton), Colleen St. Clair (University of Alberta), Alex Taylor (Universitat Autònoma de Barcelona), & James F. Cahill (University of Alberta)

P34 Nutrients in soil guide plant growth and are heterogeneous in space and across time. This study investigates whether plant root systems retain and use previously experienced spatial information on nutrient availability in their growth. Our objectives are: (1) characterize species-specific root foraging near nutrient patches, (2) test whether roots retain spatial information and display anticipatory growth based on prior experience. Plants grown in rhizoboxes-clear containers for non-destructive root imaging-enabling comparison of root growth traits at individual and species levels across time. To test for anticipatory growth, plants were grown in modified rhizoboxes containing localized fertilizer patches positioned in soil strata near either the surface or the bottom, along with a vertical partition that initially restricted lateral root growth. During an initial exploratory phase, roots were confined to a limited soil layer. Following this period, the partition was removed, allowing access to previously unoccupied soil containing no fertilizer rewards. Evidence of anticipatory growth is inferred when root growth traits into soil strata previously associated with fertilizer more closely resembled growth patterns near fertilizer patches, despite the absence of a fertilizer cue in the novel soil.

Investigating quantitative discrimination in Red-Eared Sliders (*Trachemys scripta elegans*)

Haley Pattison (Waynesburg University), Dr. Jenny Jellison (Waynesburg University), & Christian Hayes (Waynesburg University)

P35 Red-Eared Sliders (*Trachemys scripta elegans*) have previously demonstrated quantitative discrimination consistent with Weber's Law in limited studies. This project further investigates this ability by examining performance at both previously tested and higher, untested ratios. Two adult Red-Eared Sliders will be trained using food reinforcement to discriminate between two sets of visually identical red cubes and then select the larger set. Following acclimation and pretraining, turtles will complete 20 trials per day for 5 consecutive days for each of the 5 ratio pairings (2 vs. 4, 4 vs. 5, 5 vs. 6, 6 vs. 7, 9 vs. 10, and 19 vs. 20), with the correct choice rewarded. By replicating previous methods and expanding to test more difficult ratios, this study aims to identify potential limits to these skills and to evaluate whether turtles continue to follow Weber's Law at higher ratios, contributing to our understanding of limits and mechanisms within reptilian cognition.

Possible differences in short-term memory processes between chickens (*Gallus gallus*) and monkeys (*Macaca mulatta*)

Ty Henley & Robert R. Hampton (Emory University)

P36 Working memory in primates is an active, resource limited process that is thought to play a central role in intelligence. To assess whether chickens have working memory, we compared the performance of chickens and rhesus monkeys across tasks that have been shown to engage working memory in monkeys. In a matching-to-sample task, concurrent cognitive loads (CCLs) disproportionately decreased monkeys' accuracy when the sample stimuli repeated. CCLs had a minimal effect on chicken accuracy, and the effects were equivalent with repeating and trial unique images. In a reversal task, monkeys first solved the task associatively, then learned the optimal strategy of "win-stay, lose-shift," which our previous work attributed to working memory. Chickens failed to show reversal expertise and never adopted this strategy. Finally, in a directed forgetting task, monkeys' performance significantly dropped when incorrectly cued to forget a sample in a matching-to-sample task, suggesting active control over memory maintenance. Two chickens showed no difference between correctly and incorrectly cued trials, suggesting no active control of memory maintenance. These results suggest that chickens rely on short-term memory processes with distinct properties from active working memory.

Cluster N Activation in Zebra Finches Performing a Magnetic Orientation Task

Madeleine I R Brodbeck (The University of Tübingen), Rachel Muheim (Lund University), Atticus Pinzon-Rodriguez (Lund University), & Scott A MacDougall-Shackleton (The University of Western Ontario)

P37 Cluster N is a visual region in the songbird brain that is activated under dim-light conditions, and is implicated as important for magnetic field perception in nocturnal migratory songbirds. Magnetic field information is also useful for orientation outside of a migration context. It is possible that Cluster N processes magnetic compass information more generally. Our objective was to determine if Cluster N is active when zebra finches, a non-migratory songbird, use magnetic information to orient in a plus maze. Birds were tested under three conditions: i) a static magnetic field that reliably indicated the food location, ii) a sweeping magnetic field, or iii) a vertical magnetic field. The latter two conditions provided no directional information. Brains were labelled for ZENK, an activity-dependent immediate early gene, here used as a marker of recent neuronal activation. We observed high cell counts of ZENK labelled cells across all three magnetic field conditions, but no differences in ZENK immunoreactivity between the conditions. In conclusion, our results are consistent with the idea that Cluster N may not be a brain area exclusive to nocturnally migrating songbirds.

Which side are you on? Assessing spontaneous alternation in dairy calves

Wenxuan Ma, Cathy Ryan, & Kathryn Proudfoot (University of Prince Edward Island)

P38 Spontaneous alternation is used to assess short-term memory in laboratory animals, yet is less studied in farm animals such as cattle. Our objective was to design a spontaneous alternation task using a T-maze for dairy calves kept on a working dairy farm. Dairy calves (6-8 weeks old) were moved into the base of the maze and could freely choose to exit through one of two arms (left or right) over 10-12 sessions/calves. Using a series of trials, we tested different configurations and locations of the maze relative to the calves' home pen and other calves in the barn. We noted side biases when the calf pens were located on one side of the maze and when a human handler stood on one side to block an arm. We minimized these biases by placing the maze between two calf pens and closing the doors of each arm so that a handler was not needed to block an arm. Our preliminary results suggest that dairy calves are capable of showing spontaneous alternation in a T-maze, depending on individual animal differences, the presence of handlers, and the location of the maze relative to the calves' pens.

Variation in Behavioral Responses to Visual 'Light' Stimuli in Asian Elephants

Rachel L. Anello (Hunter College), Matthew S. Rudolph (Hunter College, CUNY), Chudapa Chadarat (Golden Triangle Asian Elephant Foundation), Yingboon Chongsomchai (Golden Triangle Asian Elephant Foundation), Sangpa Dittakul (Golden Triangle Asian Elephant Foundation), Sydney F. Hope (Hunter College), Sarah L. Jacobson (Hunter College), Marnoch Yindee (Akkhraratchakumari Veterinary College), & Joshua M. Plotnik (Hunter College)

P39 Human-elephant conflict remains a major conservation challenge in Thailand, where habitat fragmentation and agricultural expansion increase the frequency of contact between humans and Asian elephants (*Elephas maximus*). Existing strategies to deter elephants from human-inhabited areas often lose effectiveness because elephants habituate. To develop long-term strategies, it is essential to understand how elephants' behaviors may vary in response to different deterrents. To investigate elephant responses to visual stimuli, we custom built a motion-activated, light-emitting device that can display four light conditions: directional strobe, directional solid, diffused strobe, and diffused solid. We installed the device in the Salakpra Wildlife Sanctuary in Kanchanaburi, Thailand, and recorded camera trap video of wild elephants responding to different light conditions. To determine whether elephants are deterred by these lights, we will analyze video data to determine the amount of time that elephants spend near the device once it is activated, and compare these durations with a baseline (i.e., device installed but not activated). We will also compare behavioral responses across conditions, to determine whether certain light patterns may be stronger deterrents than others. This study aims to advance understanding of how elephants perceive novel visual stimuli and evaluates the potential of tailored light-based deterrents.

Naturally occurring triadic interactions between a zoo-housed mother and juvenile orangutan (*Pongo abelii*)

Ana Badal, Suzanne MacDonald, & Lara Pierce (York University)

P40 Across species, young children rely on interactions with their caregivers to learn about their environment and their roles within it. In humans, early triadic engagement involving shared attention between a child and their caregiver over an object or event, referred to as joint attention, is thought to play a critical role in scaffolding social and cognitive development. However, these interactions are often seen as uniquely human and whether nonhuman primates naturally engage in shared attention remains unclear. In this study we report on naturally occurring triadic interactions between a zoo-housed mother–juvenile Sumatran orangutan (*Pongo abelii*) pair at the Toronto Zoo. Approximately 60 hours of observation was conducted using a combination of direct observation and live-stream video footage. Triadic engagement was operationalized as interactions involving the mother, juvenile, and an external object or event. Descriptive analyses will summarize the relative frequency and rate per minute of each behavioural category, with box plots used to visualize variability across sessions and exhibit contexts. By quantifying triadic and shared-attention behaviours in a natural setting, this study provides preliminary evidence on how naturally occurring triadic interactions and attention sharing in non-human primates may serve similar functions to those observed in human joint attention interactions.

Oriental pied hornbills (*Anthracoceros albirostris*) solve invisible displacement tasks in a test of Piagetian object permanence

Ruitong Yao (National University of Singapore) & Elias Garcia-Pelegrin (National University of Singapore, Mandai Wildlife Group)

P41 Object permanence refers to the ability to understand that things continue to exist even when they are out of sight. The Oriental pied hornbill (*Anthracoceros albirostris*) offers an intriguing model for studying this ability due to their unique breeding behavior, where the female seals herself inside a tree cavity and relies on the male to deliver food through a narrow opening without direct visual contact. This suggests some degree of object permanence, yet empirical evidence was lacking. We tested six Oriental pied hornbills using a series of Piagetian object permanence tasks. Three individuals solved the most difficult task, demonstrating full stage 6 double invisible displacement Piagetian object permanence, while the remaining three achieved stage 5 double visible displacement. Our study provides the first evidence that a hornbill species can exhibit object permanence at a level comparable to that of great apes, parrots and corvids, thereby advancing our understanding of Piagetian object permanence as well as the cognitive capacities of the Oriental pied hornbill, a species markedly understudied.

Choosing Sides: An Evaluation of Laterality in Madagascar Hissing Cockroaches (*Gromphadorhina portentosa*)

Kate Hagemeyer & Olga Lazareva (Drake University)

P42 A tendency for cognitive processes or behaviors to be specialized on one side of the brain or body, termed lateralization, has been well-documented in vertebrates but underresearched in invertebrates. Within superfamily *Blattoidea*, lateralization has been reported in two invasive species, the German cockroach (*Blattella germanica*) and the American cockroach (*Periplaneta americana*). Recent research from our lab has found no evidence of lateralization in the non-invasive discoid cockroach (*Blaberus discoidalis*), a giant cockroach species from superfamily *Blaberoidea*, suggesting that lateralization may be a recent evolutionary development. We further tested this hypothesis by investigating lateralization in the Madagascar hissing cockroach (*Gromphadorhina portentosa*), another species in the superfamily *Blaberoidea*. Using similar methodology, we investigated turning behavior in a T-maze and antenna grooming behavior. For the T-maze, we recorded turn direction, latency to turn, and time to complete the trial. In regard to antenna grooming behavior, we recorded the duration and number of grooming episodes for each antenna. We found no evidence of lateralization in either of the two measures, and no correlation was found between turn direction and the antenna that was groomed most often. These findings provide further evidence that lateralization developed after the split between *Blaberoidea* and *Blattoidea*.

Inside the Parrot Beak-and-Tongue Apparatus: Unlocking a Model System for Dexterity Research

Özge Nasa & Alice Auersperg (Messerli Research Institute, University of Veterinary Medicine, Vienna)

P43 Dexterity, the flexible and precise control of objects, requires the integration of cognitive abilities, motor coordination, and anatomical specializations. Due to the evolutionary significance of the opposable thumb, dexterity research has traditionally focused on primate species. However, based on a review of current knowledge in parrot morphology, cognition, and neurobiology, we propose that parrots represent a highly promising model system for dexterity research. We highlight lineage-specific morphological novelties that turn the parrot beak-and-tongue apparatus into a multifunctional tool, draw comparisons between the parrot tongue and the primate thumb, and showcase existing studies on Goffin's cockatoos that reveal advanced tool-related problem-solving abilities. Characterized by fine motor control, pronounced inter-individual variability, goal-directed behavior, flexibility, and the optimization of speed through learning, the Goffin's cockatoo model embodies the core components of dexterity.

Visual Stereotypes of Intelligence in Dogs and Cats

P44 Sophia Ruppel, Remy Frost, Lindsay Palmer, Daniel N. Albohn, Clive D.L. Wynne, & Alex Todorov (Arizona State University)

The mechanisms behind how people judge intelligence in pets are not fully understood, though evidence shows that humans link specific characteristics to certain traits in pets. For instance, dogs with floppy ears are perceived as more agreeable and emotionally stable than dogs with pointed ears and people associate coat color with personality in cats. Smarter dogs are often seen as more social, while less intelligent dogs may be perceived as more physically challenged. Breed stereotypes also play a role, as herding and working breeds are typically viewed as more intelligent than others. We used generative AI to identify traits in dogs and cats that people link to intelligence and appearance-related biases. Participants viewed hundreds of synthetic dog or cat images and rated their perceived intelligence in a single 20-minute session. Idiosyncratic mental prototypes were constructed by fitting a model to each individual participant's responses. Each participant's computed values were visualized with the model, producing photorealistic images that varied with their perceptions. We then visualized perceptions of intelligence in these pets at the group and individual levels. The model was validated by a new group of participants who evaluated the images. We discuss implications for social cognition, animal welfare, and practical applications.

A comparative touchscreen study of perception in aquatic and semi-aquatic mammals

Jenna V. Congdon (Concordia University of Edmonton), Heather M. Fedyna-Carter, Twyla D. Cameron, Talia I. Letcher (Edmonton Valley Zoo), Karyn R. MacDonald (Edmonton Valley Zoo), Muhammad A. J. Qadri (Villanova University), & Suzanne L. Gray (Villanova University)

P45 The amount of information perceived by an individual at any moment is potentially infinite, and how this information is prioritized considering a limited capacity is of interest. Species have evolved different perceptual and attentional biases to relevant/useful information that is appropriate for their particular environment (i.e., ecology). The Local/Global Processing Problem is an investigation of attentional prioritization by describing two (or more) levels at which visual objects may be perceived (Navon, 1977). Using hierarchical letter stimuli, it is well known that humans have a bias to attend to global ("big picture") over local ("fine detail") information. However, findings are mixed across non-human animal species. Harbor seals (*Phoca vitulina*), Northern fur seals (*Callorhinus ursinus*), and North American river otters (*Lontra canadensis*) are the focus in an expansive touchscreen perceptual study investigating several species under-represented in cognitive research. Extending this research to multiple water-dwelling mammalian species assists in further mapping the ecological and evolutionary impacts of information processing. Training procedures of all three study species, and preliminary perceptual findings from Northern fur seals, will be presented in navigating challenges and the critical contributions of this research to our scientific knowledge about attention and perception in aquatic and semi-aquatic mammals.

Object perception in cattle: Global shape prioritized over both local contours and object size

Grant Fairchild, Stella Lourenco, & Gregory Berns (Emory University)

P46 Understanding how farmed animals perceive and differentiate objects in their environment has important implications for animal cognition and welfare. Previous perceptual studies in cattle have tested whether animals can be trained to recognize object features, leaving open which features untrained cattle naturally rely on to differentiate objects. Here, we introduce a simple assay that quantifies attention by measuring transit time from the entrance of an alley to an object placed at its midpoint. We used this paradigm to test sensitivity to changes in object size, global shape, and local shape contours. Changes in object size produced a non-significant attentional increase, precluding firm conclusions regarding size discrimination. Changes to both global shape and local contours significantly increased attention as measured by transit times, with effects for global changes almost double those for local changes. These findings indicate that untrained cattle primarily rely on shape information to differentiate objects, with a marked bias toward global shape. This pattern mirrors perceptual biases reported in adult humans and contrasts with those observed in some other species. These results document a previously unexplored aspect of ungulate perception and demonstrate a simple, ecologically valid method with minimal training requirements for assessing object discrimination in large animals.

Poster Session II - Friday Evening

Poster Locations:

#47-59 in **Opus**

#60-70 in **Beethoven**

#71-81 in **Tchaikovsky**

#82-87 in **Vivaldi**

Relationship Between Dog Owners' Perceptions of Intelligence and Dog Behavior

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

P47 Do you think your dog is smart? Dog owners often hold strong beliefs about their dogs' intelligence, but do these beliefs predict their dogs' observable cognitive abilities? We developed a validated survey that captures people's perceptions of dog intelligence on the basis of three factors: skills at social reasoning, challenges with physical reasoning, and temperament (Ross et al., 2024). We next collected dog owner's perceptions of their own dog's intelligence, as well as their predictions for their dog's performance on each task of a cognitive battery. Dogs next participated in a cognitive task battery, assessing dogs on aspects of cognition that are captured in the dog-owner survey, including memory, social communication, physical reasoning, and social motivation. Tasks are adapted from prior established paradigms, and are conducted over Zoom. We will evaluate whether owners' predictions of dog intelligence across the domains of our survey predict their dogs' observable behaviors, and specifically whether owner's perceptions are more heavily influenced by some domains (e.g., social cognition) than others (e.g., memory). This study is pre-registered, and data collection is ongoing (N = 109/160) but will be ready prior to the conference.

Dogs Continue to Outperform Humans in an Olfactory Working Memory Task

Kristen Busby, Sarah Krichbaum, & Jeff Katz (Auburn University)

P48 The Odor Span Test (OST) follows a non-match-to-sample procedure in which the participant has to identify a newly introduced stimulus (S+) which is presented alongside a previously experienced stimulus (S-) on each trial. In our previous studies, dogs and humans performed qualitatively similar on the OST, showing steady declines in performance across trials. Though overall, dogs displayed a higher accuracy than humans. This study aims to address methodological discrepancies between the human and dog experiments which possibly contributed to the quantitative differences in performance. Hence, using a between subjects, 2 x 2 factorial design, we manipulated verbal suppression (with and without) and response feedback (with and without) in the OST with humans. Contrary to our hypotheses, the results indicated no significant differences between the four experimental groups, but all groups experienced the typical decrease in performance across trials and increasing stimuli to remember. None of the groups were quantitatively equivalent to dogs.

The Effects of Early Life Experiences on Adult Behavior in the Domestic Dog

Remy Frost (Arizona State University), Lindsay Palmer (Arizona State University), Sophia Ruppel (Arizona State University), Christina Hansen Wheat (Linköping University), & Clive Wynne (Arizona State University)

P49 The sensitive period for socialization is the window of development during which animals form bonds with members of their own and other species. In domestic dogs, the sensitive period falls within approximately the first 3 to 12 weeks of life, and experiences at this age have been found to influence dogs' adult behavior. However, little prior research has addressed the role of factors such as size and breed on dogs' ontogeny. Therefore, the current study aims to investigate how the influence of early life experiences varies in dogs of different phenotypes. We aim to recruit an international sample of 500 participants to complete a survey about their adult dogs' early life experiences (e.g., degree of socialization to different dogs and people) and current behavioral concerns (e.g., aggression). We predict that the number and severity of reported behavioral concerns will depend on (1) quality and degree of positive and negative early life experiences, (2) adult size, and (3) breed group. We will discuss practical implications of our findings, such as guidance on rearing strategies for dogs of different morphologies, as well as implications for future work on the effects of early life experiences on adult dogs' social cognition.

State Space Modelling of Contest and Co-Regulation in Dog-Guardian Dyads

Hannah M.R. Burrows, Alex Dinsmore, & Valerie A. Kuhlmeier (Queen's University)

P50 Dog-human relationships involve mutual behavioural adjustment, particularly when interests conflict. This project applied a dynamic-systems analytic approach to examine how dyads reorganize after a behavioural challenge. Dog-guardian pairs participated in two five-minute Free Play sessions separated by a Surprise Self-Control task in which guardians were instructed to prevent their dog from eating a plate of treats. This task introduced a contest of control, ranging from no

contention to physical restraint accompanied by canine arousal. The intensity of this contest was quantified using a validated Contest Index (0–4). Free Play segments were coded using structured ethograms of guardian behaviours (Inattentive, Passive, Supportive, Directive) paired with dog behaviours (Inattentive, Monitoring, Engaged, Distressed), enabling State Space Grid (SSG) visualization of dyadic behaviour over time. These grids are used to identify attractor states—stable patterns such as Positive Dyadic Engagement—and examine how states reorganize following conflict. Additionally, guardians completed the Perception of Undesirable Pet Behaviours Survey (PUPS), allowing exploratory analyses of whether pre-existing beliefs about behavioural control predict dyadic flexibility or regulatory style. This study introduces SSG methodology to dog–human interaction research, providing a framework for understanding how conflict, perceptions, and co-regulation jointly shape interspecies interaction.

Overimitation in dogs: ontogenetic influences

Karoline Gerwisch, Remco Folkertsma, & Ludwig Huber (University of Veterinary Medicine Vienna; University of Vienna)

Recent studies investigating overimitation (OI, copying of causally irrelevant actions) showed that pet dogs copy more irrelevant actions demonstrated by their caregiver than by an unfamiliar person, highlighting the influence of the human-dog relationship. Previous studies focused on adult dogs experienced in communicating with humans. Puppies, predisposed to human interaction but still learning through experience, are ideal to study the strength of ontogenetic influences on OI.

P51 We hypothesised that overimitation in dogs requires ontogenetic triggers, particularly close human-dog relationships, and predicted that OI would be weaker in puppies than in well-socialised adults. Puppies (N = 54, 6–8-weeks-old) observed their breeders perform a relevant action (pushing a lid off a bucket for a treat) in either a nose or paw condition, and an irrelevant action (touching two paper sheets with coloured dots on the wall by nose). Each of two trials included demonstrations of both actions, followed by a 1-minute free-roaming phase for the puppies to respond. By comparing our data to adult dogs' data we assess how overimitation is influenced by age group. The preliminary analysis suggests no significant difference between the two, however, with our results we provide further insight into dogs' OI behaviour and clarify ontogenetic and phylogenetic influences.

Failure to learn two odor categories in a conditional discrimination by companion dogs

Courtney Collins-Pisano & Jeffrey S. Katz (Auburn University)

This study aimed to investigate odor categorization in dogs with a conditional discrimination. Four companion dogs were trained to sample a port delivering exemplars from two olfactory categories, fruits and spices, and then respond at one of two Treat and Trains located 6 ft to the left and right of the sample port to indicate the fruit or spice category. Dogs participated in two 24-trial sessions weekly. They were initially trained to perform a 2-second nose-hold at the port. 16 training stimuli (8 fruit, 8 spices) were then introduced, and the correct Treat and Train was triggered immediately after sampling. Dogs were then allowed to choose independently, and a correction procedure was incorporated. Training criteria was 80% correct on a session once with correction procedure, handler blind, and handler blind without correction procedure. Two dogs met the first criteria after 17 and 41 trials but did not progress further. Hence, the training set size was dropped to one exemplar per category, but all dogs were still unable to meet criteria. Not surprisingly, after 39-54 training sessions, transfer tests to novel stimuli were at chance. Reasons for failure to learn the olfactory conditional discrimination and future directions will be discussed.

P52

When do human infants and pet dogs expect contact in transport events? The role of animacy in causal expectations

Beyza G. Ciftci (Central European University), Gergely Csibra (Central European University, University of London), Christoph J. Völter (Vetmeduni Vienna, Medical University of Vienna and University of Vienna), & Jonathan F. Kominsky (Central European University)

As humans and pet dogs evolved in and share the same physical environment, and dogs underwent certain cognitive changes during domestication, comparing their causal and animacy perceptions with humans becomes particularly interesting. To investigate this systematically we designed several eye-tracking experiments using transport events with human infants and pet dogs. In Experiment 1, we familiarized 8-month-old infants (n = 40) with occluded transport events. The potential causal agent was either a human hand or a toy train. In the test, the agent either contacted or did not contact the transported patient. We predicted greater pupil dilation in the gap event compared to the contact event, independent of agent type (Muentener & Carey, 2010; Adibpour & Hochmann, 2023). Contrary to our hypothesis, infants pupil dilation was greater in the contact event than the gap event (GAM: hand, $p < .001$; train, $p < .001$; when event factor is included only train remains significant). Experiment 2 aimed to test whether the unexpected findings in Experiment 1 resulted from the causal patient's self-stopping. To test this, we included an obstacle that made the causal patient stop after moving. This version is tested with both dogs and human infants. Data collection is ongoing.

P53

Long-term Odor Memory in Dogs

P54 *Oskar Wolters, Holly-Root Gutteridge, Claire Ricci-Bonot, Agnese Crisante, Adele Spain, Rebecca Sumner, Helen E. Zulch, Daniel S. Mills, Thomas W. Pike, & Anna Wilkinson (University of Lincoln)*

Long-term memory is adaptive as it allows animals to retain important information about their environment. There is evidence that mammals can remember social partners for decades; however, much less is known about long-term retention of non-social stimuli. Seventeen former scent detection dogs, that had been retired for between 8 months and 8 years, took part in this study. We assessed retention of one of their operational target odours. Dogs were asked to search for, and alert to, this target amongst a variety of distractors and control stimuli in a 10-box room search. Remarkably, all dogs performed this task significantly above chance, demonstrating that dogs can retain learned odour information for at least 8 years; substantially longer than has been observed previously in mammals. Moreover, their performance did not correlate with time since retirement, suggesting that the limits of their long-term memory had not been reached.

Dogs' perception of causality in launching events

Leslie-Ann Eickhoff (University of Veterinary Medicine Vienna), Jonathan F. Kominsky (Central European University), & Christoph J. Völter (University of Veterinary Medicine Vienna, Max-Planck Institute for Evolutionary Anthropology)

P55 Detecting causality in movement patterns can be useful for many animals, e.g. because it can help predict objects' movements. Research has established that infants can categorize Michottean launching events into causal and non-causal based on spatiotemporal features. Initial evidence using similar methods suggested that dogs also have basic expectations of causality. To investigate which spatiotemporal characteristics trigger the perception of launching as causal in dogs, we conducted an eye tracking study using video animations of launching events: a causal event, and two control events with the same kinematic properties, but with either a gap remaining between the two balls or a 0.5-sec lag when the balls collide. We analyzed their pupil size as well as their looking times. We hypothesized that dogs' pupil size should be larger in the gap and lag events than the causal event, as these violate spatiotemporal features of causal launching. Preliminary results provide some, albeit weak, evidence that dogs' pupils dilated more in response to the gap event. Moreover, dogs looked significantly less at the launched ball in the gap condition. We discuss possible explanations and implications. Additionally, we compare results from this study to a study with human infants using the same stimuli.

Social Evaluation of Resource-Based Human Dominance in Domestic Dogs: Effect of Owner Involvement

Xiaomeng Song (Kyoto University), Yin Zhen (Kyoto University), Ono Naru (Kyoto University, Japan Society for the Promotion of Science), & Hika Kuroshima (Kyoto University)

P56 Evaluating third-party dominance relationships benefits humans by reducing social assessment costs. We can also infer dominance status in members of other species. Is this cross-species evaluation uniquely human? Domestic dogs are adept at recognizing human social cues, but whether they understand human-to-human dominance remains unknown. This study aims to clarify whether domestic dogs evaluate social dominance relationships between humans through third-party observation. In Study 1, 22 dogs observed a resource competition where a Dominant actor (D) verbally rebuffed ('Ah!') a Subordinate (S) to monopolize a toy. Dogs completed four trials, with each trial consisting of two demonstrations followed by a choice of accepting food from D or S. Dogs showed no significant preference between actors, consistent with previous reports on third-party evaluation of strangers. However, alternative methods indicate that dogs may socially evaluate when interactions involve their owners. Thus, Study 2 introduced the owner as S (interacting with D), with a Neutral (N) actor as the alternative choice. With this procedure, individual dogs (n=12) showed preferences for one of the actors, but variably across subjects. We will discuss potential factors involved in the variability of our preliminary results, including dog-owner attachment and dog temperament.

Kin discrimination in conspecific brood parasites

Emily M. Burt (McGill University), Rodger D. Titman (McGill University), Shawn R. Craik (Université Sainte-Anne), & Mélanie F. Guigueno (McGill University)

P57 Social behaviours can be biased towards relatives if it improves their reproductive success via kin selection. The capacity to accurately discriminate between kin and non-kin is essential to direct these behaviours accordingly. Conspecific brood parasitism (CBP), an alternative reproductive tactic in which parasites lay eggs in nests of individuals of the same species, has been hypothesized to be driven by kin selection by facilitating host acceptance of a relative's parasitic eggs. Despite evidence of host-parasite relatedness indicating kin-directed behaviour, few studies have evaluated the role of kin discrimination in conspecific brood parasitism. We aim to investigate the roles of kin selection and sociality in a free-living, colour-banded population of red-breasted mergansers (*Mergus serrator*) where up to 64% of nests are parasitized. Using microsatellite genotyping and cameras placed at nests, we will link the behaviour of colour-banded individuals to their genotype and assess host-parasite interactions at the nest. If kin discrimination exists, we hypothesize that hosts tolerate related parasites and resist unrelated parasites during encounters at the nest. Here, we present preliminary results on host-parasite relatedness in the population and future work analyzing behavioural interactions between hosts and parasites on video that can be linked to genotypes for the first time.

Object motion estimation in pigeons

P58 *Naru Ono (Kyoto University, Japan Society for the Promotion of Science), Yuya Hataji (Kyoto University), Hiroshi Ashida (Kyoto University), & Hika Kuroshima (Kyoto University)*

Retinal motion during locomotion is a mixture of motion signals from one's own locomotion and from external objects. Estimation of objects' real-world motion requires reconstruction from such retinal motion. Primates, including humans, use flow-parsing, a mechanism that extracts object motion by subtracting self-generated optic flow from retinal motion. However, the mechanisms underlying object motion estimation in other vertebrate clades remain largely unknown. Birds utilize optic flow for heading estimation and controlling flight speed. Therefore, it is anticipated that birds also utilize optic flow for estimation of object motion in the form of flow-parsing. In the present study, four pigeons were trained to discriminate the direction of visual object motion after simultaneous presentation of background motion that either simulated self- or random motion. They were trained with object motion whose perceived direction was unaffected by background motion. In the test, probe trials with intermediate object motion directions were inserted. One subject exhibited a shift of psychometric function due to background motion contrary to the expected shift by flow-parsing. This subject may have responded according to the vector average of object motion and background motion. These results along with ongoing experiments with manipulation of translation speed and projection area will be discussed.

Spatial Memory Relates to Inter-Individual Variation of Free-Range Foraging Movement in Ring-Billed Gulls

Stefan Stanescu (McGill University), Anna Lippold (McGill University), Jonathan Verreault (UQAM), & Mélanie Guigueno (McGill University)

P59 Spatial memory can increase animal survival, facilitating successful home range establishment, migration, and foraging across taxa. However, few studies integrate controlled cognitive tests with behaviour in the wild. We combined fine-scale GPS tracking of foraging movements with tests of spatial memory in ring-billed gulls (*Larus delawarensis*) to determine whether individual differences in spatial memory explain the observed variation in foraging movements, namely home range size, number of foraging sites, and path efficiency. Gulls were given two tasks of spatial memory: a 5x5 array and a modified radial arm maze. We found a significant association between spatial memory in captivity and the following metrics in the wild: path efficiency when returning to the colony, and the number of visited foraging sites. These findings suggest that individual differences in spatial memory play a role in observed foraging movements. Taken together, we highlight the importance of integrating controlled cognitive tests into existing movement ecology paradigms to better understand the role of cognition in movement, and other fitness-related behaviour in the wild.

Neurochemical modulation of auditory learning and social memory formation

Daria-Salina Storch, Michaela Bierman, & Jon Sakata (McGill University)

P60 Recognizing familiar individuals is essential for social functioning and communication. Like humans, songbirds such as zebra finches learn to identify one another through their vocalizations (e.g., songs) and demonstrate behavioral responses to familiar vs. novel vocalizations (e.g., they remain quiescent and still for longer upon hearing a novel song). The neural mechanisms supporting familiarity-based auditory learning across taxa remain poorly understood. Norepinephrine is a key neuromodulator implicated in sensory learning, alertness and attention. Prior studies in songbirds demonstrate that norepinephrine-synthesizing neurons in locus coeruleus (LC) project to auditory processing areas including the caudomedial nidopallium (NCM) and respond differently to familiar versus novel songs, but the causal contribution of norepinephrine to auditory learning is not well established. Here, we investigated how norepinephrine contributes to song recognition in zebra finches by ablating noradrenergic neurons projecting from LC to the NCM and quantifying behavioral responses to familiar and novel songs using deep learning-based pose estimation software. We find that manipulations of norepinephrine signaling affect behavioral responses to familiar vs. novel songs. By clarifying how norepinephrine neurons encode familiarity and modulate auditory learning, these results fill a critical gap in our knowledge of how neuromodulators shape social behavior at the circuit level.

Investigating the links between exploration behaviours and spatial cognition in a wild mouse population

Nicolas Bonin, & Vincent Careau (University of Ottawa)

P61 Cognitive performances can influence how individuals react to their environment and consequently impact their fitness. As white-footed mice presumably need to thoroughly explore their environment for resources, we assumed that they optimize their foraging efforts using spatial learning and memory. However, the main paradigm explaining the relation between exploratory behaviours and spatial learning have received limited evidence. To estimate the potential among-individual correlations between these traits in a wild population, we adapted a cognitive test historically developed for laboratory rodents. Our results will hopefully bring more insights on the links between behavioural and cognitive traits in a wild species.

The Role of Context on the Expression of Actions and Habits

Jordan Nerz, Katie Cagney, Anneli Spieler, Stephanie Millar, Catherine Piskurich, & Ken Leising (Texas Christian University)

P62 A goal-directed action is sensitive to changes in outcome value, whereas a stimulus-driven response (i.e., a habit) is not. Amount of training influences expression of a behavior as an action or habit, such that minimal training often results in an action, but extensive training results in a habit. The current research examined how habit- and action-associated contexts influence how a behavior is expressed. Rats received minimal training of one response (R1) in Context A to establish an

action and extensive training of another response (R2) in Context B to produce a habit, followed by outcome devaluation via satiety. R1 (action) and R2 (habit) were then tested for devaluation sensitivity in both Context A (Test 1) and Context B (Test 2). We hypothesized that both responses would be sensitive to devaluation in Context A, but only R1 would be sensitive in Context B. Unexpectedly, R2 was insensitive to devaluation in Context A, but sensitive in Context B. R1 was marginally sensitive to devaluation in Context A (i.e., an action), but inconsistent with previous research, was insensitive in Context B. Satiety and consumption data suggested that a bias for the training substance may have resulted in incomplete devaluation.

Impact of Experience on Cognitive Performance - Comparative approach in bees and humans

Samantha Béchet (University of Toulouse; University of Toulouse Jean-Jaurès), Gwenaël Kaminski (University of Toulouse Jean-Jaurès), & Aurore Avarguès-Weber (University of Toulouse)

P63 Our brain is plastic: with dedicated training, we can develop expertise or recover lost cognitive abilities. This property is shared by other species. For example, mice raised in stimulating environments, rich in new objects and social interactions, show greater test-solving abilities and delayed aging effect. But is such cognitive plasticity really universal? Could it exist in insects like honeybees? Despite bees' sophisticated learning and cognitive abilities, their short lifespan and lack of adult neurogenesis could hinder performance improvements with experience. This project investigates visual perceptual learning in bees, namely the enhancement of visual discrimination through intensive practice. In humans, extensive training on specific stimuli reliably improves fine visual discrimination over time, likely via synaptic reorganization, increases in dedicated receptors and/or attentional mechanisms. However, these improvements are often highly task-specific, with limited transfer to new tasks unless training involves varied perceptual tasks. Honeybees underwent one-day intensive visual discrimination training based on a single low-level visual feature (orientation or spatial frequency). They were then tested on the following day for potential perceptual learning, defined as improved perceptual abilities compared to a control group. Preliminary results (data still under collection) suggest no effect of intensive training on subsequent performance in similar visual tasks.

Inferential reasoning in Ara macaws using a 3-choice 1-item task

Tanita Giri (National University of Singapore) & Elias Garcia-Pelegrin (National University of Singapore, Mandai Wildlife Group)

P64 Reasoning by exclusion employs the logical concept of disjunctive syllogism, corresponding to the statement: "Either A or B, not A, therefore B". This form of logical inference has been examined primarily through forced choice tasks, such as Call's (2004) 2-cup 1-reward paradigm. However, the reliability of 2-choice tasks to assess true inferential reasoning has been challenged, since performance can often be attributed to avoidance of the empty cup, and reasoning by possibilities. In the present study, we employed 2 & 3 choice tasks, including an adaptation of Call's (2022) 3-cups 1-item paradigm to examine reasoning by exclusion in 4 Scarlet macaws (*Ara macao*) and 3 Blue-and-Yellow macaws (*Ara ararauna*), while controlling for avoidance strategies. Analysis of the results found that 1 subject made choices that are consistent with an inference by exclusion strategy in the 3-choice task. This finding suggests that macaws may possess the capacity for inferential reasoning by exclusion, although further research is warranted to assess the generalizability of reasoning by exclusion abilities in macaws. Despite this limitation, the present study contributes to the growing body of literature on the cognitive capacities of macaws and parrots more broadly.

Nice Doggy: The Development of Empathy towards Dogs in Children and Adults

Kristine Kovack-Lesh, Jennifer Cortes, Chloe Daly, & Julia Meyers-Manor (Ripon College)

P65 Emotional contagion from humans to dogs has been well-established; however, less is known about emotional contagion from dogs to humans. Our experiment examines whether empathy for dogs can impact the emotions of 8-13-year-olds and undergraduate students using several measures. Participants viewed pictures of dogs expressing emotions (happiness, sadness, anger, and tiredness) on a large screen accompanied by corresponding sounds and rated their own emotions on visual analog scales (VAS) related to happiness, anger, sadness, stress, and tiredness. All participants and children's caregivers filled out the EmQue-CA Survey. Participants' heart rate variability (HRV) was measured using heart rate monitors, and sessions were video recorded. Videos were processed for facial expressions using a facial analysis coding system. Analyses show that both children and undergraduates matched their emotional states as measured by the VAS to the emotional states displayed by the dogs, but there were no effects for HRV measures. This demonstrates that self-reports supported emotional contagion more than physiological measures. Coding of facial expressions showed that the undergraduates expressed fewer facial expressions than the children and that many participants did not match their facial expressions to the corresponding dogs' emotions.

A behavioural task for identifying multi-step planning processes

Thomas MW Leir, Nicholas Vanlian, & Matthew P Gardner (Concordia University)

P66 The Successor Representation family of algorithms has become a popular conceptualization of learning. By representing state transitions in terms of probabilistic future state occupancies, these algorithms forgo the planning of model-based learning. When paired with a replay mechanism as in SR-replay, Successor Representation algorithms maintain a similar

level of flexibility to model-based learning. However, information about state sequences is unavailable because of the lack of a planning mechanism. In the present study, rats underwent a novel sequence-unblocking procedure. In training, a blocked stimulus is presented before a neutral stimulus, which predicts a rewarded stimulus. The stochastic control group disperses the blocked stimulus across trials such that the blocked stimulus is a worse predictor of the neutral stimulus. Rodents are then probed with the blocked stimulus in extinction to test reward expectation. Experimental rodents respond to the blocked stimulus significantly more than control rodents during the extinction test. Because the blocked stimulus cannot be used to directly predict reward at test, a sequential planning process could be used to predict the absent neutral stimulus and then the absent rewarded stimulus. SR-Replay does not satisfy this requirement since it cannot generate a reward prediction from the predicted neutral stimulus.

Humans, but not monkeys, form compressed representations of visuospatial sequences

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P67 Humans are extremely sensitive to patterns in the environment. Previous studies suggest that this sensitivity is closely linked to the compressibility of information. For example, the sequence ‘1, 2, 3, 4, ...’ can be compressed and encoded as a simple rule, ‘n+1’, while a sequence like ‘5, 2, 6, 8, ...’ cannot be similarly compressed. It has recently been argued that while humans spontaneously form these compressed representations, nonhuman animals do not (Dehaene et al., 2022, TICS). Here, we developed a serial reaction time paradigm to assess the ability to compress spatial information in macaques and humans. We presented participants with sequences of visual stimuli that occurred at one of eight spatial locations, corresponding to the principle directions on a compass, which they were required to touch as quickly as possible. These sequences were either regular (appearing clockwise in a circle and were thus compressible) or irregular (random and thus incompressible). Humans responded faster to regular compared to irregular sequences, suggesting that they formed compressed cognitive representations. However, monkeys did not show similar differences in reaction times. These data are in line with prior hypotheses, implying that what makes humans unique is their capacity to form compressed cognitive representations.

Investigating Visual Working Memory Representations Using the Delayed Match-to-Sample Task with Pigeons

Gerrit L. Bankuti (College of the Holy Cross), Muhammad A. Qadri (College of the Holy Cross, Villanova University), & Jad Nasrini (College of the Holy Cross)

P68 Pigeons can solve a visual delayed Match-to-Sample (dMTS) task, which requires comparing images at test to a stored mental representation of the sample image. To investigate the most prominent visual features held in working memory, we trained five pigeons on the dMTS task with a set of three scene images. After reaching a 70 percent criterion on the task with a two-second delay, we presented pigeons with always-reinforced probe trials to evaluate working memory representation. Probe trials presented two manipulated versions of the sample at test, each of which was degraded on one visual feature space, and a familiar distractor as the third response option. Experiment 1 compared grayscale and pixel-scrambled images, evaluating reliance on shape or color information. Pigeons were more likely to match the sample to the grayscale manipulation, suggesting that shape was a more important feature for matching their working memory representation. Experiment 2 compared high- and low-pass spatial frequency filtered images, evaluating reliance on global and local features. Response patterns varied by image and subject, revealing a diversity of approaches to this task. These findings suggest that the prominent features held in visual working memory may depend on the images used and on individual differences.

Habitat-Independent Directional Orientation During Rest in Two Pinniped Species

Kristy Houskeeper (C-SPEC, SUNY Empire State University), Tor Alvey (C-SPEC, Marist University), Nick Rose (C-SPEC, Marist University), Kristy L. Biolsi (C-SPEC, Marist University), & Kevin L. Woo (C-SPEC, SUNY Empire State University)

P69 Individuals in social aggregations often trade off the ability to recover during rest with the need to remain vigilant of their surroundings for safety. Observational studies of social species at rest provide an opportunity to better understand the cognitive strategies employed during this vulnerable state. For example, behavioral orientation to stimuli in the environment may play a critical role for acquiring relevant information, such as predator location. Our previous work with wild harbor (*Phoca vitulina*) and gray seals (*Halichoerus grypus*) across two habitats found that both urban and non-urban populations show the same primary orientation pattern: all seals tended to orient themselves in the same direction, which may support their ability to scan the surrounding area. We expanded on this by studying directional orientation during rest with a sample of harbor and gray seals in human care at the Long Island Aquarium (LIA), allowing us to compare orientation patterns across urban, non-urban, and artificial habitats. Our findings revealed that seals in human care exhibit the same orientation patterns as wild seals, lending credence to this behavior being an innate cognitive ability, as the seals at the LIA are not exposed to the same predatory threats as those in the wild.

The impacts of motion perception on amphipod escape behavior.

Allison Scholl, Madison Fanning, Aalaya Jacklin, Amelia Miner, Joshua Wolf (Carroll University)

P70 Amphipods, *Gammarus pseudolimnaeus*, tend to live in shallow streams with quick-moving water and are often subject to involuntary displacement. Additionally, most species of amphipod tend to be negatively phototactic, and it is reasonable to assume that they may also be sensitive to moving visual stimuli within the water. Responding to these moving visual stimuli may be helpful in predator evasion and navigation strategies. We created a submerged maze apparatus that allowed us to present a variety of moving visual stimuli, both artificial and more “naturalistic” to determine how these moving stimuli would impact amphipod escape behavior in a variety of maze environments. For all experiments we recorded time to escape and in some maze setups we also recorded errors made during escape. The moving stimuli seem to impact the escape behavior but do not necessarily make escape performance more efficient.

More than Meets the Eye? Zebrafish and the Over-attribution of Agency

Eleanora Baty & Noam Miller (Wilfrid Laurier University)

P71 Recent research has found that 3D virtual environments elicit shoaling responses from fish better than 2D videos or images. There remain, however, many questions about what aspects of social stimuli lead fish to treat them as social partners. We compared zebrafish (*Danio rerio*) shoaling behaviour in response to a digital model across 6 conditions. Fish were presented with either a realistic model fish or a simple sphere, and the models’ movement was also varied (stationary, linear, & realistic). Movement of the fish in relation to the model was assessed. We found that zebrafish tracked the fish model in all conditions but remained closer to the sphere when it did not move. Fish remained closest to non-moving stimuli of both kinds, and preferred realistic models over a sphere when they were still. Our data validates the use of 3D virtual environments as effective assays of social cognition in fish.

Disrupted Nights, Disrupted Minds: Effects of ALAN on What-Where-When Memory in Black-capped Chickadees

Aastha Saini & Scott A. MacDougall-Shackleton (Western University)

P72 Daily rhythms of light and dark regulate most biological processes and synchronize our internal physiology with the environment. Artificial light at night (ALAN) is a growing environmental pollutant, disrupting these rhythms. This may adversely impact humans and wildlife by disturbing the sleep-wake cycle, and therefore memory consolidation. Our research investigates the impact of ALAN on memory consolidation in black-capped chickadees (*Poecile atricapillus*), a songbird that relies heavily on spatial memory for survival. Chickadees show what-where-when (WWW) memory for food caching events. We manipulated light-dark cycles and monitored changes in chickadee WWW memory tasks. Initially, birds learned locations of sunflower seeds and mealworms in an aviary. Then birds revisited those sites after short (3 h) or long (125 h) retention intervals, and preference for food type was recorded. We hypothesized that birds would prefer mealworms during SRI and seeds during LRI, as mealworms in LRI were degraded. We also predicted that ALAN will impair WWW memory. Preliminary data suggest that control birds preferred mealworms more after SRI than LRI, but this was not true for birds exposed to ALAN. Sleep analyses are ongoing. ALAN may therefore degrade sleep and WWW memory in wildlife.

Effects of Spatial Proximity and State Anxiety on the Acquisition of a Spatial Feature-Positive Discrimination with Humans

Stephanie Millar, Sara Bond, Hiya Bhatte, Ashley Kyle, Bri Vaughan, & Kenneth Leising (Texas Christian University)

P73 In a feature-positive discrimination, responding is reinforced (+) when a target stimulus (A) is presented with a feature stimulus (X), but not when the target stimulus is presented alone (A-). In a spatial variant of this procedure, the location of a reinforced response (e.g., left lever) differs in the presence of A alone compared to A following X (e.g., right lever). In the current experiment, participants navigated a small room to make a response relative to a landmark (A, a 3-D object). Responses to one side of A were correct on trials following the presence of X (a floor mat) (X->A+), whereas responses to the other side of A were correct when A was presented alone (+A). The experiment included a between-subjects manipulation of the spatial proximity (Near vs. Far) between X (the floor mat) and A (3-D object), and manipulation of state anxiety (Anxious vs. Control) using the Trier Social Stress Test. Participants in the Anxious Near and Control Far groups learned the correct response during A and XA trials, but extinction of X reduced performance to chance for all groups. Direct control vs. occasion setting, as well as the effects of the anxiety manipulation will be discussed.

The effect of prepositional words on a spatial occasion setting task in pigeons

Catherine Piskurich, Katie Cagney, Jordan Nerz, Ines Ceballos, & Kenneth Leising (Texas Christian University)

P74 Humans are unique in their use of language. However, studies of language in non-human animals have revealed that many components of language are shared. For instance, pigeons can be trained to discriminate nonwords from words (Scarf et al., 2016). Few comparative studies have used prepositions, which express a relationship between elements of a sentence, such as “left of the landmark”. Our lab has found that pigeons can learn whether and where to respond in relation to a landmark in the presence of different-colored screens (Leising et al., 2015). The current experiment evaluates whether pigeons can use prepositional words (e.g., “left” and “right”) as modulatory stimuli in a landmark-based task in a similar manner to humans. The current study uses a feature-positive discrimination procedure with the words “left” (X) and “right” (Y) as features, and eight trial types (XA+, YA+, XB+, YC+, D+, A-, B-, C-). Preliminary training data show that the pigeons

learned the correct response for XB and YC trials (i.e., the feature is not required to learn where to peck). Performance on XA and YA trials indicated an overall preference for one direction for most birds. Implemented targeted training adjustments will be discussed.

Changes in local field potential in non-human primate prefrontal cortex during a transitive inference task

Fabian Munoz (Columbia University), Greg Jensen (Reed College), Rael Sammeroff (Columbia University), Herbert Terrace (Columbia University), & Vincent Ferrera (Columbia University)

P75 Transitive inference (TI), the ability to deduce that if $A > B$ and $B > C$, then $A > C$, may rely on mental schemas that spatially organize hierarchical relationships, but the neural computations underlying TI remain unknown. To investigate the role of prefrontal cortex (PFC) in TI, we recorded local field potentials (LFPs) from two monkeys (*Macaca mulatta*) performing a TI task. Monkeys learned the implied rank order of seven novel images each session, indicating choices via saccadic eye movements. During the training phase of each session, monkeys were exposed to adjacent pairs (AB, BC, CD, etc.) for 150 trials, followed by testing on all pairs for approximately 200 trials. Monkeys reliably learned each new list, achieving asymptotic accuracy of 80-90%. LFP analyses revealed dominant oscillatory power in the beta band (20-25 Hz). Critically, distinct changes emerged between training and testing phases across alpha, beta, and gamma bands, with temporal specificity during fixation, decision, and reward periods. Beta and gamma power during the decision period increased from training to testing. These findings provide support for the idea that PFC-basal ganglia beta rhythms support learned rule application, while gamma-band modulation may reflect local computational demands during hierarchical reasoning and decision-making.

Deduct This: Transitivity Inference and Transitivity Tasks Utilize Different Cognitive Skills

Gia Han Nguyen, Maura Hanley, & Olga Lazareva (Drake University)

P76 Transitive inference (TI) and transitivity (TR) tasks are widely used non-verbal measures of relational reasoning (TI) and stimulus equivalence (TR) in both humans and nonhuman animals. Although the two procedures are often treated as interchangeable measures of a common construct (Kumaran & Ludwig, 2013), it is unclear whether they do in fact address the same cognitive process. TI tasks require subjects to extract an ordered series from overlapping pairwise discriminations and to use it to make inferences about new relationships. In contrast, TR tasks assess whether learners can combine conditional associations to derive previously untrained relations among stimuli. In our study, participants completed both tasks sequentially, with each task involving individual training followed by non-reinforced tests of inferential performance. If the TI and TR tasks measure the same construct, then individuals who succeed in one task must also succeed in the other. However, we found no statistically significant correlation between participants' inferential performance across the two tasks. These findings provide the first empirical assessment of the relationship between the TI and TR and suggest that they engage distinct processes rather than a shared underlying capacity.

Checked relationships: Social interactions in a southern gartersnake

Margarita Muscat, Neomi Qubti*, Maggie-Rose Johnston, Morgan Skinner, & Noam Miller (Wilfrid Laurier University)*

*co-first authors

P77 Gartersnakes are highly social; for example, Eastern gartersnakes (EG; *Thamnophis sirtalis sirtalis*) form stable social networks and "friendships". To test how these social patterns are shaped by ecology, we tested social behavior in checkered gartersnakes (*Thamnophis marcianus*), who inhabit warmer environments than EG. We examined whether checkered gartersnakes display social attraction, form specific social relationships, and coordinate exploration. We observed 10 individuals, in two 5-snake groups and all together. Snakes explored a large arena containing multiple shelters for 6 days, and were 'shuffled' twice a day. An overhead camera captured an image every 5 seconds. We compared our results to published data on EG. All groups showed social attraction, remaining longer in shelters that had more snakes in them (like EG), and had stable social networks across days. Snakes had no preferred partners (unlike EG). Males had higher weighted degrees than females (unlike EG). Snakes were approximately equally active at all times of day (unlike EG), possibly due to smaller temperature fluctuations in their environment. Overall, checkered gartersnakes appear to be socially consistent but not selective, unlike EG. This suggests that we can use aggregation assays to identify environmental drivers of species-level variation in social evolution.

Implicit and explicit measures suggest continuities in mechanisms of false belief tracking in humans and other apes

Luke A. Townrow (Johns Hopkins University), Melodie Qian (Johns Hopkins University), Fumihiro Kano (University of Konstanz), & Christopher Krupenye (Johns Hopkins University)

P78 One goal of comparative psychology is to clarify continuities and discontinuities between species in cognitive mechanisms like Theory of Mind (the ability to represent others' mental states). Prior work utilizing anticipatory-looking gaze behavior demonstrates that nonhuman primates can predict the behavior of agents with false beliefs, expecting those individuals to search for objects where they last saw them. However, it remains debated whether these measures indeed reflect theory of mind, and whether they produce robust or analogous patterns in humans. In a pre-registered experiment, we tested 110 human adults in an eye-tracking task using highly-engaging stimuli from the primate literature, while measuring false belief understanding both implicitly (through anticipatory looking) and explicitly (through verbal responses). Both measures of

anticipatory looking (looking-duration and first-looks behaviors) replicated in humans the successful performance of NHPs, and both predicted participant's verbal responses, suggesting a concordance between anticipatory looking and explicit reasoning. These results suggest that foundational mechanisms of belief tracking are shared between humans and other primates, and raise the possibility that even implicit measures reflect a unified, or at least integrated, mechanism of explicit belief reasoning.

Using machine-learning to automatically identify individual elephants from videos: implications for studying cognition in the wild

Ashley Avalos (Hunter College), Jan Blunk (Friedrich Schiller University), Sydney F. Hope (Hunter College), Sarah L. Jacobson (Hunter College), Matthew S. Rudolph (Hunter College), Robbie Ball (Hunter College), Joachim Denzler (Friedrich Schiller University), & Joshua M. Plotnik (Hunter College)

P80 Understanding individual behavioral variation over time is critical for cognition research but difficult to study in wild animals. Our lab investigates problem-solving, sensory responses, and cognitive flexibility in a wild population of Asian elephants in Kanchanaburi, Thailand. To do this, we install apparatuses in the wild and use camera traps to record elephant behavior. Identifying individual elephants is essential for examining variation in cognitive and behavioral traits, but currently relies on time-consuming manual annotation of morphological traits (e.g., markings, ear tears). To accelerate this process, we are using an automated machine-learning program. The program detects subjects via the MegaDetector and applies object tracking. Afterward, it extracts visual features via a pre-trained ResNet, reduces dimensionality with PCA, and classifies individuals using a linear Support Vector Machine. We have trained the program on ~800 videos of 18 manually-identified individuals, and will add more data over time. We will evaluate this program on new video data to: 1) examine accuracy compared to human experts, 2) assess whether performance scales with dataset size, and 3) examine the impact of environmental variables (e.g., weather, lighting) on accuracy. This approach has the potential to reduce human effort and error, increasing efficiency in wild animal cognition research.

Ants use tools to solve foraging problems

Anna Bilotta, & Suzanne Gray (Villanova University)

P81 We investigated problem-solving in the ant species *Aphaenogaster rudis*, focusing on the flexibility of their tool use behavior during foraging. Previous research has found that these ants use tools to carry food to their nest by placing tool objects into liquid sucrose food sources. We hypothesize that this tool use behavior can be generalized across foraging contexts. Three colonies, which differ in both the number of foragers and prior tool exposure, were assessed using two problem-solving paradigms: a water crossing task and a height climbing task. The ants had access to six naturally occurring and ecologically relevant tool objects to use for solving the problems. We assessed the proportion and efficiency of problem solving, the tool objects used for the task, and whether there is a difference between the different-sized and different-experienced colonies. The findings of this study expand the literature on the problem-solving capabilities of ants.

Performance on a Serial Same/Different Discrimination Task Suggests Working Memory Use in Pigeons

Margaret C. Jinks (College of the Holy Cross), Ester Paw (College of the Holy Cross), Muhammad A. Qadri (College of the Holy Cross, Villanova University), & Jad Nasrini (College of the Holy Cross)

P82 Pigeons have been shown to discriminate same/different categories based on sequential presentations of dot motion videos that vary in travel direction and speed. When videos are presented sequentially, recognizing video repetitions requires an animal to compare its current perception with a representation held in short term memory. To investigate features of the memory system used to make these comparisons, we presented three well-trained pigeons with this sequential same/different discrimination task and manipulated the duration of both the video stimuli and the inter-stimulus interval (ISI) in each sequence. Across different trials, videos in each sequence were either all the same, all different, or alternated between two different videos. Videos were presented for 250, 1000, or 2000ms, with ISI values of 100, 316, or 1000ms. Pigeons discriminated same/different sequences more accurately with longer videos and shorter ISIs. When video display duration was sufficiently long, response rate to sequences with two alternating videos appeared distinct from all-same and all-different sequences. These findings suggest that stimulus representations decayed over time and that multiple items could be held in memory depending on encoding and/or retrieval limitations of the system. These features are consistent with active working memory maintenance.

The Influence of Task Type on Hand Preferences in Olive Baboons (*Papio anubis*)

Logan Brownell (Carnegie Mellon University, Rochester Institute of Technology), Clare Belden (Seneca Park Zoo), Anna Sofia Hege (Rochester Institute of Technology), Mara Tysick (Rochester Institute of Technology), Jessica F. Cantlon (Carnegie Mellon University), & Caroline M. DeLong (Rochester Institute of Technology)

P83 Handedness is the tendency to use one hand more naturally than the other. Humans show strong population level right-handedness, while baboons and other nonhuman primates show individual preferences but appear to be more influenced by task complexity. This study investigated how task demands impact hand preference in six adult olive baboons housed at the Seneca Park Zoo (Rochester, NY), with the goal of understanding how different factors may have contributed to the evolution of human handedness. Each baboon completed a cognitively complex match-to-sample task on a touchscreen

computer, and hand use was recorded for each step of the sequence (start box, sample stimulus, choice stimulus, and food reward collection). The same individuals also completed the manually complex tube task, which required the baboon to reach into a tube to remove a food reward. During the cognitive task, four baboons were left-handed and two were right-handed. During the tube task, four baboons were left-handed and two showed no clear preference. Across tasks, only two baboons showed consistent preferences, however, both tasks elicited strong hand preferences from most animals, suggesting that the evolution of handedness may have been driven by different factors such as cognitive and manual complexity.

Survey says...: Relating Behavioral, Physiological, and Owner Reported Surveys of Empathy

Kalyn Otzelberger, Calysta Kurz, & Julia Meyers-Manor (Ripon College)

P84 The lives of humans and dogs are greatly intertwined, making it crucial to understand how human emotions impact companion animals. While previous work found dogs respond greatly to human emotions through different metrics, including heart rate variability (HRV), person-oriented behaviors, and owner-reported empathy surveys, little work has compared these measures of emotional responsiveness. We examined relationships between the aforementioned measures while dogs were presented with human vocal emotions by their owner and a stranger. We hypothesized that these metrics would highly correlate if all measured empathy. We found the most person-oriented for crying, followed by laughing. Survey results suggested that dogs with higher empathy scores showed more person-oriented behaviors while their owner cried and had marginally greater attachment scores. Dogs with greater attachment had marginally more owner-directed person-oriented behaviors while the stranger presented emotions. Lastly, dogs who displayed more person-oriented behaviors showed greater physiological stress (i.e., low HRV) when the stranger cried. Our findings suggest dogs respond greatly to human emotions, which is reflected through physiological measures, and owners can predict their dog's emotional responsiveness. Additionally, dogs with greater attachment are viewed as more empathetic by their owners and orient to their owners in novel emotional situations.

Emergence and differentiation of exploratory strategies in capuchin monkeys (*Sapajus apella*) during a visuospatial working memory task

Hika Kuroshima (Kyoto University), Muku Tahara (Kyoto University), Aoi Miyagawa (Kyoto University), & Martin Florian (University of Veterinary Medicine and Pharmacy in Košice)

P85 This study examined the exploratory behavior of capuchin monkeys in a visuospatial working memory task. Nine monkeys performed a food retrieval task using a 3×3 vertical array of lids under two conditions: transparent (visible contents) and opaque (concealed contents). Each of the 18 sessions included two trials per condition, and each trial continued until all food items were retrieved. Errors, defined as revisits to previously emptied locations, remained consistently low in the transparent condition, and declined significantly over time in the opaque condition ($t = -6.38, p < .001$). In the opaque condition, the entropy of transition probabilities also decreased ($t = -4.28, p < .001$), indicating increasing regularity in search behavior. Entropy and error counts were strongly correlated across sessions ($t = 13.74, p < .001$), suggesting that improved performance was associated with more structured exploration. To assess whether monkeys adopted similar strategies across conditions, we compared exploration pattern similarity. Similarity did not change significantly over time and was associated with entropy only in the early sessions. During this period, greater dissimilarity between conditions predicted lower entropy ($t = -2.71, p = .023$), indicating that regularity did not depend on replicating transparent-condition strategies. Ongoing analyses will examine condition-specific search patterns over time and individual differences in strategy development.

Inhibitory Control in the Douglas squirrel (*Tamiasciurus douglasii*)

Shannon M Digweed & Marko Muselin (MacEwan University)

P86 The detour task is commonly used in comparative cognition to explore abilities related to motor self-regulation, inhibitory control, social learning, and route planning. These tasks generally involve presenting individuals with a situation in which the direct route to a goal is blocked and a detour must be made to obtain it. Our study explores the use of a locomotor detour task in the Douglas squirrel, in a field setting. Each individual was presented with a detour apparatus that required a locomotion detour around a clear barrier in order to obtain a valued reward. Results indicate that squirrels can successfully navigate the task within the allowed time period and random apparatus orientation. Thus, our preliminary results may suggest that red squirrels may have motor-self control in a foraging related task and thus require further exploration with other detour and motor-control related tasks.

Inference by Exclusion Coquerel's sifakas and Fat-Tailed Dwarf Lemurs

Maya Reilly, Gabriela Venable, & Brian Hare (Duke University)

P87 Inference by exclusion (IbE) is the ability to deduce the location of an unknown object by eliminating known alternatives and is considered a foundational component of reasoning. Comparative studies of IbE across the primate taxa provide insights into the evolutionary origins of reasoning; however, prosimians, including lemurs, remain largely understudied. This study examined IbE performance of two lemur species – the Coquerel's sifaka (*Propithecus coquereli*) and the fat-tailed dwarf lemur (*Cheirogaleus medius*) – using a two-cup paradigm. Results showed that *C. medius* performed significantly above chance on the IbE task, whereas *P. coquereli* did not differ significantly from chance. This interspecific

difference provides preliminary evidence that factors such as diet complexity or absolute brain size may have contributed to the evolution of inferential reasoning abilities in primates. Substantial individual variation in task performance was also observed, and further analyses will examine whether individual temperament predicts success on the IbE task.

Comparing wild and commercial bumblebees (*Bombus impatiens*) on an object manipulation task

Jack Potts, Eve Garbutt, & Caroline Strang (The University of Western Ontario)

P88 Wild and commercially produced bumblebees (*Bombus impatiens*) are widely used in North America to provide pollination services for agriculture, but commercially produced bumblebees are more frequently used in studies of cognition. We explored possible differences in cognition between wild and commercial bumblebees by testing them on an identical object manipulation task. Bumblebees are generalist foragers that collect nectar and pollen from a wide variety of flowers which vary in morphology. Bees must learn how to manipulate flower petals to reach to nectaries, making object manipulation a critical component of bumblebee natural ecology. We compared wild and commercial bumblebees on an object manipulation task, in which bees must lift a plastic door, modelled after a flower petal, in order to escape a small testing tube. Wild foraging bumblebees were collected from gardens on the University of Western Ontario campus, given a single testing trial in the field, and then released. Commercial bees were housed in the lab, collected while foraging in an artificial foraging environment, and tested with the same procedure as wild bees. Bees will be compared on their success rate, as well as their behavioural repertoire and flexible switching between behaviours while engaging in the object manipulation task.

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