32nd Annual International Conference on Comparative Cognition

Sponsored by the Comparative Cognition Society

March 26th to 29th, 2025

Hotel Albuquerque at Old Town
Albuquerque, New Mexico

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CO3 2025 Program Summary			
	Location	**Time**	**Page**
Wednesday			
Optional Paid Event: ABQ BioPark Zoo	*Off-site*	11:00 AM	4
Registration & Poster Session I Setup (*snacks & coffee*)	*Atrium* & Alvarado ABC	3:00-6:00 PM	4
Opening Remarks	Alvarado FGH	6:30 PM	4
Associative Processes	FGH	6:50 PM	4
Break	*Atrium*	7:50 PM	6
Inhibitory Control	FGH	8:10 PM	6
Individual Differences in Cognition	FGH	8:40 PM	7
FEATURE SESSION: CCS Presidential Address	FGH	9:10 PM	8
Thursday			
Free Cultural Event by Visit Albuquerque: Flamenco Performance	*Tablao Flamenco*	10:00-11:00 AM	8
FEATURE SESSION: Outstanding Student Presentation Competition	Alvarado FGH	11:30 AM	8
Learning	FGH	12:17 PM	10
Break	*Atrium*	1:33 PM	12
Serial Processing	FGH	1:53 PM	13
Spatial Cognition & Navigation	FGH	2:52 PM	14
Snack Break	*Atrium*	3:37 PM	15
Problem Solving & Coordination	FGH	4:17 PM	15
Cognition & Welfare	FGH	4:32 PM	16
Animal Emotion	FGH	5:02 PM	16
EDI Event	*DE*	6:30-7:30 PM	17
Poster Session I	*ABC*	8:00-10:00 PM	17
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.			

Friday			
Poster Session II Setup	*ABC*	9:00-11:00 AM	18
CO3 Mentoring Session	*DE*	9:30-10:30 AM	18
FEATURE SESSION: Early Career Award Winner - Rachael Miller	FGH	11:30 AM	18
Canine Cognition: Olfactory Discrimination	FGH	11:50 AM	18
Break	*Atrium*	12:43 PM	20
Canine Cognition	FGH	1:03 PM	20
Discrimination	FGH	1:40 PM	22
Emerging Topics in Comparative Cognition	FGH	2:41 PM	23
Snack Break	*Atrium*	3:22 PM	24
Communication	FGH	4:02 PM	24
Perspective Taking & Social Perception	FGH	4:54 PM	25
Poster Session II	*ABC*	8:00-10:00 PM	27
Saturday			
Optional Paid Event: *New Mexico Museum of Natural History*	*Off-site*	9:00 AM	28
Business Meeting (All are welcome!)	FGH	10:30 AM	28
Group Photo	*Terrace*	11:40 AM	28
Closing of Silent Auction	*ABC*	11:59 AM	28
Development	FGH	12:00 PM	28
Attention & Memory	FGH	1:08 PM	29
Break	*Atrium*	1:53 PM	30
Decision Making	FGH	2:13 PM	31
Snack Break	*Atrium*	3:12 PM	32
Symposium: In Honour of the Contributions of Suzanne MacDonald	FGH	3:52 PM	32
Closing Remarks	FGH	5:16 PM	33
FEATURE SESSION: Master Lecture by Suzanne MacDonald	FGH	5:30 PM	34
Banquet	*DE*	7:00 PM	34
Note: Poster Session I & II details can be found on page 35 and 42, respectively.			

Wednesday

Optional Paid Event: ABQ BioPark Zoo

11:00 AM

This is a recommended activity for those who arrive prior to Registration. Admission is reduced by $2 on Wednesday, March 26th by mentioning to the cashier that you are a member of the "Comparative Cognition Society". You are also welcome to obtain the CCS discount with presentation of your CO3 conference badge, post-registration, between March 27-29th.
Note: This is not a guided event and transportation is not provided.

3:00-6:00 PM Registration & Poster Session I Setup *(in Atrium & Alvarado ABC)*

Snacks & coffee are available.

6:30 PM Opening Remarks by Conference Organizers *(in Alvarado FGH)*

6:50 PM Associative Processes (Chair: Suzanne Gray)

1

Unveiling Crossmodal Links: Comparative Evidence from Tortoises and Chicks

Maria Loconsole (Department of General Psychology, University of Padova, IT), Beatrice Malaman (Department of General Psychology, University of Padova, IT), Elisabetta Versace (Department of Biological and Experimental Psychology, Queen Mary University of London, UK), Gionata Stancher (Rovereto Civic Museum Foundation, Rovereto, IT), & Lucia Regolin (Department of General Psychology, University of Padova, IT)

Humans naturally link information from different senses–a phenomenon known as crossmodal correspondences. For instance, we associate high-pitched sounds with small or bright objects rather than large or dark ones. Similar associations in mammals suggest an evolutionary advantage, possibly helping animals interpret incomplete environmental cues (e.g., judging an animal's size from its call, signalling resource locations). However, evidence in non-mammalian species is scarce, limiting our understanding of this phenomenon's evolutionary origins. To address this gap, we collected evidence of different instances of crossmodal associations in two non-mammalian species: the tortoise (*Testudo hermanni*) and the domestic chicken (Gallus gallus). In tortoises, we reported a pitch-size association, and recently added novel evidence of spontaneous pitch-luminance association. In chicks, we present evidence of space-luminance association, as well as phono-symbolic associations, akin to human tendencies to pair arbitrary sounds (e.g., "Bouba" or "Kiki") with specific shapes (round or spiky). These findings reveal that crossmodal associations are not unique to mammals and may reflect shared organising principles in the vertebrate brain. This research uncovers perceptual similarities between distantly related species and supports the idea that crossmodal associations are evolutionarily conserved. Such mechanisms likely enhance multisensory integration, improving adaptability across diverse environments.

2 7:04 PM

Inferential reasoning Vs contingency learning, two phenomena or two interpretations?

Alex Kacelnik (Department of Biology, Oxford), Dániel Rivas-Blanco (Domestication Lab, Konrad Lorenz Institute of Ethology, Department of Interdisciplinary Life Sciences, University of Veterinary Medicine Vienna, Vienna, Austria), Marco Vasconcelos (William James Center for Research, University of Aveiro, Aveiro, Portugal), Friederike Range (Domestication Lab, Konrad Lorenz Institute of Ethology, Department of Interdisciplinary Life Sciences, University of Veterinary Medicine Vienna, Vienna, Austria), & Tiago Monteiro (Domestication Lab, Konrad Lorenz Institute of Ethology, Department of Interdisciplinary Life Sciences, University of Veterinary Medicine Vienna, Vienna, Austria; William James Center for Research, University of Aveiro, Aveiro, Portugal; Department of Education and Psychology, University of Aveiro, Aveiro, Portugal)

The two-cups task is currently used to investigate inferential reasoning, including inference by exclusion, with focus on primates and parrots. In a simple version subjects view two opaque containers, only one of which is

baited. After being briefly shown the contents of either cup or none, the subject can choose between them. Preference for the baited cup after viewing the empty one is interpreted as confirmatory of inference by exclusion. A recognized difficulty is that the task can be conceptualized as viewing an empty/full/not-shown cup being discriminable stimuli with definite contingencies, independent of folk physics inferential reasoning and understanding causality. To explore this matter, we first trained starlings with individual arbitrary (non-causal) stimuli paired with appropriate contingencies (i.e., pecking keys representing S-, S+ and S1/2). We then presented choices between the stimuli in all possible pairs. Most subjects chose correctly from the beginning of testing. This contrasts with reports of poor performance in inferential reasoning tests that excluded plausible causality tried with primates. Poor performance reports, and their power as evidence for inferential reasoning deserve further analytical examination.

3

7:18 PM

Choice by Exclusion in Pigeons: Does it require prior associations or is it merely a stimulus familiarity effect?

Kayley Ozimac, Cyrus Kirkman, & Aaron P. Blaisdell (UCLA)

In a previous study, pigeons demonstrated choice-by-exclusion after training with increasingly larger stimulus sets, particularly when novel sample-comparison pairs were introduced alongside familiar foils. To examine whether prior associations between familiar sample-comparison pairs are necessary or if familiarity alone drives choice by exclusion, we trained pigeons on 20 new sample-comparison pairs. Phase 1 familiarized 10 comparisons through instrumental reinforcement. Phase 2 introduced acquisition trials using a symbolic matching-to-sample procedure, with pairs assigned to one of four trial types (FN, FF, NN, NF; e.g., in FN, the correct comparison was familiarized in Phase 1, and the foil was novel). If prior associations are necessary, acquisition rates should show no differences across trial types (NF ≈ FF ≈ NN ≈ FN). If familiarity alone suffices, NF > FF = NN > FN. Contrary to both hypotheses, initial performance showed NF < FF ≈ NN < FN, suggesting prior reinforcement history of the familiarized comparisons influenced these results. In a second study, 10 new stimuli were familiarized without reinforcement prior to serving as comparisons. Initial results revealed no differences in learning rates across trial types, suggesting that prior sample-comparison associations are referenced during choice-by-exclusion.

4

7:25 PM

The Separate Roles of Reward and Response-Reward Contingency on Spatial Variability in Pigeons

Megan Cady, Cyrus Kirkman, & Aaron P. Blaisdell (UCLA)

We have previously shown that behavioral variability is impacted by reward factors, including reward probability, magnitude, and proximity. The role of response-reward contingencies on variability, however, has been unexplored. Pigeons received training where we varied Random Ratio (RR) schedules of reward–RR2, RR5, and RR20–, under Instrumental (INS), Omission (OMS), and Pavlovian (PAV) response-reward contingencies. As expected, higher RRs produced a lower percentage of rewarded Instrumental trials but a higher percentage of rewarded Omission trials. Also as expected, variability generally decreased with higher reward rates in the INS conditions at all ratios, and in the OMS condition only for RR5. Interestingly, the OMS RR20 condition revealed a pattern of increased variability with increase of reward rate (Ï„ = 0.056, p = 0.033). Contrary to previous research, we found no significant differences in overall mean variability between RR Instrumental conditions, suggesting that presenting each response ratio separately over extended periods may limit pigeons' ability to discriminate between conditions. Our findings reveal how response-reward contingencies and exposure to response ratios collectively affect behavioral variability.

5

7:32 PM

Conditioned inhibition: What is encoded when an expected outcome does not occur, and how well do different measures assess it?

Ralph R Miller (State University of New York at Binghamton), Edward Cook (State University of New York at Binghamton), Edeline Kalishevich (State University of New York at Binghamton), & James E Witnauer (State University of New York at Brockport)

Prevailing theory often constrains how we think about an intervening variable like conditioned inhibition, which refers to what is encoded when an expected reinforcer is not delivered. Most models of associative learning assume that conditioned excitation and conditioned inhibition are opposing sides of a single continuum of associative strength. Whereas conventional tests for conditioned excitation have been with us since Pavlov, most assessments of conditioned inhibition have used Rescorla's two-test strategy (i.e., retardation and summation). However, a conditioned stimulus trained with a weak contingency to an outcome can pass a conventional test for conditioned excitation and both tests for conditioned inhibition. This suggests something is wrong with either the single-variable conceptualization of excitation and inhibition or the two-test strategy for assessing inhibition. One alternative to the two-test strategy of assessing conditioned inhibition is the negative side of a bivalent scale (e.g., an approach-avoidance measure). I will review some potential models for the cognitive representation of inhibitory training and review published data and four new experiments bearing the strengths and weaknesses of

different measures of conditioned inhibition as well as how each maps into the various models of what is encoded during inhibition training.

7:50 PM *Break*

8:10 PM Inhibitory Control (Chair: Mélisande Aellen)

6

Do Asian elephants (*Elephas maximus*) wait for a larger food reward in a delay of gratification task?
Hoi-Lam Jim (Kyoto University), Shinya Yamamoto (Kyoto University), & Joshua M. Plotnik (Hunter College and The Graduate Center - City University of New York)
Self-control is crucial for social interactions and decision-making, and has been linked to better success, cooperation, and problem-solving in humans. It can be assessed by examining the ability to delay gratification. Given elephants' social complexity, cooperative nature, and problem-solving abilities, they may also demonstrate delayed gratification. However, as generalist and opportunistic feeders, they may favour immediate rewards over delayed ones. We tested six captive female Asian elephants (*Elephas maximus*) in an intertemporal choice task to examine whether they would prefer a sooner, smaller reward or a later, larger reward, with wait times increasing incrementally from 2 to 4, 8, 13, and 18 seconds. In the experimental condition, rewards differed by a 1:4 quantity ratio, while rewards were equal in the control condition. Results showed three elephants waited the full 18 seconds for the larger reward, two waited 2 seconds, and one did not wait at all in the experimental condition. One elephant who waited 18 seconds in the experimental condition also waited 2 seconds in the control condition, possibly due to a carryover effect. These findings suggest elephants may delay gratification, contributing to the literature on self-control in nonhuman animals and enhancing our understanding of elephant cognition.

8:17 PM

7

"Pause, Then Cancel? A Two-Stage Model of Motor Inhibition in Herring Gulls (*Larus argentatus*)
Anneleen Dewulf (Centre for Research on Ecology, Cognition and Behaviour of Birds, Ghent University), Sophia Knoch (Centre for Research on Ecology, Cognition and Behaviour of Birds, Ghent University), Joah R. Madden (Centre for Research in Animal Behaviour, Psychology, University of Exeter, UK), An Martel (Department of Veterinary Sciences, Ghent University), Luc Lens (Centre for Research on Ecology, Cognition and Behaviour of Birds, Ghent University), & Frederick Verbruggen (Centre for Research on Ecology, Cognition and Behaviour of Birds, Ghent University)
Inhibition of motor output is usually regarded as a fast and unitary process. However, recent findings in rodents and humans propose a two-stage mechanism: an initial salience-driven "hold-your-horses" pause that temporarily halts the go response, followed by a stop-specific cancellation process that fully inhibits it. To test this, we used a stop-change task with 80 juvenile herring gulls (Larus argentatus), in which birds had to stop and change their movements in response to a stop signal, which caused the food reward to change locations. Pose and trajectory estimation were performed using the deep-learning tool DeepLabCut. Preliminary results from 20 individuals (2 trials each) showed that, in most trials (85%), birds paused or slowed down in response to the stop signal; but whereas some successfully cancelled their original action toward the inaccessible food reward (pause-then-cancellation; N=23/30), others failed and continued toward it (pause-without-cancellation; N=7/30). These findings support a two-stage model of stopping and highlight considerable individual differences. The full dataset will be used to further investigate the pause and cancellation stages through descriptive measures (e.g., duration, latency) and additional factors influencing variability, such as fear responses and prior experience with the stop signal.

8 8:24 PM

Understanding inhibitory control in Asian elephants using a classic detour paradigm
Sydney F. Hope (Department of Psychology, Hunter College, City University of New York, New York, USA), Gillian Schmitt (Department of Psychology, Hunter College, City University of New York, New York, USA), Sangpa Dittakul (Department of Psychology, Hunter College, City University of New York, New York, USA; Golden Triangle Asian Elephant Foundation, Chiang Saen, Chiang Rai, Thailand), Sarah L. Jacobson (Department of Psychology, Hunter College, City University of New York, New York, USA), Mananya Pla-ard (Department of Psychology, Hunter College, City University of New York, New York, USA; Golden Triangle Asian Elephant Foundation, Chiang Saen, Chiang Rai, Thailand), Marnoch Yindee (Akkhraratchakumari Veterinary College, Walailak University, Nakhon Si Thammarat, Thailand), Taweepoke Angkawanish (National Elephant Institute, Forest Industry Organization, Lampang, Thailand), & Joshua M. Plotnik

(Department of Psychology, Hunter College, City University of New York, New York, USA; Department of Psychology, The Graduate Center, City University of New York, New York, USA)
Inhibitory control, or the suppression of a dominant motor response in favor of a learned behavior, is an important aspect of executive function, decision-making, and cognitive flexibility. Elephants have large brains and behave flexibly; however, little is known about their capacity for inhibitory control. We tested 16 (8M, 8F, 4-60 yrs) Asian elephants (*Elephas maximus*) at the National Elephant Institute in Thailand using a classic detour paradigm. Elephants first learned to reach their trunk around an opaque box to obtain food from a single opening. They were then given a transparent box with front-facing holes from which they could again attempt to obtain the food. The subjects needed to continue to reach around the box (i.e., learned behavior) while suppressing the impulse to reach straight toward the visible food and front-facing odor cues. Elephants performed similarly when detouring around both opaque and transparent boxes, suggesting they may have strong inhibitory control. However, once an elephant's trunk entered the opening, the amount of time needed to obtain the food increased with age– possibly indicating decreased motor ability in older individuals. This study furthers our understanding of convergent cognitive evolution, and suggests a path forward for further cross-species comparisons of inhibitory control.

8:40 PM

Individual Differences in Cognition (Chair: Mélisande Aellen)

9

Shy-boldness evolution and its relationship to cognitive evolution

Gabriela X. Venable, & Brian Hare (Department of Evolutionary Anthropology, Duke University)

Temperament and cognition are important parts of an animal's psychology which help define how an animal interacts with its environment. Research in comparative psychology often focuses on cognitive evolution, particularly the role of different socio-ecological variables (social group size and diet) as selective factors. However, temperament traits, i.e. traits related to emotional reactivity, also can evolve via natural selection and may even share the same selective factors. To examine temperament evolution, we are measuring shy-boldness, i.e. reaction to novelty, using a phylogenetic comparative approach. Our preliminary results using data collected from 10 species of lemur show that shy-boldness may correlate with social group size and diet. To expand this study, we am looking for collaborators using PhyloPsy, a new online marketplace to help researchers complete large-scale multi-species/populations studies.

8:47 PM

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Individual Variation in Wild Asian Elephant (*Elephas maximus*) Responses to Predator and Novel Playbacks

Robbie Ball (Department of Psychology, Hunter College and The Graduate Center, City University of New York), Sangpa Dittakul (Golden Triangle Asian Elephant Foundation Chiang Saen Chiang Rai Thailand), Sarah L. Jacobson (Department of Psychology, Hunter College and The Graduate Center, City University of New York), Mananya Pla-ard (Golden Triangle Asian Elephant Foundation Chiang Saen Chiang Rai Thailand), Matthew S. Rudolph (Department of Psychology, Hunter College and The Graduate Center, City University of New York), Supang Sittichok (Golden Triangle Asian Elephant Foundation Chiang Saen Chiang Rai Thailand), Marnoch Yindee (Akkhraratchakumari Veterinary College, Walailak University, Nakhon Si Thammarat, Thailand), & Joshua M. Plotnik (Department of Psychology, Hunter College and the Graduate Center, City University of New York)

Many animal species can distinguish between and respond differently to predator cues, conspecific calls, and novel sounds. The extent to which an animal approaches or retreats from predator calls or novel sounds can be used to identify personality traits. These traits, as well as the choices animals make about foraging when considering potential risks and threats, may also inform our understanding of how animals are adapting to anthropogenic change. We studied wild Asian elephants (*Elephas maximus*) in Thailand, exposing them to automatically triggered acoustic playbacks. Over two years, we first exposed elephants to predator sounds (tiger roars, leopard growls, Thai ranger shouts) and then exposed them to novel stimuli (dolphin calls, original music). Playbacks were conducted across two categories of habitat: protected areas with minimal human interaction and human-dominated landscapes where resource competition often leads to conflict. Behavioral responses and potential within-individual consistency between them (i.e., personality), such as approaching or retreating from these sounds, were analyzed to compare how elephants respond to threats and novelty in each location category. Findings from this research may highlight how environmental and individual differences shape responses to acoustic stimuli, offering insights for mitigating human-wildlife conflict and improving conservation efforts.

Wild Asian elephants tested near human-dominated landscapes are more attracted to novelty than those in a protected area

8:54 PM

Sarah L Jacobson (Department of Psychology Hunter College City University of New York New York USA), Sangpa Dittakul (Golden Triangle Asian Elephant Foundation Chiang Saen Chiang Rai Thailand), Mananya Pla-ard (Golden Triangle Asian Elephant Foundation Chiang Saen Chiang Rai Thailand), Supang Sittichok (Golden Triangle Asian Elephant Foundation Chiang Saen Chiang Rai Thailand), Marnoch Yindee (Akkhraratchakumari Veterinary College Walailak University Nakhon Si Thammarat Thailand), & Joshua M Plotnik (Department of Psychology Hunter College City University of New York New York USA)

11

Novel exploration may benefit wild animals, especially in human-dominated landscapes. Wild Asian elephants are increasingly spending time in these landscapes as natural habitat is converted to agriculture. Greater neophilia and exploration may allow elephants to successfully access agricultural resources, which may also result in negative interactions between elephants and people. We measured neophilia and exploration in wild elephants tested with novel objects in two environments: one near human-dominated landscapes, the other inside a natural protected area in Western Thailand. For individuals exposed to both novel objects, we determined whether their reactions were consistent, and therefore considered personality traits. Elephants tested near human-dominated landscapes were more neophilic and exploratory than those inside the protected area. The limited sample of elephants who were exposed to both types of objects did not demonstrate consistency in their responses, so we were not able to determine whether neophilia or exploration were personality traits in this population. Even if individual elephants were not consistently neophilic or exploratory between stimuli, those who spend time near agriculture are likely to benefit from their interest in novelty. Knowledge about this behavioral attraction could help improve efforts designed to deter elephants from human areas, reducing negative interactions and promoting coexistence.

9:10-9:30 PM

FEATURE SESSION: CCS Presidential Address (Chair: Caroline Strang)

Whither comparative cognition?

Noam Miller (Wilfrid Laurier University)

12

The field of comparative cognition has been changing rapidly over the past few years. I will review trends in comparative cognition research, and emphasize those that hold us together and those that threaten to splinter the field. I will suggest that, despite some well-known criticisms, comparative cognition does have a unifying theory and that focusing on working within that framework is a productive way forward for the field.

Thursday

10:00-11:00 AM

Free Cultural Event by Visit Albuquerque: Flamenco Performance (*in Tablao*)

This event will showcase the history of Flamenco dance in Albuquerque, with a performance, located across the back hallway in Tablao Flamenco (near Alvarado FGH).

11:30 AM

FEATURE SESSION: Outstanding Student Presentation Competition (Chair: Jenna Congdon)

Television Viewing Behaviors in Companion Dogs

Lane Montgomery, Sarah Krichbaum, & Jeffrey S. Katz (Auburn University)

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Dogs stare and bark at televisions, even attempting to follow objects off-screen. However, little research has sought to quantify and identify the mechanisms responsible for these viewing behaviors. This study aimed to evaluate how dogs engage with television stimuli and what factors are predictive of their engagement. A novel Dog Television Viewing Scale (DTVS) containing questions related to types of television stimuli (animals, inanimate objects) and the sensory domains through which stimuli were perceived (vision, audition) was distributed to companion dog owners. Owners also answered a series of demographic and temperament

questions (PANAS and DIAS) regarding their dog. A PCA was conducted on the items of the DTVS using over 450 responses. DTVS scores were explained by components related to the types of stimuli present and the behaviors the dog exhibited (following behaviors, stationary behaviors). Furthermore, temperament measures (excitement of the DIAS and negative reactivity of the PANAS) were predictive of component scores. These results suggest that television viewing habits in dogs are influenced by a dog's temperament and that dogs may maintain natural stimulus classes in the 2D television format. In practice, engagement with television may provide dogs with a meaningful experience and these findings should inform future studies.

14 11:37 AM

Zoo Visitors Learn by Observing Baboons (*Papio anubis*) Participate in Cognitive Research or Engage in Natural Behaviors

Anna Sofia Hege (Rochester Institute of Technology), Logan Brownell (Carnegie Mellon University, Rochester Institute of Technology), Allison Fitch (Rochester Institute of Technology), Jessica Cantlon (Carnegie Mellon University), & Caroline M. DeLong (Rochester Institute of Technology)

Previous studies have shown that when visitors watch live research being conducted at facilities with non-human animals, they show signs of higher engagement and report higher perceived learning, but what visitors actually learn is not clear. In the current study, 150 adult zoo visitors either observed baboons as they engaged in a cognitive research study (experimental group), or as they engaged in natural behaviors (control group). Both groups listened to a 2-4-minute presentation from an on-site scientist, then took a 33-question survey that asked about their attitudes towards scientific research being done in zoos, their perceived learning, and their actual learning. Stay time was also measured for other zoo visitors at the exhibit without engagement with a scientist while the research task was on and off. The experimental group reported higher perceived learning than the control group, and both groups performed better on questions that were taken from their interaction with the scientist than questions taken from signage. Both groups stayed longer at the baboon habitat than typical zoo guests. This research suggests that zoos hosting research projects can increase zoo visitors' understanding of cognitive capabilities of non-human animals by showcasing these cognitive tasks along with brief educational interactions.

15 11:44 AM

Monkeys May Be Sensitive to Cognitive Effort

Rael Sammeroff, & Robert Hampton (Emory University)

Cognitive effort, like physical effort, can sometimes be sensed. Distorted judgements about cognitive effort are found in many psychiatric disorders including depression and schizophrenia. However, there is no established tool that measures sensitivity to cognitive effort in nonhuman primates. I tested monkeys on a perceptual discrimination task where they had to select a target circle from among three distractor circles of a different size. Difficulty varied and monkeys had the option to accept or decline trials. Accepting a trial allowed the monkey to expend cognitive effort for a pellet reward. Declining a trial resulted in the monkey expending a fixed amount of physical effort for the same reward. If monkeys are sensitive to cognitive effort and find it aversive, then they should be more likely to decline discrimination trials that require high compared to low cognitive effort. Monkeys appeared to be sensitive to cognitive effort in this paradigm over several experiments. This capacity to avoid cognitive effort could promote efficient and strategic use of cognitive effort. That monkeys may make decisions based off cognitive effort costs suggests that the brain may have evolved metacognition not just to optimize resource gain but also to monitor and optimize resource expenditure.

16 11:51 AM

Looping towards certainty: The role of flight loops in homing pigeon navigation

Rithwik John Cherian, T. Florian Jaeger, & Dora Biro (Department of Brain and Cognitive Sciences, University of Rochester, New York, USA)

Homing pigeons develop efficient routes over repeated flights, but many open questions remain surrounding the mechanisms behind this ability. We examine the role of flight loops–instances where pigeons circle at specific locations during their journey. When they first occur, loops are a source of navigational inefficiency; subsequently, however, loops may facilitate efficiency. Using a data-driven approach we test whether looping facilitates navigation, by reducing homing uncertainty or by encoding landmarks. Using multiple GPS datasets of pigeons homing from a novel release site, we find that looping decreases with experience, with birds performing fewer and shorter loops with repeated releases. Pigeons enter loops at points of increased uncertainty, and leave loops with increased certainty, suggesting that loops may be an information-gathering mechanism. Additionally, locations where pigeons perform loops are more likely to be revisited in subsequent flights, indicating these sites might correspond to visual landmarks. This is reminiscent of findings in other species where active vision has been linked to forming view-invariant representations aiding navigation. Finally, ongoing analyses investigate the relationship between landscape complexity and looping behavior.

Together, these findings illuminate the extent to which looping is not a purely stochastic navigational event, but a deliberate strategy.

11:58 AM

17

Evaluating song consistency and its cognitive implications

Prateek Sahu, & Christopher Sturdy (University of Alberta, Canada)

Humans can perceive the degree to which presented sounds are representative exemplars of speech (such as phonemes) and non-speech (such as synthetic sounds) categories. Humans are also sensitive to the statistical distribution and variability of acoustic features among stimuli critical for speech perception. However, less attention has been paid to similar abilities in other animals that rely on vocal communication, such as songbirds. Previous experimental results from swamp sparrows and zebra finches indicate that syllable types and songs occupy distinct acoustic spaces. Here, we used a variety of computational methods to cluster a large dataset of black-capped chickadee (*Poecile atricapillus*) songs from multiple individuals, estimating the proximity and dispersion of individual songs, within an acoustic space. In this space, songs that were closer together indicated consistency, while those farther apart reflected variability. Detailed analysis of two subsamples from clusters validated the results, revealing that consistent and inconsistent songs exhibited distinct acoustic characteristics. This consistency measure can serve as a proxy for learning fidelity, and auditory cognitive abilities, paving the way for experimental validation. Our findings will help improve our understanding of the role of perceptual consistency and ability in communication.

12:05 PM

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Conformity in nest-building decisions

Julia L. Self (Department of Psychology, University of Alberta, Canada), Andrés Camacho-Alpízar (Department of Psychology, University of Alberta, Canada), Priya Binwal (Department of Psychology, University of Alberta, Canada; Department of Biological Sciences, Indian Institute of Science Education and Research Kolkata, India), Umama Mir (Department of Psychology, University of Alberta, Canada), Stefan Stanescu (Department of Psychology, University of Alberta, Canada), Benjamin A. Whittaker (Department of Psychology, University of Alberta, Canada), & Lauren M. Guillette (Department of Psychology, University of Alberta, Canada)

Culture - learned behaviours shared among members of a group - is documented across diverse species. For cultural traits to persist, newcomers must adopt the norms of the group, a process called conformity. We examined conformity in zebra finches (*Taeniopygia guttata*) by testing whether newly introduced males (n = 75; the primary nest-builders) conform to the nest material preferences of an established population. Each male's preferred colour (blue or yellow) was identified as the colour of string he interacted with most, and bias strength was measured as the percentage of interaction time spent with his preferred colour. Each male, with a female partner, was then introduced into a population of birds using nests that either matched, clashed, or were neutral to his initial preference. After observing the population for three days, males were given access to both string colours to build a nest. We found that nest material use depended on the interaction between bias strength and population composition. More weakly biased males in populations that clashed with their preference conformed, while more strongly biased males maintained their preference, regardless of population composition. These findings suggest that individual biases influence conformity and may affect the spread and persistence of culture.

12:17 PM

Learning (Chair: Lauren Guillette)

19

Abstract rule learning and generalization in human and nonhuman primates

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

Abstract rules are central to human language, but the evolutionary origin of the ability to learn and generalize these rules is unclear. We conducted three experiments to directly compare abstract rule learning and generalization in rhesus macaques and humans. In a three-alternative forced-choice task, participants were presented with sequences of trial-unique visual stimuli following three rules ('ABA', 'AAB', 'BAA'). Monkeys learned these rules, and generalized to novel stimuli on a trial-by-trial basis. To further assess generalization, we tested whether humans or monkeys would spontaneously generalize the learned rule to new stimulus domains (from colors to shapes). All human participants but no monkeys showed this generalization. Even extensive follow up testing found no evidence for cross-domain generalization in monkeys. These results demonstrate that monkeys are able to learn abstract rules and can generalize them within a single stimulus domain. However, slower learning, lack of flexibility in rule switching, and particularly failure to generalize across stimulus domains suggests that monkeys acquire more limited, context specific cognitive

representations. These results suggest that a critical open question regarding the uniqueness of human cognition is not only what animals are able to learn, but how they learn and apply abstract rules.

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12:31 PM

Monkeys learn abstract rules, and they know it: Metacognitive awareness of abstract rules in rhesus macaques

Rohini Murugan (Emory University, Emory National Primate Research Center), Angelle Antoun (Emory University, Emory National Primate Research Center), Kathleen J. Bostick (Emory National Primate Research Center), Tristan S. Correa (Emory National Primate Research Center), & Benjamin Wilson (Emory University, Emory National Primate Research Center)

Humans readily apply abstract rules in areas as diverse as language, music, mathematics and logic. Nonhuman animals have also been shown to learn abstract rules. However, questions remain about how these rules are represented in the minds of animals. Here we ask whether rhesus macaques acquire implicit or explicit knowledge of abstract rules by testing if they are metacognitive when applying these rules. Monkeys were trained on a waiting time paradigm, in which they had to maintain a response (a touch on a touchscreen computer) for a variable waiting time (5-12 seconds) to receive a reward. This was then combined with a three-alternative forced-choice abstract rule task, which they had previously learned. If monkeys are metacognitive in applying these abstract rules and know when they respond correctly, they should wait longer on trials when they make a correct decision, and pre-emptively abort trials when they are incorrect. Our data support this prediction, demonstrating metacognition, and therefore explicit knowledge, of macaques' decisions based on abstract rules.

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12:38 PM

Chimpanzees Initiate and Terminate Information Search in Adaptive Ways

Calder Hilde-Jones (University of California Berkeley), Hanna Schleihauf (Utrecht University), Esther Herrmann (University of Portsmouth), Laura Simone Lewis (University of California Berkeley, University of California Santa Barbara), & Jan Engelmann (University of California Berkeley)

Chimpanzees live in dynamic, high-variability environments where ambiguous signals and incomplete information often obscure potential decision payoffs. In inconstant environments, it is adaptive to seek information to resolve ambiguous and uncertain signals. However, previous research has mostly examined whether chimpanzees recognize their own knowledge states, not whether they flexibly seek evidence in response to environmental ambiguity. In Study 1, we investigated whether chimpanzees living at Ngamba Island Chimpanzee Sanctuary (N = 10) are more likely to seek out disambiguating evidence in a condition where they receive ambiguous evidence compared to a condition where they receive definite evidence. We found that chimpanzees adaptively initiate evidence search when presented with ambiguous signals. This raises the question of whether and when chimpanzees stop seeking disambiguating evidence. In Study 2, we show that chimpanzees (N = 12) adaptively terminate evidence-gathering when they have acquired sufficient evidence, and will pay an extra energetic cost when finding more evidence is necessary. Together, these findings suggest that chimpanzees can flexibly initiate and terminate evidence search when presented with varying levels of ambiguity. These studies indicate that both metacognitive analysis of knowledge deficits and subsequent flexible information search evolved prior to humans' last common ancestor with chimpanzees.

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12:45 PM

The Nature of Geometric Intuitions in Monkeys

Jialin Li (Carnegie Mellon University), Logan Brownell (Carnegie Mellon University, Rochester Institute of Technology), Emily Sanford (University of California, Berkeley), Wenjie Li (Carnegie Mellon University), Caroline DeLong (Rochester Institute of Technology), & Jessica Cantlon (Carnegie Mellon University)

Geometric intuition has long been considered a hallmark of human intelligence, with the regularity effect–recognizing geometric shapes with Euclidean features (e.g. parallel sides) more quickly and accurately than irregular shapes–serving as compelling evidence. Previous studies have shown the regularity effect on humans across age and cultural contexts, but they have failed to observe it in non-human primates. The explanation attributes this discrepancy to differences in representation: humans use symbolic features for geometric shapes, whereas non-human primates rely on low-level visual features. Our findings challenge this account —we demonstrate that non-human primates, through training, can recognize regular shapes more quickly and accurately than irregular ones and generalize the regularity effect to novel geometric shapes. Human children exhibit a more robust regularity effect than monkeys during both training and testing. We show that non-human primates encode geometric shapes using "symbolic" features (rather than low-level visual features alone), although human children's representation of geometric shapes correlates more strongly with symbolic features. These findings question the uniqueness of humans in geometric intuition and suggest a shared capacity for the representation in geometric reasoning across species.

12:52 PM

Monkeys process stimulus pairs compositionally, but only one at a time

Angelle Antoun (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)

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A central feature of human language is compositionality, the ability to combine discrete meaningful elements into higher-order cognitive representations, combining words into phrases, and phrases into sentences. We previously demonstrated compositional processing in rhesus macaques, training them to respond based on the combined 'meaning' of two stimuli. Here, we asked whether macaques could go beyond a single compositional operation, and process multiple stimulus combinations simultaneously. We first demonstrated that monkeys could integrate two iconic representations of individual stimulus features (color and shape), to select an appropriate composite image (a colored shape). We then presented the monkeys with two 'phrases', each consisting of a color and a shape, where the target was the set of two appropriately combined colored shapes. All monkeys learned to reliably select the target over foils in which all the stimulus features were present, but mis-combined. These results indicate that the macaques appropriately combined stimulus features, demonstrating a capacity for compositional processing. However, they often incorrectly selected foil stimuli that contained only one correct color-shape combination. This pattern of errors suggests that monkeys have difficulty processing multiple combinations simultaneously, hinting that improved capacity for composition might have played an integral role in the evolution of human language.

12:59 PM

Does Reinforcement Decrease the Variability of Response Sequences?

Edward Wasserman, Odysseus Orr, & Sophia Li (University of Iowa)

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The power of reinforcement to strengthen behavior is indisputable. But does reinforcement concomitantly reduce the variability of behavior? To test this second possible effect of reinforcement, we gave pigeons extended training in which food always followed pecks to five circularly arrayed response buttons. Pigeons were free to respond to those five buttons in any order they chose. When pigeons pecked each button, it was immediately removed from the visual display. Food was delivered after the fifth and final button had been pecked. Given that there are 120 possible sequences in which the five buttons can be pecked, pigeons did generally decrease the variability of the sequences they produced. However, that decrease was exceedingly slow and meandering. The most frequent sequence at the end of training was never the most frequent sequence at the beginning of training, with multiple sequences dominating and diminishing over 150 days. If reinforcement does lawfully decrease the variability of response sequences, then another counteracting process appears to engender increases in variability. Given training with unchanging conditions of reinforcement, perhaps pigeons are inclined to explore the consequences of other behavioral sequences. Michael Crichton colorfully called this balance between stability and change: 'life at the edge of chaos.'

1:13 PM

Examining Memory Limitations during Sequential Same/Different Discriminations in Pigeons

Muhammad A.J. Qadri (Villanova University & College of the Holy Cross), Matthew S. Murphy (Coastal Carolina University), & Robert G. Cook (Tufts University)

25

The study of abstract concept learning in non-human animals often uses same/different perception as a fundamental abstract category discrimination. Previous work shows how the information-theoretic "entropy" measure provides a reasonable correlation with pigeons' responding to static same/different displays. However, a small number of studies use dynamic displays, where the stimuli are presented sequentially over time and need to be compared to other items using something akin to working memory. We discuss these sequential paradigms and consider how ongoing responding throughout the trial can be modeled using a limited working memory capacity and the same entropy measure used to model static displays. This success suggests comparable cognitive processes for items in the simultaneous and sequential discrimination tasks.

1:33 PM *Break*

1:53 PM

Serial Processing (Chair: Anna Wilkinson)

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A new, rigorous method to calculate repeatability from time-to-event data

Kelsey McCune (Auburn University), Coralie Williams (University of New South Wales), Ned Dochtermann (North Dakota State University), Holger Schielzeth (Friedrich Schiller University Jena), & Shinichi Nakagawa (University of Alberta)

Measures of cognitive abilities are frequently expressed as "time-to-event" data, such as the time to solve a task. This data is right-censored when the event (solving) has not occurred within a certain timeframe. Failure to account for censoring can lead to biased results as the full range of performance is not known. Cox proportional hazards (CPH) models, a type of survival analysis, account for censored data. While random effect variances can be estimated in CPH models, it is not possible to estimate residual variance. Consequently, we lack a general method for calculating the repeatability of performance - a vital metric to increase our understanding of whether traits are inherent or influenced by temporally variable factors like hunger, fear or motivation. We present a solution to this issue, and functions in R to facilitate use. We describe the characteristics of CPH models and repeatability as the intra-class correlation coefficient (ICC). We use a case study to demonstrate our method to estimate repeatability using the random effects variance resulting from CPH models and the distribution-specific residual variance from a binomial GLMM. Our proposed method thus generates an easy and standardized way to quantify consistent individual differences (repeatability) in cognition from time-to-event data.

2:07 PM

27

Serial Pattern Learning in Pigeons

Thomas R. Zentall, & Daniel Peng (University of Kentucky)

Serial pattern learning implies learning not just the behavior necessary to obtain the next reward but the general trend of rewards (or their absence). A progressive schedule is one in which the requirements for reward become increasingly more difficult. The progressive schedule is an analog of natural foraging in a depleting patch. Pigeons were given a progressive schedule and a chance to leave for an alternative, signaled single fixed-ratio reward. Optimal foraging theory predicts pigeons should stay with the progressive schedule to obtain the maximum reward. Delay discounting theory predicts that pigeons would leave when the next reward requires the least effort. Instead, pigeons left the progressive schedule and did so too early. This finding indicates that the worsening progressive schedule (rewards become increasingly harder to obtain) makes the progressive schedule more aversive than if ought to be. When pigeons were exposed to a progressively improving schedule, they entered the progressive schedule sooner than expected given the effort required for the next reward. Both studies, as well as earlier research, suggest that the serial pattern of the schedule can influence the pigeons' present choice, a result that suggests a form of control by the future or planning.

2:21 PM

28

Understanding Interval Timing: Challenges from Temporal Patterning and Temporal Averaging

Andrew R Delamater (Brooklyn College & Graduate Center - CUNY), Norman Tu (Graduate Center - CUNY), & Rania Frederic (Graduate Center - CUNY)

The ability to time the occurrence of important events (e.g., food availability) is an important and ubiquitous psychological process. How do organisms learn to time? This question has prompted years of research, but we are still far from an adequate answer. Here we discuss two empirical phenomena that pose special challenges — temporal patterning and temporal averaging. Temporal patterning occurs when animals learn that food is available at one time in the presence of two stimuli when presented individually, but at a different time in the presence of their combination. We show that rats can learn this task reasonably well, though not without difficulty. A multi-layered connectionist modelling approach to interval timing can accommodate this phenomenon. Temporal averaging occurs when animals learn to expect food at different points in time in the presence of distinct stimuli (e.g., 5" in Tone, 30" in Flash), but in non-reinforced probe trials expect food at the average of these two times when those stimuli are tested as a stimulus compound. This phenomenon remains problematic for most theories of interval timing. We will present some additional data looking at possible boundary conditions of this effect, while also pointing to special theoretical challenges they pose.

29 2:35 PM

Empirical Evidence Supporting the Grand Unified Theory of Mind and Brain: A Series of Reaction Time Studies on Auditory and Visual Perception

Aaron P. Blaisdell (UCLA, Psychology), Mingda He (UCLA, Physics), Umaima Afifa (UCLA, Physics), Brian Ta (UCLA, Physics), Isabella Bustanoby (UCLA, Physics), Caominh Le (UCLA, Physics), Javier Carmona (UCLA, Electrical Engineering), Elizabeth Mills (UCSD, Physics), & Katsushi Arisaka (UCLA, Physics & Electrical Engineering)

We present a series of empirical studies designed to test the principles of the Grand Unified Theory of Mind and Brain (GUT-MB) (Arisaka, 2025). Measuring reaction time (RT) across various visual perception tasks we examined how the brain encodes and processes spatial information. RTs to visual and auditory stimuli could also dissociate unconscious from conscious processes. Human participants were presented with visual stimuli varying in eccentricity from the center of fixation, depth, rotational orientation, and size, while RTs were recorded under both covert and overt attention conditions. The results consistently showed that RT increased with spatial transformations along all dimensions, in alignment with the prediction that the brain's internal sensory processing must adjust its phase alignment to match stored memories. We also found evidence of separate unconscious and conscious processing in simple versus choice RT trials, respectively, for both auditory and visual stimuli. The relationship between RT and transformation parameters was linear, strongly supporting the space-to-time conversion hypothesis central to Neural-Holographic Tomography (NHT). These findings provide strong empirical support for the mechanistic framework of GUT-MB, illustrating how brainwave dynamics facilitate efficient perception, recognition, and motor action.

2:52 PM Spatial Cognition & Navigation (Chair: Anna Wilkinson)

Mazes, motivation, and memory, oh my! The amphipod escape journey, so far.

Joshua Wolf, Sophia Ruppel, Madison Fanning, & Elizabeth Newlin (Carroll University)

30

Amphipods have demonstrated the ability to escape a 3-D printed aquatic T-maze but have not yet demonstrated strong evidence of learning to escape faster or with fewer errors across sessions. It is still unclear whether lack of improvement is due to the motivational aspects of the procedure and apparatus, the maze itself, or a true inability to learn to escape more efficiently. The current set of experiments manipulated several variables in an attempt to provide the most likely scenario for a demonstration of improved performance. These manipulations include: different 3-D printed aquatic mazes (e.g., runway, S-maze, plus maze), use of predator olfactory cues, and a modified procedure to allow for more safe and dark time after a successful escape. We recorded number of errors and time to escape for each experiment. The results, and possible implications, of each experimental modification will be discussed.

3:06 PM **Collective route memories in homing pigeons**

Joe Morford (University of Rochester), Patrick Lewin (University of Oxford), Christopher Krupenye (John Hopkins University), Richard Mann (University of Leeds), & Dora Biro (University of Rochester)

31

This study investigates the emergence of collective memory and its potential role in collective intelligence in homing pigeons. Collective intelligence, the phenomenon in which larger groups make better decisions than smaller groups and individuals, has been observed across various taxa. One potential mechanism for enhancing group decision-making that has received little attention is the better retention of learned information in larger groups, termed collective memory. Here, we explore whether collective memory emerges in groups of co-navigating homing pigeons. Pigeons were trained to home in pairs and tested on their ability to retain learned routes after a seven-week period of forgetting. Results showed that pigeons tested in pairs flew closer to their training routes compared to those tested individually. However, this did not translate into a difference in homing efficiency between paired and solo birds, perhaps because the period of forgetting was too short to generate a sufficient drop in efficiency. An additional experimental group demonstrated that extra training and a shorter period of forgetting abolished the difference between paired and solo performance. These findings suggest that collective memory, through the differential retention of information across group members, can contribute to collective intelligence in non-human animals.

3:20 PM **Edward Tolman's cognitive maps were not 'map-like representations': an alternative explanatory scheme between stimulus-response pairings and full-bore representations**

Tyler Delmore (York University)

32

Edward Tolman's "cognitive maps" are widely held to mark a shift within American psychology from the behaviorist to the cognitivist age. It's believed, specifically, that Tolman (1948) offered experimental evidence that demanded a move from stimulus-response to *representationalist* explanations. Rats in his "latent learning" experiments encoded information regarding a maze's spatial layout. Similarly, rats in his "sun-burst maze" solved a short-cutting task by performing inferences over spatial representations. Scholarship is nearly unanimous on this view, pitting Tolman *with* O'Keefe & Nadel's "map-like representations" and *against* associative accounts. The issue is that, on examination, this understanding of Tolman is almost entirely false. Most flagrantly, the details of his experiments have become badly distorted and 'upsold' over time. Inspecting the original experiments, their results do not license representations and are easily accounted for by Tolman's neobehaviorist and "response-referential" account of learning / performance. De-mythologizing Tolman, however, does not require an erasure his "maps". Tolman favored an intermediary form of explanation — neither associative nor representationalist — in terms of what the

animal knows about the results of its respective responses to a given stimulus situation. This, I argue, intercedes as a viable alternative account of animals' navigation behavior, defying the standard oppositions.

3:27 PM **Desert ants oscillate more in navigation when conditions are more uncertain**

Sudhakar Deeti, Vito Lionetti, & Ken Cheng (Macquarie University)

33 We present selected data to show that when navigational conditions are more uncertain, as judged by experimenters, Australian desert ants (*Melophorus bagoti*) slow down, stop and scan the environment more often and for longer, and oscillate more. In the experimental set up, the ants were heading in a straight path from their nest to a feeder 7 m away. Just before the feeder stood two sizeable boards with a gap between them giving access to the feeder. After getting thoroughly used to travelling this outbound route, conditions of navigation were modified by changing the color of the boards or removing them altogether. In navigation, these desert ants oscillate by meandering left and right–called path oscillation–and swing their head left and right–called orientation oscillation. Under the more uncertain navigational conditions, the amplitudes of orientation oscillations increased and the spatial frequency of path oscillations increased. Why all these changes in navigational performance? We suggest that ants continuously trade off exploitation–getting straight to the goal–with exploration–gathering information from the environment. When conditions are more uncertain, ants explore more in order to keep the level of uncertainty within acceptable bounds.

3:37 PM Snack Break

4:17 PM Problem Solving & Coordination (Chair: Kate Chapman)

34 **The Multi-Access-Box in Horses Compared to Carnivores and Primates**

Zoe Johnson-Ulrich (Eastern Oregon University)

Several primate and many carnivore species have been tested with the multi-access-box paradigm. This paradigm involves presenting subjects with a puzzle box containing a food reward with multiple access points (solutions) and ultimately observing how many solutions an animal can learn. This is considered a measure of innovation. Multiple other aspects of problem-solving can also be assessed using this paradigm. I present preliminary data on using both a multi-access-box (MAB) and a novel and comparable spatial problem, the multi-access-spatial-problem (MASP), with domestic horses and offer some hypotheses on performance differences between horses and other species.

4:24 PM **Common marmosets exhibit coordination in a rope-pulling task**

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

35 Coordination, which requires two or more individuals to align their actions to achieve a common goal, has been tested using the cooperative rope pulling paradigm, a physically intuitive problem where two individuals are required to pull on two ends of a rope simultaneously to obtain a reward. While successful coordination in this task has been documented in a number of species, the extent to which subjects perceive the task as one requiring coordination remains unclear. We tested two pairs of common marmosets (*Callithrix jacchus*) in this paradigm and quantified both participants' gazing behavior as a potential indicator of understanding their own and their partner's role in achieving coordination. While both pairs demonstrated successful coordination within 40-80 trials, preliminary data do not show a correlation between gazing behavior and success. However, we hypothesize that a correlation might emerge under increased coordination demands, such as a "delayed release" condition where one subject is given access to the apparatus first and must wait for its partner to be released before acting. Results from our study will yield novel insights into the cognitive underpinnings and flexibility of coordination, as well as important comparative data from a species exhibiting cooperative breeding.

4:32 PM

Cognition & Welfare (Chair: Kate Chapman)

36

Exploring the Impact of Environmental Enrichment on Thinstripe Hermit Crab Behavior

Lindsey Johnson & Heidi Lyn (University of South Alabama)

Environmental enrichment has been shown to influence behavior in various species, but its effects on crustaceans, particularly thinstripe hermit crabs (*Clibanarius vittatus*), remain underexplored. This study aimed to assess behavioral differences in hermit crabs under two conditions: enriched (with added structural complexity) and barren (no enrichment). We observed hermit crabs using 1-0 interval coding for seven behaviors (e.g., walking, retraction) during multiple 10-minute intervals. Preliminary results suggest that environmental enrichment promotes increased activity. For example, walking and interaction behaviors were more frequent, while withdrawal behaviors like retraction decreased. These findings underscore the potential benefits of environmental enrichment in promoting more active and engaged behavior. These results provide valuable insights into how environmental complexity influences crustacean behavior. By demonstrating potential behavioral benefits of enriched environments, this study highlights the importance of considering environmental enrichment as a tool for improving welfare in managed care settings. Further research could refine our understanding of specific features that maximize these benefits, ultimately contributing to more effective and humane management practices for crustaceans and other aquatic species in human care.

4:39 PM

37

The Impact of Stress in Cognitive Performance in Dogs (*Canis familiaris*) and Welfare in Research

Maria Botero (Psychology & Philosophy Department, Sam Houston State University), Adam Natoli (Psychology & Philosophy Department, Sam Houston State University), & James Harper (Biology Department, Sam Houston State University)

Stress can alter cognitive performance in many species but relatively little research has been done exploring how stress affects cognitive performance in dogs. Moreover, little attention has been paid to prioritizing the welfare of dogs as research participants when experiencing stress. In this study, first, we investigated how stress affects performance on a cognitive task in dogs (*Canis familiaris*), by examining the correlation between stress behaviors, physiological stress through salivary cortisol, and interaction with a puzzle. All behavioral markers of stress other than tail position were significantly negatively correlated with overall performance on puzzle tasks, as measured by the number of treats successfully accessed by the dogs and with the amount of time oriented to the puzzle task. Second, we provided dogs with three different opportunities to dissent (i.e. refusal to participate in research). We observed that several behavioral indicators of canine stress were significantly, positively correlated with dissent behaviors and that cortisol levels decreased after the dog engaged in dissent. Taken together, canine stress appears to be inversely related to cognitive performance on puzzle tasks and positively associated with the use of dissent behaviors during study participation.

4:53 PM

38

Investigating the motivations of repetitive barrier interactions in *Pogona vitticeps*

Melanie Denomme, & Glenn Tattersall (Brock University)

In captivity, reptiles have often been observed repetitively interacting with the barriers of their enclosure (hereafter called IWB). Because IWB is directed at the barriers of the enclosure, many assume this behaviour indicates a motivation to escape; however, this assumption has never been tested. Therefore, we observed captive bearded dragons (*Pogona vitticeps*) in their home enclosures over one and a half years and examined patterns in their performance of IWB. If IWB indicates a motivation to escape, then lizards should perform this behaviour more on escape routes than any other area of their enclosure. Furthermore, the performance of IWB should be associated with other factors that may increase a motivation to escape; specifically, we predicted that a lizard's motivation to escape the enclosure would increase around the time of defecation, during breeding seasons, or in anticipation of feeding. Although IWB was biased towards known and transparent escape routes, it was not consistently associated with the factors we predicted. Our investigation is one of the first to analyze the motivations of repetitive behaviour in reptiles and highlights new and potentially elucidating areas for future research that may improve our understanding of repetitive behaviours in all vertebrates.

5:02 PM

Animal Emotion (Chair: Jordyn Truax)

39

Joyful Surprises: Eliciting positive affect in a comparative paradigm

Heidi Lyn (University of South Alabama), Lindsey Johnson (University of South Alabama), & Alex Taylor (Universitat Autònoma de Barcelona)

We present a novel methodology to explore behavioral correlates of positive affect across species. An expectation is created over several trials; then that expectation is violated in either a positive or negative direction and the animals' behaviors are recorded. For example: showing, hiding, and revealing 1 treat under a cup for 5 trials (expectation); in the 6th trial, however, the 1 treat is shown and hidden, but 10 treats are revealed (food surprise). A second condition — social surprise — was also run with a known individual vs a stranger. We expected that positive affect would be elicited only with the combination of surprise and higher than expected reward. Bonobos showed the expected responses, with positive affect coded only in the positive surprise trials. Similarly, bonobos showed negative responses only in the negative surprise trials. Dogs also showed positive responses in the positive surprise trials, and negative responses in the negative food trials, but several dogs also showed positive reactions in the negative social surprise trials. These data will be coded to examine the potential for behavioral markers of positive affect in bonobos and dogs. Similar studies are currently planned for dolphins and children to compare responses and ground-truth the methodology.

5:16 PM

Assessing Dog Emotions with a Modified Attention Bias Test

Holly Molinaro (Arizona State University)

40

Understanding and assessing animal emotions is vital for improving welfare, yet few reliable methods are currently available. The attention bias test evaluates emotional states by presenting a threat and measuring responses after its removal. It has been previously validated with pharmacologically induced emotional states in livestock and lab animals. In our study, emotional states were naturally induced by owners for two minutes in 45 dogs in three groups: positive (play and treats), negative (verbal reprimands), and neutral (quietly sitting with owners). Each dog then entered an arena for three minutes, during which a noisy fan with colorful streamers was revealed and activated for 10 seconds. Dogs in the negative group exhibited heightened stress responses, such as pacing, fewer vocalizations, and spent more time near the exit during the fan stimulus. Positive and neutral groups displayed post-stimulus recovery behaviors, including approaching a food bowl, indicating stress resilience. While results confirm the test's ability to measure stress and recovery, limited differentiation between the positive and neutral groups suggests a need to refine emotional induction protocols or test sensitivity. Future research should address variability and explore natural induction methods, enhancing the test's reliability and its application to improving animal welfare practices.

5:23 PM

Do animals prefer sounds that contain similar levels of noise to their natural vocalizations?

Marisa Hoeschele, Oliver Tab Bellmann, Melina Witt, & Bernhard Wagner (Austrian Academy of Sciences)

41

Natural sounds, including the vocalizations of many animals, contain harmonics: integer multiples of the fundamental frequency. Across cultures, humans use the relationships found in the harmonic series to synchronize their voices to be in "harmony", thereby socially bonding via music. While there is evidence that at least some other species attend to and use the harmonic series in their natural behaviour, it is still unclear what drives this attention. One hypothesis is that species with especially prominent harmonics in their vocalizations (e.g., humans) would be attracted to harmonic sounds, whereas species that have relatively obscured harmonic information in their vocalizations (e.g., budgerigars) would be more attracted to noisy sounds. Here we tested this hypothesis with humans and budgerigars using a place preference paradigm. Humans consistently showed a preference for clean sounds, which male budgerigars shared in one test. We showed a lack of preference for noisy sounds in budgerigars which may be due to conserved cross-species indicators of emotion: relatively noisier calls tend to be higher arousal and produced in more stressful situations. Overall, the stronger preference in humans for clean over distorted sounds supports the idea that harmonic sounds are especially appealing to species with prominent harmonics.

6:30-7:30 PM EDI Event (*in Alvarado DE*)

This event is to 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 PM Poster Session I (*in Alvarado ABC*)

With cash bar available.

See Poster Abstracts starting on Page 35.

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

Friday

9:00-10:30 AM Poster Session I Setup (*in Alvarado ABC*)

9:30-10:30 AM CO3 Mentoring Session (*in Alvarado DE*)

This session is titled "How to fail at science", hosting a panel of experts who will share their experiences of navigating challenges. Students will have opportunities to ask questions to each of the speakers, then engage in breakout groups. Breakfast items will be available for students in attendance.

11:30 AM **FEATURE SESSION:** Early Career Award Winner - Rachael Miller (Chair: Jennifer Vonk)

42

Avian cognition and behaviour: from fundamental to applied

Rachael Miller (University of Cambridge)

Cognition determines in part an animal's ability to adapt (i.e., respond flexibly) to variation in ecology and social environments, including responses to novel, human-imposed environmental changes, like habitat degradation. There are broad species and individual-level variation in cognition and behaviour, including in neophobia (i.e., responses to novelty), innovation (i.e., problem-solving), delayed gratification (e.g., tolerating delays for higher-value rewards) and social learning (i.e., learning from others), with important fitness and survival implications. Fundamental research quantifying individual and species-level differences may be applied to conservation strategies, including reintroductions, such as pre-release training and assessment of individual suitability for release. However, some species and individual differences are found to be consistent across time and contexts, while others are flexible. Investigating the drivers of variation are crucial for advancing fundamental understanding, as well as informing applications of cognition to animal conservation and welfare. I present research investigating variation in avian cognition and behaviour, including in threatened species during reintroduction efforts, and, as Co-Founder, through the Big-Team Open Science ManyBirds Project.

11:50 AM Canine Cognition: Olfactory Discrimination (Chair: Julia Espinosa)

43

Same-Different Odour Learning in Dogs

Anna Wilkinson (School of Natural Sciences, University of Lincoln, Lincoln, UK), Claire Ricci-Bonot (School of Natural Sciences, University of Lincoln, Lincoln, UK), Amelia Duncan (School of Natural Sciences, University of Lincoln, Lincoln, UK), Daniel S. Mills (School of Natural Sciences, University of Lincoln, Lincoln, UK), Thomas W. Pike (School of Natural Sciences, University of Lincoln, Lincoln, UK), Victoria F. Ratcliffe (Defence Science and Technology Laboratory, Porton Down, Salisbury, UK), Mike Nickson (Defence Science and Technology Laboratory, Porton Down, Salisbury, UK), Emma Hobbs (Defence Science and Technology Laboratory, Porton Down, Salisbury, UK), & Helen E. Zulch (School of Natural Sciences, University of Lincoln, Lincoln, UK)

The performance of detection dogs relies on their ability to detect and alert to variations of the stimuli upon which they have been trained. As such, a large proportion of research in the field of scent detection dogs has tended to focus on understanding the likelihood of generalising beyond a trained stimulus set. However, it remains unclear what stimuli dogs would naturally perceive as the same or different. Understanding this would allow the creation of more appropriate training aids to improve performance of working dogs. This study used a same-different concept learning approach to assess dogs' perception of odour similarity. Dogs were simultaneously presented with two odours which could either be the same as or different from each other and were trained to give alternative behavioural indications depending on this. Four dogs met the learning criteria, suggesting that they could learn the concept with the initial stimulus set. However, none were able to generalise

this to novel stimuli. Thus, whilst the work shows promise, alternative approaches may be better for assessing odour space in dogs.

44 12:04 PM

Effects of exercise and physiological parameters on odor detection performance

Liza Rothkoff (Department of Animal and Food Sciences, Texas Tech University, Lubbock, TX, United States), Edgar O. Aviles-Rosa (Department of Animal and Food Sciences, Texas Tech University, Lubbock, TX, United States), Michele Maughan (Precise Systems, Lexington Park, MD, United States), Joerg Schultz (Tier Wohl Team GbR, Rödelsee, Germany), & Nathaniel J. Hall (Department of Animal and Food Sciences, Texas Tech University, Lubbock, TX, United States)

The ability of detection dogs to maintain olfactory sensitivity during physical activity is crucial for their operational performance. Exercise is known to influence physiological factors, but its impact on olfaction remains unclear. Here we investigate how exercise intensity affects odor detection performance, core body temperature, and heart rate in detection dogs. Using an integrated olfacto-treadmill, dogs were exercised at 4 km/h (walk condition) or 8 km/h (trot condition) while simultaneously performing a go/no-go olfactory detection task. We found that during low-intensity exercise (walking), performance did not decline. In contrast, after 12 minutes of moderate-intensity exercise (trotting), it declined rapidly. This decline paralleled a 1°C increase in core body temperature, while walking produced less than a 0.25°C increase. To disentangle the effects of exercise intensity from duration and to observe recovery, we switched pace within the session in a second experiment. Dogs were able to recover from performance declines when switching from a trot to a walk mid-session, but olfactory performance deteriorated quickly when switching from a walk to a trot. These findings demonstrate that the integrated olfacto-treadmill allows precise measurement of olfactory performance during physical activity, providing a detailed understanding of how exercise intensity affects detection abilities.

45 12:11 PM

The effect of arousal on memory consolidation in dogs learning an odor detection task

Courtney Collins-Pisano (Department of Psychological Sciences, Auburn University), Sarah Krichbaum (Canine Performance Sciences, College of Veterinary Medicine, Auburn University), Lucia Lazarowski (Canine Performance Sciences, College of Veterinary Medicine, Auburn University), & Jeffrey S. Katz (Department of Psychological Sciences, Auburn University)

Memory consolidation is improved by post-learning arousal. In companion dogs, post-learning treadmill exercise and social play improve retention (Affenzeller et al, 2017; Snigdha et al, 2014). In humans, post-learning arousal interacts with arousal during learning. In dogs, the effect of arousal on performance during learning is dependent on dog's baseline arousal levels (Bray et al., 2016). This study aimed to investigate the effect of 15-minute post-learning activities (social play with a human experimenter, solitary play with a chew toy, control condition with no intervention) in a between groups design on memory consolidation in candidate detection dogs learning an odor detection task. The interaction between baseline arousal level, arousal during training, and post-learning activity was investigated. Physiological measures of arousal (cortisol and heart rate) and pre-test temperament metrics were used as arousal measures. There was a significant three-way interaction between post-learning activity, training heart rate, and baseline arousal on 24-hour hit rate. Dogs with low baseline arousal in the social play group performed better with higher training heart rates, but dogs in the social play group with high baseline arousal performed worse with higher training heart rates. This emphasizes the importance of selecting training methods for individual dogs.

46 12:18 PM

The Effect of Soil Depth and Structure on Dogs' Detection of a Buried Odor: A Pilot Study

Glenna N. Cupp, Madalyn Bower, Daniel R. Hirmas, Paola A. Prada-Tiedemann, Nathaniel J. Hall, & Edgar O. Aviles-Rosa (Texas Tech University)

Effects of soil characteristics and burial depth on dog detection performance are unknown. We developed a method to assess the impact of soil structure and depth on detection of a buried odor. Dogs were trained using an olfactometer to detect the headspace of a vial containing a target odor (1-bromooctane) buried within various soil types (decomposed granite, sand, and a mixture) and depths (2.9 cm, 5.7 cm, and 11.4 cm). Type ($F = 23.52$, $p <. 0001$) and depth ($F = 25.5$, $p < .0001$) had a significant impact on detection. The interaction of the two neared statistical significance ($F = 2.28$, $p = 0.0585$). Accuracy was higher when the target was buried under decomposed granite ($M = 0.89$, 95% CI [0.85, 0.94]), compared to the mixture ($M = 0.69$, 95% CI [0.60, 0.78]) and sand ($M = 0.64$, 95% CI [0.53, 0.74]). This corresponds with the pore size distribution of each soil. Accuracy decreased with depth. Accuracy was higher when the target was buried at 2.9 cm ($M = 0.88$, 95% CI [0.80, 0.95]), compared to 5.7 cm ($M = 0.68$, 95% CI [0.56, 0.79]) and 11.4 cm ($M = 0.64$, 95% CI [0.57, 0.72]).

47 12:25 PM

Evaluating canine detection thresholds to the primary odor volatiles of explosives

Connor Lambert (Department of Food and Animal Sciences, Texas Tech University), Glenna Cupp (Department of Food and Animal Sciences, Texas Tech University), Sarah Kane (Department of Food and Animal Sciences, Texas Tech University), Celeste Medrano (Department of Environmental Toxicology, Texas

Tech University), Paola Prada-Tiedemann (Department of Environmental Toxicology, Texas Tech University), Edgar Aviles-Rosa (Department of Food and Animal Sciences, Texas Tech University), & Nathan Hall (Department of Food and Animal Sciences, Texas Tech University)

Dogs can be trained to detect a wide variety of explosives via olfaction. Little is known about which chemical volatiles are most salient to dogs in the detection of explosives. We sought to determine the relative salience of different volatiles via investigating dogs' sensory thresholds for the chemical volatiles most prominent in two common explosives: C4-Plastics and TNT. We first compared three competing methods used to assess detection thresholds: random presentation of different concentrations; blocked presentation with descending concentration of odors; and the descending staircase procedure. We found that a blocked procedure provided the lowest thresholds, wherein dogs received consecutive blocks of ten trials at decreasing half-log concentrations until dogs reached chance performance. We then tested dogs' olfactory thresholds for different chemical volatiles prominent in explosives. We find variation in dogs' thresholds to different explosives volatiles with orders of magnitude of difference. Further examination of dog olfactory thresholds will allow better for better estimates of the relative salience of volatiles associated with explosives.

12:43 PM Break

1:03 PM Canine Cognition (Chair: Julia Espinosa)

Optimizing Automated Computer Touchscreens for Dog Cognition Testing: Insights from a Visual Discrimination Task

Stephanie Hargrave, Lorelei Switzer, Emma Kristal, Dayzee Guerrero, Kait Tereso, Nova Vogel, & Evan MacLean (University of Arizona)

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Computer-based touchscreens offer several advantages for measuring animal cognition, including automated presentation of stimuli, streamlined data collection, and facilitation of cross-species comparisons by using similar tasks across taxa. Our pilot testing of touchscreen tasks with dogs suggests that spatial tasks (e.g., spatial serial reversal learning) may be more easily learned than tasks requiring dogs to differentiate stimuli using other visual features. To optimize future use of non-spatial touchscreen tasks in canine cognition testing, we conducted a visual discrimination study to identify which types of 2-D visual stimuli dogs can quickly learn to differentiate. Dogs first learned to differentiate an initial stimulus pair to criterion (mean of 70% correct across two consecutive sessions). They then completed ten sessions in each of six additional stimulus pairs presented in a randomized order. Preliminary results indicate that dogs do not exhibit concept generalization (i.e., improvements in performance over successive sets of stimuli) but that stimuli do differ in discriminability. Dogs learned to differentiate image sets involving single colors, shapes, and high contrast patterns more successfully than those involving photographs (regardless of photograph saturation or presence of dog-discriminable colors). Additional data collection to determine if viewing distance impacts discrimination performance is ongoing.

DogTouch - a portable touchscreen-based platform for behavioural and cognitive testing of pet dogs

1:10 PM

Tiago Monteiro (Veterinary Medicine University, Vienna, Austria; University of Aveiro, Portugal), Siqi Yang (Veterinary Medicine University, Vienna, Austria), Christian Menne (Veterinary Medicine University, Vienna, Austria), Yuri Ouchi (Veterinary Medicine University, Vienna, Austria; University of Tsukuba, Japan), Cara Glynn (Veterinary Medicine University, Vienna, Austria), Daniel~~u00e1niel~~ Rivas-Blanco (Veterinary Medicine University, Vienna, Austria; University of Aveiro, Portugal), & Friederike Range (Veterinary Medicine University, Vienna, Austria)

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Dogs are increasingly becoming a preferred model in behavioural and cognitive research. Despite touchscreen-based studies with dogs having provided compelling data that illustrate their capabilities across multiple cognitive domains, the use of touchscreens did not accompany the growing publication trend using different, more traditional, testing methods. Here, we explore potential reasons for this lack of traction, such as training demands or access to the technology, and discuss potential solutions, including a new open-source portable framework for closed-loop touchscreen-based behavioural and cognitive testing in dogs - DogTouch. This system is composed of a hard case/transport trolley, a height-adjustable touchscreen controlled by a personal computer, and includes video and audio capabilities as well as an automatic food delivery system. As a testbed, we present 2 experiments where the system was used to i) investigate dogs' basic learning and memory capabilities (n=8), and ii) how it can be used to create testing environments that are simultaneously video tracking-friendly and amenable to be systematically modifiable without human intervention (n=23). DogTouch has the potential to integrate other sensory modalities, different experimental paradigms and target species in

laboratory, semi-naturalistic or even free-ranging settings, enabling multiple new avenues of inquiry and cross-lab collaborations.

1:24 PM

Training Does Not Uniformly Increase Canine Self-Control

Ellen Furlong (Transylvania University), Rebecca Singer (Berea College), Zach Silver (Occidental College), Riley Welch (Georgetown College), Isabella Perry (Georgetown College), Caitlyn Jones (Berea College), & Ahna Cates (Transylvania University)

50

Dog trainers often claim that training dogs to improve self-control will solve behavior problems (i.e., Gibeault, 2020). We investigated whether one aspect of self-control, motor inhibition, covaries in dogs with varying levels and contexts of formal training. We tested pet dogs with little formal training and dogs with high levels of training competing in scent work, barn hunt, and agility. All dogs were tested for motor inhibition on the cylinder task, a validated self-control task (Olsen, 2022). During training trials dogs watched a piece of food placed inside an opaque cylinder before being allowed to retrieve it. During test trials a transparent cylinder replaced the opaque one, requiring dogs to inhibit directly approaching the now visible food instead of immediately detouring to an open side. In contrast to the belief that highly trained dogs would uniformly demonstrate better self-control, trained dogs did not perform better compared to untrained dogs. In fact, dogs who competed in barn hunt performed significantly worse compared to untrained pet dogs. These findings suggest that self-control may involve a complex set of mental processes that does not uniformly generalize to multiple contexts.

1:40 PM

Discrimination (Chair: Robert Cook)

Investigating Judgements of Photorealistic Mental Representations of Dogs and Cats Using Generative Artificial Intelligence

Lindsay Palmer (Arizona State University), Clive Wynne (Arizona State University), Daniel Albohn (University of Chicago Booth School of Business), & Alexander Todorov (University of Chicago Booth School of Business)

51

Appearance can influence pet acquisition decisions more than health or behavior. However, the current literature is mixed on appearance factors that drive decisions. For example, some studies find that black dogs have lower adoption and higher euthanasia rates than lighter-coated dogs while other studies do not. Breed may mediate these effects, as black labs are not perceived more negatively than other breeds. To clarify how appearance shapes judgments, we investigated appearance-related biases in human decision-making using generative artificial intelligence, specifically, a validated method capable of producing photorealistic mental prototypes of dogs and cats. We recruited undergraduate participants to view synthetic images of dogs or cats and asked them to categorize the images on one of six judgments: adoptability, attractiveness, dominance, intelligence, friendliness, and aggression. Mental prototypes were constructed by fitting a model to each participant's response. The computed values for each participant were then visualized using the generative AI model, resulting in a photorealistic representation that varied along the judgment of interest. We discuss the implications of this work for human social cognition and behavior related to the welfare of cats and dogs and the practical applications for this work (i.e., adoption in shelters).

1:54 PM

Hold It! No Effect of Response Delaying on Illusory Visual Perception in Monkeys

Joseph McKeon-Sanford, Cassandra Rosales, & Michael J. Beran (Language Research Center, Georgia State University)

52

Nonhuman primates share many of our illusory perceptions, including those related to brightness and contrast. There is limited research on whether delaying responses can reduce these illusory effects. This study assessed whether requiring monkeys to delay their response improved performance compared to when they responded immediately. In the experiment, rhesus monkeys and brown capuchins made a light/dark discrimination of a grayscale stimulus. Monkeys either had to respond within two seconds of the stimulus appearing or were required to wait two seconds before responding. The background shade was also manipulated and could either be Dark, Mid, or Light. Illusory-preventing trials occurred when the circle was close to the midpoint of the grayscale and the background was the opposite category (e.g., Light circle, Dark background). Illusory-inducing trials occurred when the circle was close to the midpoint and the background was the same category (e.g., Light circle, Light background). Results indicate that although requiring monkeys to delay responding had no effect on performance, there was a significant performance deficit on illusory-inducing trials and performance boost on illusory-preventing trials. These findings have implications for our understanding of controlled and automatic processing in nonhuman primates, as well as support for a single-stimulus contrast illusion.

53 2:01 PM

The Effects of Differential Outcomes on Acquisition, Extinction, and Reacquisition of a Visual Discrimination in Rats

Jordan Nerz, Sara Bond, Katie Cagney, & Ken Leising (Texas Christian University)

The differential outcomes effect (DOE) occurs when the delivery of different outcomes following different responses facilitates learning. The current research compared the effects of differential outcomes (DO) or mixed-outcomes (MO) during pretraining, acquisition, extinction, and reacquisition of a visual discrimination. During pretraining, some rats (DO) received different rewards for a left or right lever press while others received the uncorrelated outcomes (MO). During acquisition, DO rats received one outcome following a left lever press during one visual stimulus (a flashing light) and a different outcome for right lever presses during another visual stimulus (a steady light), whereas the outcomes were uncorrelated with the responses for MO groups. Next, all rats underwent extinction in which responses were nonreinforced, followed by reacquisition with conditions switched (e.g., DO training --> MO reacquisition). The results indicated that pretraining with DO prior to MO discrimination training facilitated acquisition relative to rats that received MO throughout training. Rats that received MO in training were slower to extinguish than rats that received DO in training. In reacquisition, switching from DO to MO did not affect accuracy, but a switch from MO to DO allowed for acquisition in rats that received MO throughout training.

54 2:08 PM

Humans and pigeons overestimate numerosity in coherent visual displays

Francisca Diaz, Leyre Castro, & Edward A. Wasserman (The University of Iowa)

Understanding how nonnumerical properties of the stimuli can systematically bias responses in approximate numerical discriminations can expand our understanding of how stimulus properties contribute to organisms' conceptualization of numerosity. Recent studies have found that humans tend to overestimate the number of items in a homogeneous visual array. Conversely, previous studies using a different procedure reported the opposite effect in pigeons: namely, a tendency to underestimate the number of items in a homogeneous visual array. The present project aimed to evaluate these mixed results by using the same procedure to train humans and pigeons to discriminate the number of items of two arrays of lines that varied in line orientation coherence. Results show that both humans and pigeons overestimate the number of items in homogeneous visual arrays compared to heterogeneous arrays.

55 2:15 PM

Inverted U-Shape Preference for Auditory Stimulus Complexity in Parrots and Humans

Oliver Tab Bellmann (Acoustics Research Institute, Austrian Academy of Sciences, Vienna, Austria), Melina Witt (Acoustics Research Institute, Austrian Academy of Sciences, Vienna, Austria), Marisa Hoeschele (Acoustics Research Institute, Austrian Academy of Sciences, Vienna, Austria), & Roberta Bianco (Neuroscience of Perception & Action Lab, Italian Institute of Technology, Rome, Italy)

A well-established inverted U-shape relationship exists between stimulus complexity and human music preference, with preferences peaking at intermediate levels. This study investigated whether preference for intermediate complexity is unique to humans or shared with other species. We compared acoustic preferences of humans and budgerigars, known for their vocal learning and pattern recognition abilities, using a three-option place preference paradigm. Participants were presented with choices between pitch sequences that were either random, repeating with changes, and completely repetitive pitch sequences. In all sessions, two of these choices were presented and participants could also choose silence. All possible stimulus combinations were presented in a counterbalanced design. Our results demonstrate that both humans and budgerigars prefer stimuli with intermediate complexity, exhibiting an inverted U-shape relationship between complexity and preference, possibly due to vocal learning, however further testing on other vertebrates could determine whether this phenomenon is also present for acoustic patterns in vocal non-learning species. Research on other vertebrates has found an inverted U-shape relationship in a variety of other behavioral, non-auditory contexts, which, building on our findings, provides exciting opportunities for further research beyond the auditory and/or musical domain.

56 2:22 PM

Examination of Hierarchical Perception in African Grey Parrots

Suzanne L. Gray (Villanova University), & Muhammad A.J. Qadri (College of the Holly Cross, Villanova University)

The way animals perceive and process visual information varies significantly across species. While human vision is known to prioritize global object configurations, research in other animals, such as pigeons, suggests a preference for local details in certain contexts. However, studies on visual processing in birds beyond pigeons remain limited. This study investigates whether African Grey parrots (*Psittacus erithacus*) exhibit a bias toward local or global elements when processing Navon-like hierarchical stimuli. Two parrots were trained on a computerized touch screen task that presented displays with local-relevant or global-relevant information.

Unlike pigeons, results show that African Grey parrots showed no clear local or global preference, suggesting that visual processing strategies may differ among avian species. These findings contribute to our understanding of species-specific visual cognition and highlight the complexity of visual processing across different animals. Future research intended to explore the ecological and evolutionary factors influencing visual perception in birds will be briefly discussed.

2:41 PM Emerging Topics in Comparative Cognition (Chair: Madeleine Brodbeck)

57

Higher and the Lower Cognition: A Pernicious Gap in Comparative Psychology

Carla Cao (MINT lab, Facultad de Filosofía, Universidad de Murcia)

The distinction between higher and lower cognitive processes is core to the psychological sciences. Perception and motor control are lower cognitive processes; reasoning or planning are higher ones. The "higher versus lower" cognitive distinction in human and comparative psychological research pervades both mainstream proposals and alternative frameworks like embodied cognition and enactivism. My thesis is that the distinction between higher and lower cognitive processes is especially pernicious for the study of nonhuman cognition. The bias towards higher-order cognition translates to an excessive focus on testing higher-order cognitive skills in nonhumans and the devaluation of nonhuman cognitive capacities. The negative implications are both methodological and ethical. It is typically more difficult to investigate higher-order skills in nonlinguistic species and this difficulty engenders resistance towards ascribing cognitive capacities to nonhuman organisms even though they master lower-order skills. Addressing this issue, I advocate moving towards a nonhierarchical notion of cognition where cognition is understood as a general function underlying the process of knowing and not as a set of specified skills. With this view, a "lower-order" skill like space navigation and a "higher-order" skill like decision-making are equally cognitive because they equally serve the function of an organism knowing oneself and its environment.

2:48 PM

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Radicle embodied cognition in plants

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

Plants live in a fluctuating, heterogeneous environment. As sessile organisms, each growth decision is impactful to the plant and its surroundings. Plants respond to local conditions in context-dependent ways, which seem adaptive. Examples of these responses include complex root foraging strategies, flowers anticipating sunlight in artificial darkness, and interspecies communication. Psychological terms have been used to attempt to link these behavioural patterns to cognitive sciences. However, this has led to debates because the evidence is frequently unreplicated in subsequent studies. Here, we present a framework situated in more fertile soil into which we can root empirical evidence. Using the signature testing approach, we propose a framework that is a) comparative: by use of vascular plants across phylogeny to test the prevalence of these responses and necessary context; b) grounded in behavioural ecological practices: we prioritize challenging plants with evolutionary relevant scenarios; and c) focussed on identifying signature patterns to problems — how plants make decisions on growth rather than if they are successful. Crucially, we do not assume a mechanism or representation of information on behalf of the plant. This framework will help to better understand the nature of plant decision-making, and more broadly, problem-solving of other organisms across taxa.

3:02 PM

59

Spontaneous cognition in bumblebees

Gema Martin-Ordas (University of Stirling (UK))

Understanding what makes humans unique is a fundamental research drive for comparative psychologists. In the last decades, we have learned that several animal species are capable of remarkable cognitive achievements, which in some cases resemble those in humans. However, most of this evidence comes from vertebrate animal species–e.g., crows, non-human primates. What about invertebrates? Insects, and particularly bumblebees, have been the focus of considerable research attention. For example, studies have shown that bumblebees learn to solve problems–individually or by observing others and they achieve considerable behavioural complexity with a relatively simple brain. Importantly, most of these studies involve large number of training trials on cues signalling reward distributions or on specific actions. What cognitive achievements are bumblebees capable of without training? In this talk, I will present a series of studies on reasoning, memory and tool use with bumblebees assessing their spontaneous cognitive abilities. Most of the paradigms in these studies involve tasks that previously were used with children and great apes and that I adapted for use with bumblebees. The findings

from these studies suggest striking similarities between vertebrates' and invertebrates' cognition and shed light of the evolution of cognition.

3:22 PM Snack Break

4:02 PM Communication (Chair: Madeleine Brodbeck)

Let's Do This! An Examination of How Dolphins Recruit Partners and Signal Cooperative Intent
Kelly Jaakkola (Dolphin Research Center), Emily Guarino (Dolphin Research Center), Abigail Haddock (Dolphin Research Center), Katy Donegan (Dolphin Research Center), Christina McMullen (Dolphin Research Center), Rebecca Hamilton (RSK Environment Ltd), & Stephanie King (University of Bristol)

60 Cooperative behavior is found throughout the animal kingdom. However, the proximate mechanisms underlying such behavior can be quite varied. Previously, we showed that bottlenose dolphins actively coordinated their behavior, using whistles to aid success, when trainers explicitly asked them to perform a cooperative button-pressing task. Here, we investigate the strategies that dolphins use to recruit partners and coordinate their intention to enter into such a collaborative task on their own. Dolphins who had previously learned to perform this task on signal with a particular partner were paired with either their previous partner, a novel partner who also knew the task, or a naïve partner. These dolphin pairs were then given access to the button-pressing apparatus in the absence of any trainers, while we recorded their physical and vocal behavior to determine whether and how they would coordinate performing this cooperative task of their own volition. The dolphins successfully collaborated when both partners had previous knowledge of the task, but were unsuccessful when a knowledgeable dolphin was paired with a naïve dolphin. This pattern of success, along with the differing vocal and physical behaviors used in these pairings, sheds further light on the mechanisms underlying cooperation in the animal kingdom.

4:16 PM **How humans understand great ape gestures**
Kirsty Graham (Hunter College CUNY, University of St Andrews), Matthew Henderson (University of St Andrews), Patrick Grosz (University of Oslo), Pritty Patel-Grosz (University of Oslo), & Catherine Hobaiter (University of St Andrews)

61 There seems to be a shared repertoire of gestures used by all nonhuman great ape species, which begs the question: do humans also have this gestural repertoire? In this pair of experiments, we test human understanding of these great ape gestures. In the first study, 5,656 participants watched videos of the 10 most common chimpanzee and bonobo gestures (20 videos total) and were required to select the meaning that they thought was correct. We found that overall participants performed significantly above chance and were also significantly above chance for 9 out of 10 of the gesture types. In the second study, 300 participants watched and selected the meanings for 10 great ape gesture types again but this time the gestures were performed by a human. Participants agreed on a single meaning for 9 out of 10 gesture types; 6 of which matched those established for chimpanzees. Taken together, these findings suggest that humans interpret a range of non-human ape gestures as expected, and future research should compare the specific mechanisms that underlie how each species builds this understanding.

4:30 PM **Individual variation in call complexity in black-capped chickadees**

Kale Scatterty, Prateek Sahu, & Christopher Sturdy (University of Alberta)

62 Since the 1980s, information theoretical approaches have been used to understand acoustic complexity of the chick-a-dee call system in black-capped chickadee (*Poecile atricapillus*). Acoustic complexity varies at the individual level providing advantages in communication by conveying the caller's condition. To understand individual-level acoustic complexity, we used various holistic acoustic measures of chickadee calls from multiple individuals to cluster a dataset of chickadee calls based on individuals' complexity measures. Dimension reduction techniques and neural networks were used to find acoustic features important for individual level classification. We obtained ranks for the individuals based on the variability in acoustic space as a proxy for complexity. Our results provide crucial acoustic features (e.g., frequency range, amplitude measures) predicting individual variations and aligning with the literature. Such acoustic characteristics could be important for encoding identity and social or environmental information. The variability and complexity measures convey information that could be, at least hypothetically, transmitted via the chickadee call. Functional and perceptual

tests are necessary to assess the advantages of the complexity measure in terms of survival and fitness. Our findings will enhance our understanding of information conveyed by the entire call, in addition to what is already known about the individual notes.

4:44 PM

63

Transitive Inference in ChatGPT: A Case Study Evaluating LLMs Using the Animal Cognition Toolkit

Cyrus F. Kirkman (UCLA), Sunayana Rane (Princeton University), Amanda Royka (Yale University), Graham Todd (New York University Tandon), Ryan Law, (University of Cambridge), Erica Cartmill (Indiana University Bloomington), Jacob Foster (Indiana University Bloomington; Santa Fe Institute), & Aaron P. Blaisdell (UCLA)

Recent advancements in artificial intelligence have led to the rapid development of complex large language models (LLMs). While LLMs are constructed using bottom-up processes such as neural networks, modern scaled algorithms have exhibited emergent properties resembling "behavior." Recent psychological research has provided valuable insights into quantifying and evaluating some of these behaviors from a top-down perspective. However, structured language use by LLMs does not inherently indicate the presence of other human-like cognitive properties. We therefore propose that principles from animal cognition research offer a more suitable framework for evaluating LLM behavior. To illustrate, we apply five core principles from comparative cognition research to an empirical case study investigating transitive inference in ChatGPT-4o. Although ChatGPT-4o initially appeared capable of transitive reasoning when tested in sentence-structure tasks, trial-based experimental designs revealed this reasoning to be "brittle." Specifically, even though ChatGPT-4o could learn pairwise discriminations with overlapping elements, it performed at chance during novel non-adjacent pair testing. This case study emphasizes the importance of rigorously probing LLM behavior with robust control conditions inspired by comparative cognition research. By adopting such approaches, future studies can deepen our understanding of LLM capabilities and limitations, fostering more holistic AI evaluation frameworks.

4:54 PM Perspective Taking & Social Perception (Chair: Marisa Hoeschele)

64

What Do Monkeys Know About Knowledge?

Gavin Foster (PhD Student, Purdue University; Affiliate, Social and Cognitive Origins Lab, Johns Hopkins University)

In this paper, I examine the extent to which monkeys are sensitive to the mental states of others, focusing specifically on their capacity for factive mindreading (mentalizing/theory of mind). I compare two rival interpretations of the existing experiment data: (i) the knowledge-first view, which holds that monkeys are sensitive to knowledge states; and (ii) the awareness-relations view, which holds that they are at most sensitive to informational relation between agents and objects. After presenting a series of objections to both interpretive camps, I propose a middle-ground view: that monkeys are sensitive to knowledge states, but only in contexts that are ecologically salient to them. Instead of treating factive mindreading as a sensitivity to knowledge simpliciter, I suggest that the existing experimental evidence is better explained by monkeys being attuned to specific types of knowledge states within particular contexts.

5:01 PM

65

The Limits of Primate Gaze-Following: Rhesus macaques follow intentionally deflected gazes

Amanda Royka (Yale University), Luke Townrow (Johns Hopkins University), Madeline Meade (UCSD), & Laurie Santos (Yale University)

Gaze-following allows animals to use others' overt attention to gain useful information about the environment. But other individuals' gazes are not always directed at something; gazes can also be deflected away from stimuli as well (e.g., looking away from a dominant conspecific). Human adults show attenuated gaze-following to so-called "deflected" gazes, suggesting that humans use an understanding of others' intentions to shape their gaze-following behavior. Here, we test whether rhesus macaques (*Macaca mulatta*) differentiate between directed gazes and deflected gazes. Across three experiments (n = 338), we find that rhesus macaques follow deflected and non-deflected gazes with equal frequency, latency, and duration. While past work suggests that non-human primate gaze-following may be accompanied by an understanding of visual attention (e.g., following sight lines around barriers, altering gesturing and stealing behaviors based on eye-gaze, double-checking sightlines when a plausible gaze target is not located), our work provides an important caveat to these findings. Although nonhuman primates may use their understanding of others' visual attention during some kinds of gaze-following, their gaze-following is not shaped by an understanding of others' gaze avoidance.

66 5:08 PM

Bonobos deceive a human experimenter by monitoring nuanced cues of attention.

Luke Townrow, & Christopher Krupenye (Johns Hopkins University)

Many instances of deception have been observed in nonhuman primates, especially great apes. Whether primates deceive by taking others' perspectives, and what cues they rely on to do so, however, remains unclear. Humans heavily rely on another's eyes when attributing mental states like attention. Many view this sensitivity to eyes as a foundational requirement for neurotypical human social cognition and a necessity for facilitating our unique levels of perspective-taking. Whilst humans are highly proficient at using eyes as a cue for tracking the attentional states of others, the literature on nonhuman great apes is at odds. We developed a novel deception paradigm that capitalized on a naturalistic behavior observed in our bonobo (*Pan paniscus*) population. Across two experiments, we show that bonobos hit a viewing window to playfully scare an experimenter significantly more when the experimenter's back was turned than when he faced the bonobo (experiment one) and when his eyes were closed versus open (experiment two). These results demonstrate that bonobos successfully distinguished a human's attentional state based on both eye and body-orientation cues, enabling tactical deception. This capacity, once thought to be human-unique, is therefore within the cognitive potential of our closest relatives and, likely, our common ancestors.

67 5:15 PM

Is perspective-taking linked to executive function or causal cognition in chimpanzees?

Luz Carvajal, Elizabeth Warren, & Christopher Krupenye (Johns Hopkins University)

Several studies propose that humans' ability to infer others' mental states, known as theory of mind, depends on executive function (EF) capacities, such as inhibitory control and working memory, or a general capacity to reason about causality. While growing evidence suggests that nonhuman primates share theory of mind abilities with humans, the ancillary mechanisms have not been investigated. The present study probed the relationship between perspective-taking (measured through geometric gaze following), EF (measured through working memory updating), and causal reasoning (measured through a tool functional property task) in research-naive chimpanzees. We tested six adult chimpanzees and used mixed-effects modeling to investigate predictors of gaze-following performance. Chimpanzees were more likely to follow gaze when the human's line of sight was unobstructed than when it was obstructed, corroborating, in a research-naive population, previous evidence of chimpanzee's perspective-taking abilities. Nonetheless, we found no evidence for an interaction between gaze-following condition and either EF or causal reasoning, failing to support the hypothesis that perspective-taking depends on these capacities. We did however find a more general effect that chimpanzees with higher EF performance were overall less likely to follow gaze (across conditions). These findings clarify the evolution and cognitive underpinnings of theory of mind.

68 5:22 PM

Bonobos represent dominance as an abstract social role

Amalia P. M. Bastos, Luz Carvajal, Patrick M. Wood, & Chris Krupenye (Johns Hopkins University)

To navigate a complex social world, primates must track dominance interactions between conspecifics. However, the cognitive mechanism is ambiguous. Primates may have an abstract understanding of dominance that integrates disparate dominance behaviors (e.g., chasing, food competition) into a unified concept and allows primates to flexibly predict third-party interactions across novel contexts. Alternatively, primates may only be able to anticipate encounters that are identical to those they have previously observed. To distinguish these possibilities, we presented bonobos with a touchscreen task depicting interactions between pairs of physically identical animated apes. Initially, these videos featured dominance interactions in a single context–one bonobo chasing another–and subjects were trained to select the dominant individual (the chaser). We then presented bonobos with unrewarded probe trials depicting dominance interactions in perceptually disparate contexts: food competition and physical aggression. Bonobos should spontaneously continue selecting the dominant in probe trials only if they have an abstract concept of dominance. Both bonobos successfully did so in the first transfer context (individual two-tailed binomial tests, $p=0.006$, $p=0.038$), and one generalized a further time ($p=0.002$). Bonobos' capacity to generalize the rule 'choose the dominant' across perceptually disparate contexts suggests that they track dominance as an abstract social role.

69 5:29 PM

Do non-human great apes adjust their communication according to the perceptual and motivational state of a partner?

Elizabeth Warren (Johns Hopkins University), Chris Martin (Indianapolis Zoo), Robert Shumaker (Indianapolis Zoo), Esther Hermann (University of Portsmouth), & Christopher Krupenye (Johns Hopkins University)

Great apes have a rich system of intentional communication. However, it remains unknown whether they, like humans, tailor their communication by tracking the distractedness of their communicative partners. The purpose of the current study was to investigate whether non-human great apes moderate their rate of requesting gestures according to the perceptive and motivational state of the recipient. A human experimenter established a precedent of continuously providing food without prompting, before becoming "distracted" and ceasing the feeding behaviour. The experimenter's state of distraction juxtaposed her perceptive state (looking or not looking at the subject) and her state of occupation (engaged in physical task or not). This experiment was collected with seven orangutans (*Pongo pygmaeus*) and 24 chimpanzees (*Pan troglodytes*). While coding and analysis are underway, we predict that apes will produce the most requesting behaviours when the experimenter is looking in their direction and not occupied, as this state offers the least explanation for the cessation of feeding behaviour. This work will clarify whether apes appreciate that a communication partner needs perceptual access to their behaviors while also adjusting their behavior pragmatically based on whether the human is likely able to respond to persuasion in their current state of occupation.

8:00-10:00 PM

Poster Session II (*in Alvarado ABC*)

With cash bar available.

See Poster Abstracts Starting on Page 43.

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

Saturday

9:00 AM

Optional Paid Event: New Mexico Museum of Natural History

A member of Team CO3 will lead a walking group from the hotel foyer at 9am sharp, for an approximate 10 minute walk. A reduced admission of $5 total is offered with presentation of your CO3 conference badge.

10:30 AM

Business Meeting (All are welcome!) *in Alvarado ABC*

11:40 AM

Group Photo & Closing of Silent Auction (at 11:59AM)

This group picture will be located on terrace lawn at 11:40am.

12:00 PM

Development (Chair: Heidi Lyn)

70

Sex, body size, and reproductive morph are associated with differences in cognition in a polyphenic insect

Rebecca Westwick, & Armin Moczek (Indiana University Bloomington)

Individual variation in behavior and cognition can have important consequences for an animal's ability to survive and reproduce. This variation may be influenced by a variety of factors, including (but not limited to) sex, nutrition, previous experiences, and the microbiome. Quantifying the influence of any of these factors in isolation can be challenging, while investigating their interaction dynamics is often beyond the reach of most studies. I used a polyphenic insect (the bull-headed dung beetle, *Onthophagus taurus*) to test whether sex, adult body size (a direct function of early life nutrition), and reproductive morph are associated with performance on a variety of cognition tests. *O. taurus* males show a nutritionally cued polyphenism in both morphology (horned vs. hornless) and reproductive tactic (fighter vs. sneaker), while females are morphologically and behaviorally monomorphic over similarly diverse nutritional conditions. I found that variation in performance on an associative learning test, a spatial learning test, and a detour test was contributed to differentially by sex, body size, and male reproductive morph. Current RNAseq work is now assessing how variation in cognitive performance across these groups may be reflected in similarities and differences in brain gene expression.

12:14 PM

Effects of the early social environment on behavioural flexibility in a cooperatively breeding cichlid fish

Océane Ferreira, Birgit Szabo, & Barbara Taborsky (University of Bern, Switzerland)

71

Behavioural flexibility is crucial for survival and reproductive success. The early social environment is an important driver of variation in cognitive abilities including behavioural flexibility. However, few studies have investigated this relationship across contexts. Likewise, few studies have investigated the development of modular versus general cognition in social species. Here, (1) we investigated the influence of the early social environment (rearing group size) on behavioural flexibility in adult helpers of a cooperatively breeding cichlid fish (*Neolamprologus pulcher*) and (2) we assessed the presence of general or modular cognition irrespective of early experience by using three nonsocial flexibility tests (innovation test, reversal learning, set shifting) and two social flexibility tests (hierarchy test, integration test). Overall, early social experience only influenced social but not nonsocial flexibility. For all fish, performances were not correlated across tests, implying the existence of domain-specific cognition. Nevertheless, results of a principal component analysis suggest an association between performances in some of the social and nonsocial contexts. Future research should develop approaches that can clearly distinguish between general and modular cognition, and that compare species with different environmental predictability.

12:21 PM

Some like it hot: determinants of temperature preference in corn snakes

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

72

Snakes are extremely sensitive to temperature, modifying their behaviour according to the climate and their energetic needs. This is true even prior to hatching: incubation temperatures impact several traits, such as locomotion and aggression. 47 corn snake (*Pantherophis guttatus*) eggs were incubated at 27, 29, or 31 degrees C, or a variable temperature condition. All snakes were assayed for boldness and sociability. At one year of age, these snakes explored an arena with a thermal gradient, twice each. Subjects' preferred temperature range was compared to their incubation temperature, personality, sex and weight. Snakes incubated at higher temperatures preferred warmer areas of the arena. Females also preferred the hotter side of the arena, though the two effects did not interact. We also found that higher incubation temperatures were weakly correlated with boldness. These results suggest that snakes modulate their interactions with heat according to individual needs, which can be shaped by early life experiences. This may be evidence for a pace-of-life personality syndrome: bolder snakes prefer and seek out heat, permitting a more energetically costly and risky lifestyle.

12:28 PM

Assessing the Stability of Temperament in Infant Rhesus Macaques

Annika Paukner (Nottingham Trent University), Amanda M Dettmer (Yale), Lauren M Robinson (Mount Holyoke College), & Elizabeth A Simpson (University of Miami)

73

Compared to the human infant, the infant rhesus macaque (*Macaca mulatta*) is boisterous, mobile, and capable of actively exploring the world they have just entered. They develop quickly and the 'who' of 'who they are' begins to emerge. Within weeks, we see the early and largely persistent individual differences in emotional and behavioural tendencies, commonly known as temperament. Given the relationship between temperament and well-being, if we can identify the early behavioural predictors of temperament, then we could potentially support the development of targeted interventions that can address potential health risks or future harmful behavioural patterns. In this study, we aim to test the relationship between infant rhesus macaque personality measured at four weeks and four months using two measures of temperament: the Infant Behavioral Assessment Scale and the BioBehavioural Assessment. We focus on behavioural measures that reflect attention, emotionality, and motor activity, as these are shared constructs between both assessments, whilst accounting for other factors that could potentially influence temperament measures such as the early rearing environment and sex. We also

incorporate cortisol reactivity and adaptation to the BBA, which have been shown to reflect neuroendocrine responses to this challenge and to also be related to behavioural responses.

12:35 PM

74

Measuring Age-related Cognitive Decline and the Possibility of Neurodegenerative Disease in Cotton Top Tamarins

Julie Neiworth, Ella Rogers, Eliza Hawthorne, Dominic Dennis, Megan Cablk, & Emerald Wang (Carleton College)

Aging tamarins (n=16, aged 8-24) were tested over a 10-year period from 2014-2024 on tasks requiring working memory, episodic memory, visual search, and flexible rule-shifting in a modified card sort task. Common characteristics differentiating human aging from Alzheimer's Disease (AD) were used to select cognitive tasks, and data from individual monkeys were tested to see whether they showed an age-related gradual decline, or a sharp decline after a certain age. It is clear that the monkeys' peak performances on most of these cognitive tasks occurred between 11.5 and 12.9 years of age, depending upon the complexity of the task. They commonly showed a gradual decline after that, with some occurrences of sharp decline that might signal neurodegenerative disease in particular monkeys. Physiological data suggesting particular neural problems are presented.

12:49 PM

75

Effects of age and food deprivation on the avian brain: insights from domesticated pigeons

Leslie S. Phillmore (Dept of Psychology and Neuroscience, Dalhousie University, Halifax NS Canada), Broderick M.B. Parks (Dept of Psychology and Neuroscience, Dalhousie University, Halifax NS Canada), Casandra Hayar (Dept of Psychology and Neuroscience, Dalhousie University, Halifax NS Canada), Ainsley Monchesky (Dept of Psychology and Neuroscience, Dalhousie University, Halifax NS Canada), T. Adam Liddle (School of Biodiversity, One Health, & Veterinary Medicine University of Glasgow, Glasgow UK), Jason R. Treberg (Department of Biological Sciences, University of Manitoba, Winnipeg, MB Canada), Tyler J. Stevenson (School of Biodiversity, One Health, & Veterinary Medicine University of Glasgow, Glasgow UK), & Debbie M. Kelly (Department of Psychology, University of Manitoba, Winnipeg, MB Canada)

Pigeons (*Columbia livia domestica*) are studied to understand the interaction between cognition and the neural structures and plasticity supporting cognition, particularly the hippocampus. However, evidence of age-related atrophy in the avian brain remains unclear. Here, we present data from several ongoing studies examining plasticity in the aging avian brain. First, we quantified hippocampus and telencephalon volume in laboratory-housed pigeons (N=30) ranging in age from 2-22 years old. Recent studies examining age-related changes in gross neuroanatomical measures in pigeons have mixed findings. Using fine scale volume-reconstruction methods, we found evidence of age-related atrophy in the telencephalon, but not the hippocampus. Next, we examined whether a metabolic stressor (food deprivation) affected plasticity in a separate sample (N=22) of adult (1-4 years) and aged (9-18 years) pigeons. We quantified volume and neurogenesis (using doublecortin immunohistochemistry), finding further evidence for age- and food deprivation-related changes in both measures. We then used Nanopore RNA-sequencing to sequence the transcriptome of the pigeon hippocampus and mediobasal hypothalamus, identifying multiple transcripts differentially expressed by age, sex, and food condition. Taken together, the results of these studies reveal previously unknown effects of age and metabolic challenge on the avian brain at both the systems and molecular levels.

1:08 PM

Attention & Memory (Chair: Sarah Jacobson)

76

Rhesus monkeys appear insensitive to the cognitive effort of active working memory across four tests

Jad Nasrini (Department of Psychology and Emory National Primate Research Center - Emory University, Department of Psychology - College of the Holy Cross), & Robert Hampton (Department of Psychology and Emory National Primate Research Center - Emory University)

Keeping information in working memory requires active maintenance for as long as the information is retained, and humans find this active maintenance effortful. In contrast, subjects can identify previously experienced items based on familiarity signals, or select recurring targets based on habits, without active maintenance during the interval leading up to test. To assess whether monkeys, like humans, are sensitive to the cognitive effort involved in working memory maintenance, we measured monkeys' preferences for memory tests that either emphasized working memory, or could be solved by familiarity or habits. To ensure that any preferences were controlled by differences in the demands of the memory tests rather than by differences in reward rate, we used several methods to equate reward rate. Across four experiments, monkeys did not avoid working memory tests, even when they were equally likely to receive a reward after tests that could be solved with familiarity or habits. These findings suggest that unlike humans, monkeys may not be sensitive to the cognitive effort involved in working memory maintenance. If true, this may limit the ability of nonhuman primates to discover efficient cognitive strategies.

1:15 PM

77

Attentional Sink: Pigeons Show a Reversed Attentional Boost Effect

Walter Herbranson (Whitman College)

Attentional boost is a phenomenon in which humans sometimes show enhanced memory under divided attention conditions. We developed a parallel method to see if pigeons would show the same effect. Pigeons were pretrained on a classical conditioning procedure, in which colors were presented alone (S-), overlayed with a distractor stimulus (S-), or overlayed with a target stimulus (S+). Subsequently, pigeons were run on a Rapid Serial Visual Presentation procedure. On each trial, pigeons were presented with a sequence of three different colors, each of which was either presented alone, overlayed with a distractor stimulus, or overlayed with a target stimulus as during pretraining (but without any food pairing). Reinforcement was subsequently provided for choosing a presented color from among two options. Birds responded with better than chance accuracy on all trial types, but with lower accuracy to target-paired colors. This primary result is the opposite of what is interpreted in humans as attentional boost: better accuracy on target trials than on distractor or control trials. The difference may be due to pigeons' history as opportunistic feeders, and parallels pigeons' performance on other procedures such as the ephemeral reward task.

1:29 PM

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Effects of Sensory Modality of Cueing in a Visual Working Memory Task

John Solorzano-Restrepo, Alexander Randall, Bri Vaughn, & Kenneth Leising (Texas Christian University)

Environmental cues often occur prior to relevant changes that affect survival, and their presence is associated with response accuracy and speed improvements in visual working memory (VWM) tasks. Evidence from different species suggests that cues presented after relevant events (i.e., retro-cues) also exhibit these enhancements. However, the effect of the sensory modality of the retro-cues has not been tested. In this study, we evaluated the effect of cue modality and timing on VWM in a within-subjects design. Two groups were exposed to auditory or visual cues. Each trial followed the structure: Pre-cue, target stimuli, retro-cue, delay, and probe stimulus. Subjects were trained that the colour or pitch of the pre- or retro-cue would signal whether to respond "same" or "different" regarding the relationship of the identity (Id) or location (Sp) of the probe stimulus to the target stimulus. An analysis of d' revealed similar response patterns in each group. The results support our previous findings of an interaction between cueing and property, and extend them to include modality in some cases. Results and implications will include a comparison of cueing effects across species.

1:36 PM

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Long-term Memory for Rhythmic Vocal Object Labels in the Bottlenose Dolphin

Heidi E. Harley (New College of Florida, Disney's EPCOT's The Seas), Wendi Fellner (Disney's EPCOT's The Seas), Leslie Larson-Plott (Disney's EPCOT's The Seas), Kim Odell (Disney's EPCOT's The Seas), Leah Maurer (Disney's EPCOT's The Seas), Lisa G. Carbary (Disney's EPCOT's The Seas), & Julianna Kadar (Disney's EPCOT's The Seas)

Bottlenose dolphins live in fission-fusion societies and form long-term associations with specific individuals identified by individually unique "signature" whistles. Recognition memory for these whistles lasts for years. Here we investigated the long-term memory of a dolphin to produce vocal labels to referents. Initially, adult male dolphin subject Calvin learned to label nine objects vocally using arbitrary, human-designed rhythms. Testing occurred in 18-trial sessions in which objects were presented (twice) randomly and researchers naïve to an object's identity identified Calvin's vocal label by ear. Performance accuracy on the last 10 sessions of the study averaged 87% (chance=1/9, 11%). After more than 6 years, Calvin revisited the project in five 18-trial labeling sessions. He immediately resumed the labeling task and correctly labeled 5 of 9 objects at least once (56%) in session 1. Performance accuracy ranged from 33% to 78% across the 5 sessions. Calvin produced 8 of 9 rhythms without any prompting in the first session and labeled every object correctly at least once across 5 sessions. Correct labels for each object across all sessions ranged from 10% to 90%. Overall, these results indicate enduring long-term memory for vocal production with variable memory for associations between label and referent.

1:53 PM Break

2:13 PM

Decision Making (Chair: Christopher Sturdy)

Toward a novel setup for studying rationality in zebrafish

Mélisande Aellen (Department of Brain and Cognitive Sciences, University of Rochester), Rithwik J. Cherian (Department of Brain and Cognitive Sciences, University of Rochester), Richard P. Mann (School of Mathematics, University of Leeds), Christopher Krupenye (Department of Psychological & Brain Sciences, Johns Hopkins University), & Dora Biro (Department of Brain and Cognitive Sciences, University of Rochester)

80 The "decoy effect" is a well-known example of irrational decision-making, demonstrated in species ranging from ants to humans. In this scenario, an individual's preference between two options is shifted by the introduction of a third, irrelevant alternative (the decoy). This shift is paradoxical since the decoy is designed to be entirely inferior to one option (the target) and partially inferior to the other (the competitor), hence the decoy should have no influence on a rational agent's choice between the original two options. In this study, we aimed to develop a novel experimental setup for zebrafish, inspired by the choice response paradigm of Sasaki and Pratt (2011), to examine whether this species is susceptible to the decoy effect. We have identified two orthogonal environmental variables influencing habitat choice. We isolated plant density and shade intensity as two such variables, with monotonic changes in fish's preference with increasing density/intensity, allowing us to construct suitable target, competitor, and decoy habitats where we can measure fish's choice when presented with either two or three alternatives simultaneously. Our results — on both solo fish and shoals — will be compared to data from other non-human species to situate our results in a broader comparative context.

2:27 PM

The individual and social skills important for nest selection in prospecting brown-headed cowbirds.

David White (Department of Psychology)

81 Female brown-headed cowbirds (*Molothrus ater*) experience a cognitive challenge borne of their brood parasitic breeding biology; they must locate and select quality nests for their eggs. I review a series of experiments examining the decision processes of female cowbirds that afford them the ability to parasitize host nests effectively. I manipulate artificial host eggs in nests and measure female cowbirds' prospecting and laying patterns while they live and breed in large outdoor aviaries. Using surveillance cameras and RFID tracking, these experiments have revealed that cowbirds use a variety of types of information acquired during prospecting to evaluate nests, time parasitism effectively, and to react to the prospecting decisions of other females. Recent work has extended these findings to examine individual differences in cognitive skills among females and to examine how these individual differences lead to differing prospecting strategies. Cowbird prospecting serves as an effective system to investigate the mechanisms and function of cognition using an ecologically relevant task directly linked to fitness.

Select less from more, Yoda can: Training a California sea lion to discriminate quantity in a computerized task

2:41 PM

Angelo Incitti (National Marine Mammal Foundation, San Diego, CA), Molly Wilson (Science Applications International Corporation, San Diego, CA), Marissa Rodriguez (Science Applications International Corporation, San Diego, CA), Kelley Winship (National Marine Mammal Foundation, San Diego, CA), & Mark Xitco (U.S. Navy Marine Mammal Program, San Diego, CA)

82 Relative quantity discrimination experiments have been a foundational comparative tool for exploring numeric cognition capacities in which relational judgements between sets of stimuli are made based on their relative numeric value. Yoda, an adult male California sea lion at the U.S. Navy Marine Mammal Program, participated in a relative quantity discrimination task using our computerized testing system and a task designed from work with bottlenose dolphins (Jaakkola et al., 2003). Yoda was presented with pairwise sets of visual stimuli consisting of two dotted arrays with between one to eight dots. He successfully indicated the numerically-less alternative by moving a cursor on a monitor. The shape, density, and surface area of dotted arrays were controlled for by varying the size and distribution of dots within the array stimuli. Yoda was successful in conceptual acquisition, and rapidly applied the learned rule when surface area was reversed between small and large quantities. This study was the first to test numerical quantity judgement in California sea lions with two-dimensional images. Further investigation (e.g., varied stimuli shapes within arrays, icon dot contrast inversion, and reporting equivalence) is needed to further assess numeric understanding in sea lions.

What is a birds' favorite colour? The effect of bias on nest-building decisions

83 2:55 PM

Benjamin A. Whittaker (Department of Psychology, University of Alberta, Canada), Henry R. Swartwood García (Department of Psychology, University of Alberta, Canada; Department of Biology, Universidad de las Américas Puebla, Mexico), Simran K. Gill (Department of Psychology, University of Alberta, Canada), Julia

L. Self (Department of Psychology, University of Alberta, Canada), & Lauren M. Guillette (Department of Psychology, University of Alberta, Canada)

Biases distort cognitive processes and influence the outcome of important decisions. We assessed the effect of bias on making a decision which impacts reproductive fitness in birds: choosing material to build a nest. We tested the initial colour bias of fourteen (females = 7, males = 7) captive zebra finches (*Taeniopygia guttata*) interacting with orange and pink nest-building material (string), by recording the colour with which an individual spent most time interacting (preferred colour) and the proportion of total interaction time spent with that colour (bias strength). Birds then repeated the test after a short-term (one week) and long-term (two months) break. There were among-individual differences in colour preference and bias strength, which were highly repeatable for both sexes in the short-term and for males in the long-term. Birds with stronger initial biases were less likely to change colour preference than birds with weaker initial biases, with no effect of time or sex. Individuals with the strongest initial bias (spent all their time interacting with a preferred colour) had less-than 1% probability of changing colour preference in subsequent tests. Nest building is a potential model system for evaluating the causes and consequences of bias in different social and ecological contexts.

3:12 PM

Snack Break

3:52 PM

Symposium: In Honour of the Contributions of Suzanne MacDonald (Chair: Jenna Congdon)

Traveling Through Field and Experimental Settings, It Is Not About the Destination but a New Way of Seeing Things: A Tribute to Suzanne MacDonald

Maria Botero (Psychology & Philosophy Department, Sam Houston State University)

84

Suzanne MacDonald's research on animal behavior spans across different species, both in the field and experimental settings. Her work has advanced traditional areas of research, like memory and cognition, and has explored human and wildlife interactions, because, in her own words, that is when "interesting things happen!". Through the experience of being a philosopher trained by Dr. MacDonald, I will highlight one of the most innovative lessons from her overall body of research: her ability to navigate between experimental settings and field settings. I will focus on how this journey has provided her with a privileged perspective that has advanced the field of comparative cognition. Her work is a testament of what is gained when, as researchers, we learn the methods, the difficulties, and the advantages of different ways of engaging in comparative cognition studies.

4:07 PM

Feeling felines & cooperative canines: Exploring dimensions of mind perception in companion animals

Julia Espinosa (Harvard University), & Suzanne MacDonald (York University)

85

Stereotypes about companion animal personalities are pervasive in pop culture and social media. Cats are cold, condescending, and autonomous, while dogs are goofy, loving, and completely dependent on human caregivers. How accurately do these characteristics map onto the psychological dimensions underlying human perceptions of pets? We explore how the dimensions of affect and mind perception differ for cats versus dogs, and whether the dimensions describing these species resemble the agency and communion dimensions used to evaluate humans. In a large-scale study, pet guardians described their cats' (n=366) and dogs' (n=799) affective experiences, cognitive abilities, and behavior. Group-specific analyses revealed greater dimensional differentiation for perception of cats (vs. dogs). We also identified a common, measurement-invariant five dimensional model of pet perception, with two dimensions similar to classic dimensions of social judgment of humans—autonomy (agency) and social affiliation (communion). Three unique dimensions of trainability, negative affect, and maladaptive behavior emerged that appear specific to human perception of pets. Guardians' characteristics varied systematically with their perceptions, indicating an important role of identity and education in how humans relate to animals. I will discuss the pivotal role of perceptions of nonhuman animals in the broader context of human-animal interactions and animal welfare.

4:22 PM

Crow Attitudes: A Survey of Human-Crow Relationships

Laura Adams (Langara College), & Suzanne MacDonald (York University)

86

Attitudes toward urban crows vary widely, from viewing them as dive-bombing pests to playful companions that bring gifts in exchange for food. These attitudes are particularly notable in Vancouver, Canada, where Northwestern Crows (*Corvus caurinus*) are a frequent subject of media attention, prolific online discussion,

"attack" maps, and artistic and cultural representations tied to the city's identity. We conducted an anonymous online survey to investigate the relationship between human attitudes, experiences, and behaviours toward crows. We hypothesized that personal experiences and media representations shape attitudes and behaviours, predicting that exposure to stories of crow-human friendships would correlate with an increased intention to feed crows. Our study also examined motivations for feeding crows, with practical implications for managing urban wildlife conflicts and contributing to the field of human-animal relationships. Feeding behaviour intended to foster individual relationships exemplifies one significant cognitive challenge urban crows face: navigating interactions with humans. Qualitative data provided insights into folk perceptions of crow cognition. This research represents the initial phase of a larger project incorporating observations of crows and crow-human interactions, including crow responses to regular provisioning. I will also briefly summarize my dissertation research from Dr. Suzanne MacDonald's lab on orangutan cognition and perception.

4:37 PM

No Choice, No Matter: Orangutans and Chimpanzees Perform Similarly under Conditions of Choice and no Choice

Jennifer Vonk (Oakland University), Christopher Flynn Martin (Indianapolis Zoological Society), & Robert W. Shumaker (Indianapolis Zoological Society)

87

Monkeys sometimes perform better in cognitive tasks when they can choose which tasks to perform. However, it is unclear how choice benefits the performance of apes and whether they prefer challenging or less challenging tasks. We presented chimpanzees (n = 12) and orangutans (n = 7) with three cognitive tasks (bubble-popping, oddity, sequencing) on a touch-screen. Tasks varied in cognitive and physical effort (defined by the number of touches required). On half the trials, the apes chose from two of the three tasks. On the other half of trials, the apes were presented with only one task option, allowing comparison of performance on choice and no-choice trials. Overall, the apes did not show a strong preference for tasks or a performance benefit when they had chosen which task to perform. However, orangutans and chimpanzees differed in their attention to species-specific stimuli on the oddity task, with orangutans apparently more distracted by orangutan faces presented alongside chimpanzee and human faces. On the sequencing task, apes found an arbitrary sequence more challenging than sequencing by stimulus shade but easier than sequencing by stimulus length. This paradigm can reveal preferences for challenge based on performance. Future studies will present more challenging tasks.

4:52 PM

Animal cultures matter for conservation, but also to animals

Kristin Andrews (York University) & Simon Fitzpatrick (John Carroll University)

88

A growing acceptance that nonhuman animal communities have distinct cultures is transforming ideas about animal conservation practices. Since socially learned behaviors can significantly influence how animals interact with their environment and how they may respond to environmental changes, diverse animal cultures clearly have important implications for conservation research, policy, and practice. The literature on animal culture and conservation has led to novel and valuable insights about how to best protect threatened and endangered populations, but it has also led to some challenging questions. For example, should protecting animal cultural diversity become a new conservation goal, along the lines of preserving biodiversity? Should "complex" culture be an important consideration in prioritizing populations for conservation? Should we be designating animal "cultural heritage sites" for special protection, analogous to heritage sites of special significance for humans? In this paper, we explore these questions and the various arguments that have been offered in the literature. These include both instrumental arguments for preserving animal culture and arguments that suggest that animal cultures are of intrinsic value in their own right. We critique these arguments as failing to show why animal cultures matter from a normative perspective. In particular, we argue that culture-based conservation practices should take into account what matters to the animals, and explore whether threats to animal cultures should be seen as harms to the animals themselves.

5:07 PM

A canzone in honour of Suzanne MacDonald

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Ken Cheng (Macquarie University)

5:15 PM

Closing Remarks

5:30 PM **FEATURE SESSION:** Master Lecture by Suzanne MacDonald (Chair: Jenna Congdon)
Suzanne E. MacDonald (York University)

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7:00-10:00 PM Banquet (*in Alvarado DE*) *with cash bar*
Tickets required.

Posters

Poster Session I - Thursday Evening

The Effects of Humans' and Conspecifics' False-Beliefs on Dogs' Performance in a False-Belief Task

Dana Ravid-Schurr (Graduate School and University Center and College of Staten Island, City University of New York), Robert W. Lurz (Brooklyn College, City University of New York), Sarah-Elizabeth Byosiere (Hunter College, City University of New York), & Bertram O. Ploog (College of Staten Island and Graduate School and University Center, City University of New York)

P1 The false-belief task (Wimmer & Perner, 1983) requires subjects to predict that an agent will act in accordance with the agent's false belief, which is in conflict with subjects' knowledge. A recent false-belief study with dogs yielded perplexing results, as most breeds performed opposite to what was expected (Lonardo et al., 2021). In the current study, implementing an alternative method (based on Lurz et al., 2022, with chimpanzees), we are testing the effects of humans' and conspecifics' false-belief on dogs' behavior. Dogs face an agent (either their owner or another dog), and both see a treat being hidden in a specific location. On true-belief trials, both the agent and the dog see the treat move to a different location; on false-belief trials, the agent does not see the treat move but the participating dog does. The dog is then required to approach the correct location of the treat. We compare true- and false-belief trials on the number of errors, latency to approach, and vicinity to the target location. Data collection will be completed by early 2025. This study will help illuminate if, and how, dogs are impacted by conspecifics' and humans' beliefs.

Big-brained but less bold: Enrichment affects snake personality and brain size

Gokulan Nagabaskaran, Vijay Moonilal, Morgan Skinner, & Noam Miller (Wilfrid Laurier University)

P2 The effects of environmental enrichment have been well-documented in mammals and birds, but not reptiles. Here, we examined the effects of environmental enrichment on brain development and personality in a popular pet snake species, the Western hognose snake (*Heterodon nasicus*). Snakes (n = 15) were individually housed in either physically enriched or standard environments for one year, during which boldness and sociability were assessed at three timepoints (beginning, middle and end of treatment). Afterwards, brains were harvested and imaged using MRI. We found that enriched snakes decreased in boldness significantly faster and had significantly larger brain volumes than standard-housed snakes, most prominently in posterior brain regions. There was no difference between treatments in sociability. Additionally, male snakes decreased in boldness significantly more than females. As snakes grew larger, males displayed relatively larger cerebral hemispheres and females displayed larger posterior brain regions. These results suggest that environmental enrichment is critical to encouraging healthy brain development in snakes, that snake brain plasticity is similar to that observed in mammals and birds, and that the expression of personality can depend on housing conditions.

Rats replay episodic memories in context

Siyan Xiong, Cassandra Sheridan, & Jonathon D. Crystal (Indiana University)

P3 Humans remember streams of episodic details across different times and contexts. 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, no evidence exists that rats remember the context in which event sequences occurred. We presented event streams across multiple contexts and trained rats to select the third-last odor from random-length lists. Rats were trained in four arenas (contexts A-D). An odor list was presented in one context (context A) followed by a memory assessment in another context (context C). Similarly, list encoding in context B was followed by a memory assessment in context D. First, we showed that rats remember the order of events in two lists (Exp 1). Next, using two lists, we showed that rats remember the context in which each list occurred (Exp 2) and simultaneously remember the order and context of odor presentation (Exp 3). Finally, we interleaved odors across multiple encoding contexts to show that rats replay episodic memories in context (Exp 4). We conclude that rats replay the sequence of context-specific items using episodic memory.

Hey, it's me! Hey, it's me again?

P4 *Sarah M.L. Smeltz (Department of Psychology, University of Alberta), Moriah Deimeke (Department of Psychology, University of Alberta), Carolina Montenegro (Department of Psychology, University of Alberta), Prateek K. Sahu (Department of Psychology, University of Alberta), Katharine H. Stenstrom (Department of Psychology, University of Alberta), Andrés Camacho-Alpízar (Department of Psychology, University of Alberta), & Christopher B. Sturdy (Department of Psychology, University of Alberta, Neuroscience and Mental Health Institute, University of Alberta)*

Individual discrimination (ID) is the process by which signal receivers attend to distinctive acoustic features of producers' vocalizations in order to differentiate among individuals. Previous bioacoustical analyses of black-capped chickadees' (Poecile atricapillus) fee-bee songs and chick-a-dee calls suggest these vocalizations could encode individual identity

information. However, ID by chickadees has only been tested experimentally using fee-bee songs. As both male and female chickadees produce both vocalizations year-round, often communicating outside of visual contact, it would be advantageous for chickadees to generalize ID across these vocalization types. Here, we aimed to: 1) replicate findings of ID using songs; 2) determine whether chick-a-dee calls can be used for ID; and 3) test for generalization of ID across vocalization types. We first trained chickadees using operant conditioning to discriminate among individuals using either songs or calls as discriminative stimuli, comparing their learning rates to control groups trained to respond to a random assortment of either songs or calls. Next, we presented these chickadees with recordings from the same individuals, but of the opposite vocalization type to test for generalization. Although chickadees successfully employed ID for both songs and calls, they were unable to generalize ID across the two vocalization types.

Environmental Unpredictability and Its Impact on Social Behavior in Zebrafish

Britney Sekulovski, & Noam Miller (Wilfrid Laurier University)

P5

Animals integrate personal and social information when making decisions, but the role of external factors such as environmental conditions in shaping this balance remains poorly understood. Here, we investigated how environmental stability influences the use and relative weighting of personal and social information in decision-making tasks, as well as its effects on personality, stress levels, schooling behavior, and social memory. We raised 80 zebrafish (*Danio rerio*) for three months under either stable or unstable conditions, characterized by static or daily-changing physical and social environments. Fish were then tested on a wide range of assays to expose social and personal information use, schooling characteristics, stress levels, and personality. Females from stable environments relied on social information in the absence of personal information during decision-making tasks, whereas males and fish from unstable environments showed no evidence of social learning. Furthermore, fish from unstable conditions exhibited tighter schooling and stable sociability over time, while those from stable environments showed declining sociability over consecutive tests. These findings highlight how environmental predictability shapes decision-making strategies, personality plasticity, and social behavior, offering new insights into the behavioral flexibility of animals in dynamic ecological contexts.

Transitive Inference in Rats

Jose A. Pena, Tess Cody, Andrew Pryor, & Victoria L. Templer (Providence College)

P6

Transitive Inference (TI) is a form of deductive reasoning that involves the use of explicitly learned relationships (AB>C>D>E; list 1) and (F>G>H>I>J; list 2) by reinforcing the higher stimulus in each adjacent premise pair (e.g., A>B, B>C). After reaching criterion on the adjacent stimulus pairs, rats received non-differentially reinforced tests of non-adjacent stimulus pairs (e.g. B, D) and selectively chose the higher ranked item (i.e., B over D). Rats participated in list-linking procedures (e.g., E > F) to evaluate whether they would integrate two separate lists (A < B < C < D < E < F < G < H < I < J). Successful linking of between-list pairs (e.g., D > G) is more effectively explained by inferred order rather than associative values. However, we observed limited evidence of list linking, even after providing additional training with internal pairs (e.g., C > H). The potential role of spatial training in facilitating list acquisition and the extent to which subjects used associative value vs. inference will be discussed.

Who's a Good Dyad? Owners' pre-existing beliefs about their dog's impulsivity shape interactions in novel settings

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

P7

Guardians' responses to their dogs' impulsive behaviours can act as real-time feedback, shaping the frequency and nature of these behaviors. This study examines these dynamics by (1) creating the Perception of Undesirable Pet Behaviors Survey (PUPS) to capture guardians' beliefs regarding their dogs' impulsive behaviours, and (2) examining how these beliefs relate to the expression and management of dogs' impulsivity during interactions in novel settings. PUPS overcomes some limitations of existing impulsivity scales by focusing on observable behaviors within specific social contexts (e.g., "I feel comfortable walking with my dog in places where there are bicycles, squirrels, or other moving objects") rather than inferred mental states (e.g., "My dog is often anxious"). EFA and CFA identified core contextual behavioral dimensions of beliefs regarding impulsivity. These prior beliefs about impulsivity are examined in relation to behavior during a free play session and a surprise inhibitory control task (when desirable items are off-limits). State Space Grids (SSGs) are used to determine dynamic behavioral patterns between the dog and guardian over time, highlighting, for example, attractor states–persistent behavioral patterns, such as mutual engagement or avoidance–that indicate how each participant's actions influence the other's behavior.

An investigation of the global/local bias in harbor seals (*Phoca vitulina*) and fur seals (*Callorhinus ursinus*) using a waterproof touchscreen

Jenna V. Congdon (Concordia University of Edmonton), Heather M. Fedyna-Carter (College of the Holy Cross), Talia I. Letcher (Villanova University), Karyn R. MacDonald (Villanova University), Muhammad A. J. Qadri (Villanova University), & Suzanne L. Gray (Villanova University)

P8

In zoo settings, Northern fur seals (*Callorhinus ursinus*) and harbor seals (*Phoca vitulina*) are typically the focus of extensive training. An international zoo collaboration had been initiated, exploring how complex and hierarchical information in visual stimuli are perceived. Expanding upon research presented previously with emu (*Dromaius novaehollandiae*), waterproof

touchscreens have been introduced to these marine mammals at Edmonton Valley Zoo to further investigate visual bias. Species have evolved distinct biases in effectively extracting relevant information from complex visual stimuli; using hierarchical letter stimuli (e.g., large "P" constructed of small separated "O", and vice versa; e.g., Navon, 1977), 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 species: honeybees and redtail splitfin fish also demonstrate a global bias, whereas pigeons, domestic chicks, and several species of nonhuman primates demonstrate a local bias. Extending this research to marine mammals assists in further mapping the ecological and evolutionary impacts of information processing; the training and preliminary results of seals on this task will be discussed in its contribution to our scientific knowledge about attention and perception in understudied species.

An associative mechanism for delay discounting in monkeys (*Macaca mulatta*)

Ty Henley, & Robert R. Hampton (Emory University, Emory National Primate Research Center)

P9 Monkeys often exhibit steep temporal discounting, favoring smaller immediate rewards over larger delayed ones. This is often interpreted as indicating poor impulse control. We hypothesized that if impulse control limits delay tolerance, then reminders of upcoming rewards should reduce discounting. In Experiment 1, we tested this hypothesis by using a delay-discounting task in which the stimulus monkeys selected remained visible during the delay as a potential reminder. Monkeys exhibited less discounting than expected. Experiment 2 confirmed that discounting was greatly attenuated in Experiment 1 by testing monkeys without the chosen stimulus remaining on screen during the delay. In Experiment 3 we investigated whether the observed attenuation in discounting was consistent with the "reminder hypothesis" described above or was instead the result of a conditioning delay gradient. In a conditioning delay gradient, the strength of the association between a choice and reward decreases with longer choice-reward intervals. We tested monkeys as in Experiment 2, except the delay interval was blank and the monkey's choice only appeared one second before the reward was delivered. In these conditions, monkeys again showed greatly reduced discounting. These findings align best with the conditioning account of reduced discounting rather than the reminder account.

Unleashing the Truth: Training a Long Stay Fails to Enhance Canine Self-Control

Rebecca Singer (Berea College), Caitlyn Jones (Berea College), Riley Welch (Georgetown College), Isabella Perry (Georgetown College), Zach Silver (Occidental College), & Ellen Furlong (Transylvania University)

P10 Dog owners report struggling with "problem" behaviors, such as stealing food, jumping on visitors, and leash pulling. They consult trainers who often claim that training self-control will solve these problems across multiple contexts (Gibeault, 2020; Kaough, 2022). In the current experiment, we directly tested the claim that training dogs to remain calm in the context of increasing distractions would improve their performance on a series of tasks designed to measure self-control. Fifty-one pet dogs participated in the 4-task test battery. Experimental dogs then participated in a 15-session training program designed to improve self-control, while waitlist control dogs did not. All dogs returned and repeated the 4-task self-control test battery. Contrary to trainers' claims, there was no difference in pre- and post-training performance on any of the four self-control tasks for dogs who completed the self-control training. We suggest that self-control is not a generalizable skill; rather, it is context specific and must be trained across multiple domains.

Barking Up the Wrong Tree: Construct Validity of Canine Self-Control Methodologies

Zachary Silver (Occidental College), Rebecca Singer (Berea College), Nataly Barrera, Taegan Berkshire, Tully Daire, Jasmine Grooms, Nyx Nichols, Mataiya Reese, Chandon Thomson (Berea College), Danielle Levin (Occidental College), & Ellen Furlong (Transylvania University)

P11 Canine cognition researchers study inhibitory control using a variety of paradigms, including perseveration tasks (e.g., A-not-B task), response inhibition tasks (e.g., the cylinder, middle cup, and V-detour tasks), and owner surveys (Dog Impulsivity Assessment Scale, DIAS; e.g., Bray et al., 2014; Brucks et al., 2017; Wright et al., 2011). However, often these tasks do not correlate: dogs may perform well on one response inhibition task and poorly on another (Bray et al., 2014; Brucks et al., 2017). Here we report results deepening methodological concerns about these tasks. First, we show learning effects in the middle cup task: dogs improve their performance on the second half of 20 trials compared to the first half. We also see learning effects in the cylinder task: dogs perform better the second time they encounter the cylinder task compared to the first. Finally, we presented dogs with a test battery including the cylinder, middle cup, V-detour, and A-not-B tasks and asked owners to complete the DIAS. These tasks do not robustly correlate with each other or with owner reported impulsivity. Our results suggest the need to explore new impulsivity tasks that perhaps have more external validity to the lives of pet dogs.

The Role of Emotion in Social Evaluation: Dogs Distinguish Between Prideful and Shameful Humans

Isla Hall, & Zachary Silver (Occidental College)

P12 To navigate the social world, social animals perform rapid evaluations of novel agents. Previous research suggests that domestic dogs (Canis Lupus Familiaris) successfully evaluate human agents using observed social behavior. Less is known, however, concerning the role of emotional cues in dogs' social evaluations. During their evolutionary history, dogs may have experienced selection pressures not only to seek out humans who engage in desirable behaviors, but also those who

display emotional expressions that convey their value as potential social partners. Two particular emotions that may have been relevant for evolving dogs are pride and shame. In humans, pride and shame serve as indicators of one's position in social hierarchies. For evolving dogs, affiliating with high-ranking humans may have represented an evolutionary advantage. In the present study, we explored whether dogs preferentially interacted with a human who displayed pride over one who displayed shame. Our data suggest that dogs are sensitive to these emotional displays and use this information to inform their evaluations of novel humans. These data support the view that dogs use human emotion as a component of their holistic evaluation of novel humans. Additionally, this finding may have important methodological implications for future research in canine social evaluation.

Incidental visual memory in rhesus monkeys and orangutans

Mackenzie Webster, & Robert Hampton (Emory University)

P13 Working memory and familiarity processes are dissociable in rhesus monkeys, with working memory thought to be under cognitive control and familiarity relatively automatic. Our lab has found the surprising result that orangutans do not use familiarity in memory tasks, even when use of working memory is prevented. The current study compared incidental memory - memory for non-cued items - between conditions that emphasized cognitively controlled working memory and conditions that favored automatic familiarity. Subjects performed a match-to-sample task with either repeating images or trial-unique images. On each trial, three images were presented at study, with one highlighted as the to-be-remembered sample. In infrequent probe trials, the highlighted image did not appear as a choice at test, but one of the non-highlighted images did. Both monkeys and orangutans selected the non-highlighted image more often than expected by chance in probe tests with trial-unique images, suggesting incidental memory. Neither species demonstrated incidental memory in probe tests with repeating images, however, demonstrating that incidental memory may not occur with stimuli that repeat frequently. These results provide some of the first evidence we have found that orangutans may use familiarity in at least some contexts.

Differential Outcome Effect in Action Sequence Learning

Scott Gulizio, Norman Tu, & Andrew Delamater (Brooklyn College, City University of New York; Graduate Center, City University of New York)

P14 The Differential Outcomes Effect (DOE) refers to the finding that training on a biconditional discrimination task with two different types of reinforcing outcomes (S1—R1—O1, S2—R2—O2) produces superior learning compared to nondifferential training (Trapold, 1970). We explored if the DOE would also apply to action sequence learning. We trained rats to "switch" (i.e., press left then right or press right then left for reward), but not to "stay" (press left then left or press right then right). Group Differential was reinforced with different tasting pellet outcomes for each correct "switch" (e.g., L-R-O1, R-L-O2), while Group Nondifferential was reinforced for switching with both outcomes with equal probability. Initially, rats were biased to "stay" (L-L and R-R), but both groups learned the switch sequences equally rapidly. We then devalued one of the reinforcing outcomes to see if rats had encoded the different sequence-outcome relationships, but Gp Differential provided little evidence that they had. These results may mean that rats do not use outcome identity when learning to switch, or that other aspects of our task could have masked such an effect. The results should help us better understand how organisms learn complex behavioral patterns.

Auditory and visual attentional control in rhesus macaques

Pankhuri Singhal, & Robert Hampton (Emory University)

P15 Monkeys have similar brains to humans but lack language. Comparing auditory attention in primate brains with and without language may help us determine the extent to which auditory attentional control and language co-evolved. We played simultaneous sounds to monkeys, one from each of two speakers. To make a correct response, monkeys had to attend the sound from the target speaker and ignore the "flanker" sound. The flanker sound could be one of three types. Congruent flankers were the same as the target sound; Incongruent flankers were different than the target and instructed a competing response; Neutral flankers were different than the target but not associated with any response. To assess the extent to which similar attentional processes operate in vision and audition we measured performance in a parallel visual flanker task. Four monkeys were more accurate than expected by chance in the presence of all flanker types, but accuracy was lower with incongruent and neutral flankers in both modalities. Error analysis showed that flankers did not just distract, they sometimes gained control of responding. While monkeys did get distracted, they modulated attention in both vision and audition. Similar attentional processes appear to operate in both modalities in monkeys.

Does a Stimulus Paired with Reward and the Reward Itself Activate the Same Internal Representation?

Jennifer Abrams (CUNY Graduate Center), Norman Tu (CUNY Graduate Center), & Andrew Delamater (CUNY Brooklyn College)

P16 Rats learned to choose one response lever after non-contingent presentation of a pellet (O1) but a different response after sucrose (O2). Each correct response was rewarded, either immediately or after 5s delay, with the opposite reward type (O1: R1-O2, O2: R2-O1). All rats then received differential Pavlovian training (A-O1, B-O2), before testing whether these cues could substitute for the outcomes in a choice task. Tests were instrumental training sessions with unrewarded substitution

probe trials inserted; probes presented a CS rather than an O as the trial-initiating stimulus and responses were recorded with no food delivered. Evaluation of individual rats identified distinct subgroups: one showing a bias toward the lever reinforced with the outcome paired with the trial-initiating CS (a PIT-like effect), and one showing a bias toward the lever correctly chosen after a specific trial-initiating outcome (a substitution-like effect). More individuals in the delayed reward group appear to show the substitution-like effect than in the immediate reward group. We interpret this pattern to mean that CS-activated reward representations can sometimes resemble those representations activated by the reward itself, particularly when control by R-O associations has been weakened and control by O-R associations has been strengthened by increasing a response-reward delay.

Formation of new attachment bonds in working dogs

Kristen Busby (Auburn University), Emma Cox (Auburn University), Jordan Gillespie-Smith (Auburn University Canine Performance Sciences), Lyndsey Elrod (Auburn University), Jordan Remack (Auburn University), Kelsey Mitchell (Auburn University), Gopikrishna Deshpande (Auburn University), Frank Kreuger (Auburn University), & Jeffrey Katz (Auburn University)

P17 The dependence of dogs on their relationships with human caregivers can persist through the lifespan. Resultantly, dogs must retain the ability to form attachment bonds, especially in environments with high caregiver turnover rates. The current study aimed to explore the ability of working dogs to form new human attachments and assess their preference for familiar or novel individuals. Eighteen human/dog pairings participated in four weeks of bonding sessions, consisting of three one-hour sessions per week in which they engaged in play, petting, and basic obedience commands. Attachment was assessed before and after bonding using the Secure Base Test (SBT) and the Paired Attachment Test (PAT). 89% of dogs demonstrated secure attachment to their human partner after completing bonding sessions. However, in the PAT, dogs demonstrated a significant preference for the unfamiliar person. These results suggest that working dogs retain their ability to form new bonds, perhaps developing hypersociability and disinhibited attachment. This may be attributable to genetic factors or enhanced socialization practices in this population.

To give a dog a bone: Does a dog's "ownership" of an object affect spatial memory

Em Sundby, Jessica Vance, & Valerie Kuhlmeier (Queen's University)

P18 This study aims to determine whether Canis familiaris (domestic dogs, "dogs") has improved memory for objects that they "own." In humans, there are robust cognitive effects for owned objects–the objects are remembered better, valued higher, and given more attention than other objects. Since previous research in non-human animals on ownership has focused on possession and territoriality, the potential effects of object ownership on non-human cognition are relatively unexplored. Dogs lend themselves to this study due to their unique relationships to humans–not only do dogs work and live alongside us, but they are also one of the few other species that humans gift objects to. Dogs' performance was evaluated via their accuracy in novel object versus "owned" object trials in a spatial short-term memory task ("the disappearing object task") across three different retention intervals (0s, 60s, 120s). If object ownership affects dogs' object representation as it does in humans, we expect the dogs to perform with better accuracy for owned objects across 60s and 120s retention intervals compared to novel objects. Since many working dogs are object-driven, rather than food-driven, exploring the effects of object type on dog memory may have wider-reaching applications for the training of working dogs.

Odor training paradigm affects detection dog generalization to novel explosive odors

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P19 The goal of the current study was to determine which of three training paradigms most efficiently trained dogs to detect high-explosive varieties and to generalize to novel explosives. Eighteen dogs were randomly assigned to one of three training paradigms: Mixture, Sequential, and Intermixed. Mixture dogs were trained to a four explosive odor mixture; Sequential dogs were trained to detect one explosive at a time; Intermixed were trained to four explosives simultaneously, but each presented in randomized discrete trials. After reaching a training criterion, all dogs then received generalization

testing to a total of eight explosive variants and continued training until reaching criteria for all 8 varieties. Finally, all dogs received an identical generalization test to additional novel explosives. Results indicate that there was no difference in the required number of training sessions to learn the initial eight explosive odors. The Intermixed trained group, however, showed higher levels of generalization to novel targets. Thus, all odor training methods led to acquisition of eight explosive varieties within a similar number of sessions, but Intermixed training produced the most robust generalization. Olfactory training paradigm influences generalization to novel odors.

Can amphipods be conditioned to expect opportunities for amplexus?

Elizabeth Newlin, Madison Fanning, Allison Scholl, Amelia Miner, & Joshua Wolf (Carroll University)

P20 Male amphipods engage in precopulatory mate guarding known as amplexus where they use their front feeding arms (gnathopods) to hold and carry a female around until she is ready to mate. We wanted to determine if amhpipods would re-amplex in an experimental setting and find out if providing a classically conditioned expectation of the opportunity to re-amplex with a female would lead to faster or more successful amplexing during testing. Pairs of already amplexed amphipods were collected from a local freshwater stream and were housed in individual petri dishes. During the training phase, pairs were split up and the female was removed from the container. After a 5-minute ITI the females were reintroduced to their suitor. Half of the males were presented with a 10-s stimulus (e.g., light, olfactory cue, vibration) before the female was reintroduced and the other half were not. During the test day, a conditioned male and non-conditioned male (matched for previous successful re-pairings) were placed into the same petri dish and a novel, but previously amplexed female, was introduced following the 10-s stimulus. Amphipods demonstrated successful re-amplexus after separation, but conditioning did not provide an advantage for re-amplexus.

Less is more: 50% Reinforcement Facilitates Learning of The Ephemeral Reward Task

Ariana Lomeli (University of Kentucky), Helly Patel (University of Kentucky), Daniel Peng (University of Kentucky), & Thomas Zentall (University of Kentucky and Transylvania University)

P21 The ephemeral reward task involves a choice between two stimuli, A and B. If a subject chooses A, it gets fed and the trial is over. If it chooses B, it gets fed and it can respond to A to get fed again. Thus, choosing A gets it fed once, choosing B gets it fed twice. With this task, both wrasse (fish) and parrots learn to choose optimally within 100 trials. Primates, pigeons, and rats, however, do not learn this task, even after hundreds of trials. In the present research using this task, we rewarded all responses by pigeons, randomly 50% of the time. Surprisingly, the pigeons showed significant learning of the task. We suggest two possible explanations for the learning. First, given the negative exponential relating magnitude of reward to value, it may be that the difference in reward value between 1 and 2 rewards is less than the difference between 50% reward (choice of A) and 75% reward (choice of B followed by a response to A). Second, pigeons, like people may prefer two chances to get a reward over just one. That is, under these conditions, pigeons may value the uncertainty of the partial reward.

Delayed Conditional Discrimination in Tiger Salamanders (*Ambystoma tigrinum*)

Shannon Kundey (Hood College)

P22 Researchers have studied how different species perform delayed conditional discrimination (DCD) tasks, where they view a cue indicating which later choice will be rewarded after the cue is removed. Pigeons, rats, and several monkey species have learned these conditional rules in various contexts (Mourmourakis, 2021; Herremans & Hijzen, 1997; Honig & Dodd, 1983; Watanabe, 1981). I explored tiger salamanders' (*Ambystoma tigrinum*) performance in a delayed conditioning maze task. Salamanders first saw a black or white card in the start arm. They then chose one of three maze arms, marked by blue, yellow, or green squares, to retrieve a hidden food reward. One color stimulus always indicated reward (palatable food), another always indicated punishment (unpalatable food flavored with quinine), and a third always served as a distractor. The black or white in the start area indicated which relationship between color and food palatability was in effect on each trial. The assignment to various conditions was randomized across animals but consistent within any one animal. Salamanders eventually reached a criterion of 80% correct over the last 10 trials (mean 64.67; range 52-72). During testing when no mealworms were present, animals chose correctly based only on the visual cues present.

Landmark Discrimination in a Spatial Task with Rats

Sara Bond, Jordan Nerz, Busola Adetunji, Hiya Bhatte, Brennan Balzac, Hampton Zidlicky, Katie Cagney, & Ken Leising (Texas Christian University)

P23 Rats use many cues when navigating to biologically significant locations. Visual cues (e.g., landmarks) have been found to be reliable predictors of spatial behavior (Biegler & Morris, 1993). In the current experiment, we released rats onto an open field from a start box with a transparent door. We tested whether rats in the start box would discriminate between two landmarks (wooden figurines; A and B) 122 cm away from the box, with a visual angle near the threshold of their visual acuity. On Landmark A trials, a food reinforcer was hidden in a cup 30.5 cm behind the landmark (A+), whereas no reinforcer was present on separate trials with Landmark B (B-) or during C- trials with no landmark. Latency to the goal cup during A+ trials was less than during B- and C- trials. However, after additional controls for reinforcer scent were implemented, latency differences were eliminated, and rats did not acquire the visual discrimination with additional

sessions. The landmark was moved closer for some rats and more A+ trials were added, but discrimination performance did not improve. The discriminability and distance of the landmarks, as well as the use of additional cues, will be discussed.

An Evaluation of Control Groups for the Differential Outcomes Effect in Rats

Katie Cagney, Hiya Bhatte, Jordan Nerz, Sara R. Bond, Catrina Gillespie, Ana Miranda, & Kenneth J. Leising (Texas Christian University)

P24 The differential outcomes effect (DOE) occurs when the delivery of different outcomes following different responses facilitates learning. Common outcomes (CO) (i.e., one outcome for both correct responses) and mixed outcomes (i.e., uncorrelated outcomes for each correct response) have been utilized as control groups in differential outcomes (DO) procedures. Previous research in our lab has found a DOE when a DO group was compared to an MO control group, but not when compared to a CO control group. The current experiment examines acquisition of a visual discrimination in DO, MO, and CO groups. During acquisition, DO rats received one outcome following a left lever press during one visual stimulus (a flashing light) and a different outcome for right lever presses during another visual stimulus (a steady light), whereas the outcomes were uncorrelated with the responses for the MO group. The CO group received only one outcome following each response. Based on our prior research, we predicted that accuracy in group DO would differ from group MO, but not group CO. However, both controls had relatively low accuracy, and the CO showed little to no acquisition. The factors that influence discrimination acquisition in each control group will be discussed.

Saving the Hardest Discrimination for Last: Assessing Possible Cognitive Offloading in Monkeys

Brooke Jackson, Joseph McKeon, & Michael Beran (Georgia State University)

P25 Cognitive offloading involves using external tools or the environment to reduce cognitive load. While well-documented in humans, its evolutionary origins remain unclear. We investigated rhesus macaques' and capuchin monkeys' cognitive offloading abilities using a perceptual discrimination task. The monkeys were presented with stimuli containing three perceptual features (darkness, size, and line orientation) that varied along a continuum. In some trials, the monkey needed to classify all three features. In other trials, the monkeys chose two features to classify. In Experiment 1, the monkeys received feedback immediately after each classification. In Experiment 2, the monkeys received feedback only after completing all required classifications for that trial. Avoiding the hardest classification or saving it for last could suggest a form of cognitive offloading. However, the results showed that the monkeys did not consistently avoid the hardest classification or save it for last. Instead, the monkeys showed a preference for certain features over others, regardless of the difficulty of the discrimination on a given trial. These data may indicate that offloading is beyond the ability of other primates, or it may require a different kind of test to show such abilities.

Brain regeneration and schooling in Zebrafish are affected by social isolation

Vijay Moonilal, Makenna Wiebe, Nirosha J. Murugan, & Noam Miller (Wilfrid Laurier University)

P26 Understanding traumatic brain injuries (TBIs) is of critical importance since they affect millions of individuals annually and result in neurological impairments. Zebrafish (*Danio rerio*) present a promising animal model to study TBI's due to their high neuroregenerative capacity, use in existing behavioural research, and complex social skills. Zebrafish exhibit remarkable brain regeneration following injury, facilitated by reactive progenitor cells in specific brain regions, allowing them to completely regrow lesioned brain areas. Despite much research on zebrafish social behaviors, little is known about how isolation affects both social behaviour and neural regeneration. We examined the impact of social isolation, a known stressor linked to poor health outcomes in other animals, on social behavior and neural regeneration in zebrafish following TBIs. We compared socially housed and isolated zebrafish 3- and 14-days post-injury using a schooling assay and immunohistochemistry staining for proliferative cell markers. We found that socially isolated zebrafish exhibited less polarized schooling, while brain-injured zebrafish tended to swim further apart. These findings indicate that the combination of brain injuries and social isolation plays a complicated role in zebrafish social behavior. Social stressors, such as isolation, can impact healing processes in the brain, which in turn will affect behavioral recovery from injury.

No Evidence of Lateralization in Discoid Cockroaches (*Blaberus discoidalis*): Implications for Evolutionary Origins

Kate Hagemeier, Maura Hanley, & Olga Lazareva (Drake University)

P27 Lateralized behaviors are well-documented in vertebrates but less studied in invertebrates. Within Blattodea (termites and cockroaches), lateralization has been reported in the German cockroach (*Blattella germanica*) and the American cockroach (*Periplaneta americana*). We have explored lateralization in a non-invasive discoid cockroach, which diverged from these species during the Mesozoic era. Our study focused on turn behavior in a T-maze, lateralization in antenna grooming, and sex differences in lateralization. In the T-maze, we recorded the direction of the first turn, latency to turn, and time to complete the trial. For antenna grooming, we measured the number and duration of grooming instances for each antenna. We found no evidence of lateralized behavior in either T-maze turns or antenna grooming, and no correlation existed between the two measures; for example, cockroaches that preferred grooming left antenna were equally likely to turn left or right in the T-maze. We also found no evidence of sex differences in lateralization. These findings suggest that lateralization may be a recent evolutionary development in invasive cockroach species, whereas non-invasive tropical species like the discoid cockroach display no such behavioral asymmetries.

Poster Session II - Friday Evening

Chimpanzee Performance on a Cognitive Task is Influenced by Human Audiences

Christen Lin (Wildlife Research Center, Kyoto University), Akiho Muramatsu (Research and Education Center for Comprehensive Science, Akita Prefectural University), & Shinya Yamamoto (Wildlife Research Center, Kyoto University)

P28 While humans can be affected by audience members watching, in terms of performance, behavior, and more, it is unclear how chimpanzees, our close evolutionary relatives, are affected by the presence of an audience in terms of cognition. Over six years, chimpanzee performance data on three number-related cognitive touch screen tasks of varying difficulty was recorded while they were watched by a varying number of human audience members every day, comprised of both familiar and unfamiliar people. Our results suggest that the chimpanzees' performance on these tasks is influenced not only by the number of people watching, but also how familiar they are with these humans. For the most difficult task of the 3, the chimpanzees improved in performance the more experimenters were present, while for the easiest task the chimpanzees did worse the more experimenters and familiar humans there were in the audience. We propose several potential explanations for these results based on audiences influencing perception of reward value, cognitive load, and concentration levels. These results suggest that the evolutionary roots of audience effects may be traced back to before reputation-based societies were formed in humans.

Optimization of Tool Use in Red Fire Ants

Luke Bowles (University of Georgia), Horace Zeng (University of Georgia), & Takao Sasaki (University of Rochester)

P29 This study investigates the learning and optimization of tool use behavior in red imported fire ants (*Solenopsis invicta*), focusing on their paving process. While previous research has shown that fire ants cover toxic surfaces with particles to facilitate foraging, the dynamics of this process have not been well explored. We hypothesized that red fire ants can optimize tool use behavior and exhibit collective learning. Through experiments allowing colonies to pave paths over toxic surfaces to reach food sources across successive trials, we examined whether they could improve and optimize their paving routes. Our findings revealed that red fire ants improved route efficiency not only by increasingly paving narrower and more coherent paths throughout trials, but each ant also became responsible for a greater share of the coherence. Our results show, for the first time, collective learning–when animal groups improve their performance collectively over time–with respect to tool use in social insects.

Baboons are more sensitive to some geometric features than others

Logan Brownell (Carnegie Mellon University, Rochester Institute of Technology), Jialin Li (Carnegie Mellon University), Caroline DeLong (Rochester Institute of Technology), & Jessica Cantlon (Carnegie Mellon University)

P30 The geometric regularity effect, the ability to quickly and accurately detect shapes with more uniform Euclidean features than more variable ones, is observed in humans but not in non-human primates. Humans consistently show sensitivity to geometric regularities, such as right angles, parallelism, and symmetry, across cultures and age. However, despite having a comparable visual system and similar performance in some shape recognition tasks, non-human primates fail to show this effect even with extensive training. The current study investigates the representation of regular geometric features in baboons using a match-to-sample task. Subjects matched whole shapes (triangle, hexagon, octagon) and their components (side length, angle, number of segments) on a touchscreen. Baboons achieved over 70% accuracy in matching whole shapes, with side length and number of segments being consistently easy for them to match and angle being consistently difficult. These findings suggest that angle discrimination may be a key feature contributing to the absence of the regularity effect in non-human primates. Ongoing tests with novel shapes will explore whether these performance patterns generalize. This research reveals the factors that affect geometric perception in non-human primates, expanding on our understanding of the cognitive mechanisms that shaped human geometric processing.

Oddity discrimination in honeybees

Alexandra Nosarzewska, & Patricia A. Couvillon (University of Hawaii at Manoa, Department of Psychology)

P31 The results from a variety of associative learning experiments with honeybees show striking similarities to those of similar experiments with vertebrates. More recent studies of honeybee learning have focused on more complex cognitive phenomena. This research replicates an oddity discrimination task similar to that of Muszynski and Couvillon (2015), but with stimuli consisting of concentric circles of two different colors instead of their two-color pinwheels. This flexible color configuration should facilitate a variety of other same/different problems with honeybees. Forager bees were trained individually to visit a laboratory window for sucrose. Two oddity experiments were conducted where bees found three stimuli, two identical and one different on every training trial. In Experiment 1 the color of the inner circle was odd and in Experiment 2 the color of the outer circle was odd. Training was trial-unique, so that on each trial there was a different triad of stimuli. Choice of odd was rewarded with sucrose and choice of nonodd was punished with stevia. All choices were recorded and correction permitted. Honeybees learned to choose the odd stimulus in both experiments, and the results provide additional evidence of oddity learning. The next step is to conduct a simultaneous same/different experiment.

Age-Related Differences in Spatial Working Memory Learning and Performance in Rhesus Macaques

Lili Lurye, Daniel Smith, & Alison Weiss (Oregon National Primate Research Center, Oregon Health & Science University)

P32 Previous studies revealed deficits in working memory among old macaques compared to young adult macaques, but have not thoroughly assessed these metrics in middle-aged macaques. Here, we sought to query middle-aged macaques, in comparison to young-adult and very old macaques, to address this gap. We administered a manual, 3-choice delayed-response task in rhesus macaques (n=21, aged 7-27 years, 11 female) to assess spatial working memory. Macaques were grouped as Young (â‰¤ 13 years), Middle-aged (14-19 years), and Old (â‰¥ 20 years). An initial acquisition phase, to measure learning, consisted of 15 sessions, and used a short 1-second delay. Accuracy (% correct) significantly improved across sessions ($F(14,252)=11.53$, $p<0.001$), and this interacted with age ($F(28,252)=1.64$, $p=0.026$). Working memory was further probed using variable delays of 5, 10, 30, and 60 seconds. Macaques performed worse as delays increased ($F(3,54)=68.33$, $p <0.001$), and performance differed significantly across age groups, with old macaques making the most errors ($F(2,18) =24.29$, $p <0.001$). In addition to accuracy, the temporal and spatial distribution of errors were analyzed to assess perseverative responding. Our study identified age-dependent differences in memory, learning and perseveration, alluding to a decline in cognitive abilities in late adulthood.

What makes an innovator? Examining the role of non-cognitive traits on flexibility and innovation in Carnivora.

Kathryn Wheeler, & Zoe Johnson-Ulrich (Eastern Oregon University)

P33 Cognitive flexibility, the ability to adapt behavior in response to changing environments, and innovation, the ability to devise novel solutions to problems, are critical components of animal cognition and can be assessed in animals with a Multi-Access Box (MAB), a device with multiple ways to access a reward (Johnson-Ulrich et al., 2018). Previous research found that a syndrome of persistence, motivation, and activity contributed to flexibility and innovation (e.g., learning more solutions on the MAB) in spotted hyenas. Here, we examine these traits in additional species within the order Carnivora. In particular, we aim to analyze the role of non-cognitive traits like motor diversity and persistence. These findings align with the concept that innovation is associated with cognitive abilities like inhibitory control and behavioral traits such as motor diversity, persistence, and boldness.

Squirrel monkeys use vision for withdraw-to-eat movements

Christopher Shoukry (Florida International University), Ian Whishaw (University of Lethbridge), & Eliza Nelson (Florida International University)

P34 Withdraw-to-eat movements refer to the action of bringing a food item grasped by the hand to the mouth for eating. Prior studies indicate catarrhine primates use vision to guide these movements, while strepsirrhine primates do not. However, little work has been done in platyrrhines, which are a group that is evolutionarily in between catarrhines and strepsirrhines. We examined whether Peruvian squirrel monkeys (*Saimiri boliviensis peruviensis*) use vision during withdraw-to-eat movements. We conducted naturalistic observations of feeding in a group of approximately 75 semi-free ranging squirrel monkeys housed at a local wildlife park. Videotaping was done opportunistically with no manipulation to the monkeys' normal diet or husbandry routine using focal follow methods. An observation started when one monkey was observed reaching for food and ended when the monkey finished eating or went out of view. Preliminary coding evaluated the presence/absence of visually-mediated withdraws during each observation. A binomial test revealed that the proportion of feeding bouts with visual engagement to the food held in hand differed significantly from chance ($n=240$, $k=220$, $p=.5$, $p<.001$). This finding suggests squirrel monkeys use vision in withdraw-to-eat movements, which has important implications for the evolution of visuomotor control of the hands in primates.

Exploring Pigeons' Ability to Develop Expertise in Dermatological Categorization

Odysseus Orr, & Edward Wasserman (University of Iowa)

P35 Prior studies have suggested pigeons as a promising model species for studying image-based medical diagnosis. However, it is unknown whether pigeons can reliably model expert diagnosis. We sought to assess two pigeons' ability to develop diagnostic expertise in a dermatological domain. We evenly divided 400 benign and 400 malignant dermatological samples into 50 sets each. The pigeons first received daily training, categorizing samples from one set as benign or malignant. Upon reaching 85% accuracy, the pigeons concurrently categorized a second, novel set in addition to the previously learned set. Once criterion was achieved for both sets, the old set was replaced by another novel set. This process was repeated until the pigeons reached criterion for all 50 sets. Despite initial improvements, both pigeons showed a decline in categorization performance with novel sets compared to learned sets. Furthermore, neither pigeon appreciably improved its learning speed for novel sets. Probing performance after training revealed better performance to more recently seen sets and to sets that had taken less time to learn. We conclude that pigeons exhibited limited signs of dermatological expertise. Further study with other training paradigms is needed to determine whether pigeons are capable of expertise in a medical image domain.

Understanding Elephant Responses to Olfactory Cues: Implications for Human-Elephant Conflict Mitigation

Matthew S. Rudolph (Department of Psychology Hunter College City University of New York New York USA, Department of Psychology The Graduate Center City University of New York New York USA), Sangpa Dittakul (Golden Triangle Asian Elephant Foundation Chiang Rai Thailand), Sydney F. Hope (Department of Psychology Hunter College City University of New York New York USA), Sarah L. Jacobson (Department of Psychology Hunter College City University of New York New York USA), Mananya Pla-ard (Golden Triangle Asian Elephant Foundation Chiang Rai Thailand), Melissa Schmitt (Department of Biology University of North Dakota Grand Forks North Dakota USA), Supang Sittichok (Golden Triangle Asian Elephant Foundation Chiang Rai Thailand), Marnoch Yindee (Golden Triangle Asian Elephant Foundation Chiang Rai Thailand), & Joshua M. Plotnik (Department of Psychology Hunter College City University of New York New York USA, Department of Psychology The Graduate Center City University of New York New York USA)

P36 Elephants are highly social animals that utilize olfactory cues to inform decisions regarding foraging, reproduction, and navigation. Surprisingly, an elephant's olfactory limit, how they use odors, and how they respond to different types of odors remain largely unknown. To support the growing field of elephant olfactory research and to determine how this work can be used to promote elephant conservation, we implemented a suite of experiments to further investigate elephant olfactory capabilities. Specifically, our odor-based experiments found dynamic limits to elephant olfactory capabilities and evidence to support olfactory social learning. The results of these experiments provide a basis for our current work investigating how elephants respond to different odors in the wild. This knowledge can then be integrated, among other stimuli, into a single programmable device, the Targeted Personality Device (TPD), aimed to better deter elephants from entering human-dominated areas. The TPD is a transportable device that can be carried into the field and programmed to create different combinations of sensory stimuli based on the results of our previous experiments. By integrating an elephant's use of odors into conservation strategies, we aim to create a targeted intervention that takes the individual into account in order to promote coexistence.

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Deciphering the chickadee *tseet*

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

P38 The tseet, a one-note call, is the most frequently produced vocalization of many chickadee species (genus *Poecile*) and thought to maintain contact between conspecifics. Like the namesake chick-a-dee call and fee-bee song, tseets are given year-round by both sexes, have learned components dependent on early exposure to conspecifics, and differ acoustically across species, sex, and individual. Unlike those vocalizations, tseets are rarely the subject of chickadee communication research, leaving numerous insights regarding the call relegated to a handful of papers, research posters, and supplementary analyses. Here, we present work from our lab, old and new, which feature this brief vocalization. We include a recent tseet discrimination on the basis of sex, a bioacoustic analysis contrasting features between various types of tseets, and a current operant go/no-go discrimination task investigating whether black-capped chickadees (*Poecile atricapillus*) perceive the acoustic differences between tseets produced by black-capped chickadees and mountain chickadees (*Poecile gambeli*). Preliminary analyses of the latter suggest that, similar to the sex discrimination, black-capped chickadees can learn the discriminations between the species but do not readily generalize to novel tseets. Taken together, these efforts can better support the development of future tseet research and shed light on an otherwise understudied vocalization.

Unusual Art Patterns Following Sudden Feather Loss: A Case Study of Stress-Induced Spatial Change in a Pigeon

Tianxing (Cameron) Guo, Cyrus Kirkman, & Aaron P. Blaisdell (UCLA)

P39 This case study examines a significant shift in the painting behavior of Darwin, a laboratory pigeon, following an unexpected neck feather loss observed for several days. Darwin is previously known for creating digital artwork characterized by large, expansive strokes. She exhibited a sudden change toward producing highly constrained and spatially focused art pieces across several days of uncharacteristic feather loss. This behavioral shift led us to explore whether the feather loss, a well-documented indicator of pigeon stress, could be correlated with changes in her artistic style. We identified and quantified parallels between Darwin's altered painting patterns and known effects of stress on spatial exploration and attentional focus such as a narrowing of attentional breadth, increased fixation on localized details, & etc. This case highlights the potential for non-invasive creative tasks, such as digital painting, to provide insights into animal welfare and affective states. Subtle shifts in creative expression may reflect underlying physiological or psychological changes, offering a novel approach to monitoring animal well-being. The findings suggest that artistic behavior could serve as an additional tool in animal care, potentially enhancing our ability to assess the mental and emotional health of animals in captivity.

Can Rhesus macaques (*Macaca mulatta*) self-construe perceptual categories under deferred feedback?

Andres Sanchez, Brooke Jackson, & Michael Beran (Georgia State University)

P40 Research suggests two category learning systems. The implicit-procedural system relies on stimulus-response associations. The explicit-declarative system relies on executive attention and working memory. It may underlie hypothesis testing and rule learning. We explored how monkeys self-defined perceptual categories when given immediate reinforcement and when reinforcement was deferred for four trial blocks. In one task, the monkeys were presented with the vertical-horizontal illusion. In another task, the monkeys were presented with rectangle stimuli that morph from more horizontal to more vertical in orientation. In both tasks, the defined category breakpoint for reinforcement of responses differed from the objective perceptual center (i.e., it was not the point where both lines were the same length, or the shape was closest to square). We hypothesized that without immediate feedback, monkeys may form subjective, intuitive task structures that conflicted with the objective reinforcement contingencies. However, results suggest that in both tasks, in the deferred condition, the monkeys still defined categories based on the reinforcement contingencies rather than a self-construal of the task. Current assessments explore monkeys' potential self-construal of a task with color discrimination to see whether this result generalizes to another type of discrimination.

"Preparation" of the proboscis extension reflex in the fruit fly, *drosophila melanogaster*

Ella Kole (Villanova University), Avadhoot Kolee (Temple University), Danielle Buckley (Villanova University), Andrew Beck (Villanova University), Annie Berkowitz (Villanova University), Steven DiSiervi (Harriton High School), Alexandra Juhasz (Harriton High School), Yazen Latif (Villanova University), & Matthew Matell (Villanova University)

P41 Insects from several orders (e.g., butterfly, honeybee, fruit fly) will extend their proboscis in response to appetitive stimuli such as sugar. Prior work (Smart et al., 2023) has demonstrated that periodic (e.g., every 20s) stimulation of sugar receptors in the fruit fly via optogenetics results in a progressive increase in the probability of non-stimulated proboscis extensions as time approaches the next scheduled stimulation event, a phenomenon consistent with a preparatory process. Further, the slope of this ramping activity declined with longer stimulation intervals, consistent with vertebrate interval timing characteristics. We investigated whether these ramps would peak during extended duration probe trials, indicative of temporal specificity. Our results showed that optogenetic stimulation of the fructose receptor induced ramping activity of the proboscis ($p<0.005$) during the intervening interval between stimulations, although there was a trend ($p<0.06$) for a complex effect of the stimulation interval (20, 40, 60s), as ramping wasn't monotonically related to duration. On extended duration probe trials, ramping activity continued beyond the normal stimulation interval, rather than peaking. We conclude that the dynamics of unstimulated proboscis extensions are most parsimoniously interpreted as recovery from habituation, rather than event timing.

Effect of Familiarity and Use of American Sign Language (ASL) on Chimpanzee (*Pan troglodytes*) Sign Modulation

Katelyn Seymour (Central Washington University), & Mary Lee Jensvold (Central Washington University, Friends of Washoe)

P42 Familiarity of conversational partner affects conversational behaviors in human interactions. In this study, the researcher examined the effects of familiarity and use of American Sign Language (ASL) on four signing chimpanzees' modulations of signs. Three of the chimpanzees had been cross-fostered and acquired signs from human caregivers. The fourth acquired signs from other chimpanzees. They used more conversational behaviors (e.g., vocabulary, turns, initiation, participation) with familiar-signers than unfamiliar or nonsigners. Modulations, or modifications to the form of a sign, alter the sign's meaning, affect intensity and comprehension, and vary across conversational contexts among human and chimpanzee signers. During 4-min trials, the chimpanzees were presented with a human participant who was in one of four conditions: familiar-signer, familiar-nonsigner, unfamiliar-signer, and unfamiliar-nonsigner (N=20 participants in each condition). The experimenter coded sign duration from videos of trials. Chimpanzees were expected to use longer durations of signs with the unfamiliar-nonsigners than with the familiar and signer conditions. Sign durations were significantly longer with unfamiliar-nonsigners than familiar-signers. Human and chimpanzee literature supports the expectation that individuals adjust their conversational behaviors to their conversation partner according to their familiarity and use of signs.

The effects of age on cognitive task performance in Tufted Capuchins (*Sapajus [Cebus] apella*): A cross-sectional study

Stella Mayerhoff (Georgia State University, Language Research Center), Matthew Babb (Georgia State University, Language Research Center), Grace Weyman-Heller (Georgia State University, Language Research Center), Sarah Barber (Georgia State University), & Sarah Brosnan (Georgia State University, Language Research Center)

P43 Understanding the factors driving age-related changes in cognitive performance is a key challenge in aging research. Non-human primates are an excellent model for studying cognitive aging as they are phylogenetically close to humans, but allow for researchers to control for many of the cultural and social factors intrinsic to humans that can influence human cognition. In the current study, we tested for age-related differences in performance on two cognitive tasks in tufted capuchin monkeys (*Sapajus [Cebus] apella*), a platyrrhine primate with a remarkably long lifespan, especially for its relatively small body size. Each monkey participated in two computerized cognitive tasks: a delayed match to sample task using a limited number of stimuli designed to assess working memory and a reversal learning task designed to assess cognitive flexibility. Analyses are ongoing. The data we report here are cross-sectional but are part of a larger longitudinal study with the goal of determining the effects of aging on cognitive task performance in capuchins.

Conceptual Set-Shifting in the Squirrel Monkey (*Saimiri spp.*): Disambiguating Age/Sex Effects

Lisa M. Pytka (The University of Texas MD Anderson Cancer Center, Michale E. Keeling Center for Comparative Medicine and Research), Michele M. Mulholland (The University of Texas MD Anderson Cancer Center, Michale E. Keeling Center for Comparative Medicine and Research), Will Whitham (Texas A&M University-Commerce, Department of Psychology and Special Education), Henrieta Scholtzova (New York University, Grossman School of Medicine, Department of Neurology), & William D. Hopkins (The University of Texas MD Anderson Cancer Center, Michale E. Keeling Center for Comparative Medicine and Research)

P44 The Conceptual Set-Shifting Task (CSST) is a simplified, touchscreen-based analogue of the Wisconsin Card Sorting Test. CSST measures executive control and inhibition by requiring subjects to adapt to unexpected changes in reward contingency. We administered CSST to squirrel monkeys (Saimiri spp.), including six young males (M=4.3 years), five young females (M=4.5 years), and five old females (M=20.4 years). Here we present on their first 27 rules learned. We found a difference in learning latency (blocks required to reach criterion) between young females (M = 6.24) and old females (M=14.43; Mann-Whitney U=10.0, $p>.05$), while we found no difference between young females (M=6.24) and young males (M=5.55; Mann-Whitney U=3.0, $p<.05$). In addition, old females exhibit significantly higher learning latencies after extradimensional shifts (M=14.32) than young females (M=5.66; Mann-Whitney U=3.0, $p<.05$) but not after intradimensional shifts (old M=14.23; young M=7.15; Mann-Whitney U=4.0, $p>.05$). These data suggest that cognitive flexibility is impaired as female squirrel monkeys age, as young females significantly outperformed old females but were not significantly different from young males. Also, this impaired cognitive flexibility is more pronounced when shifting between rules of different dimensions. Further research with old males is required to confirm these findings are consistent in both sexes.

The Role of Age and Individual Differences in Captive Tiger (*Panthera tigris*) Behavior

Kate M. Chapman, & Lilly S. McCoy (University of Arkansas)

P45 Animals often experience increased levels of stress in captivity, resulting in stereotyped behaviors (e.g. pacing) and reduction in species-typical behaviors. Environmental enrichment is used to reduce negative behaviors and increase positive behaviors in captive animals. Anecdotal observations from researchers and care staff indicate that dramatic individual differences exist in stereotypy, activity level, behavioral diversity. This study used focal-animal and time sampling to assess individual and age group level differences in activity level, behavioral diversity, and stereotypy in a sample of 55 captive tigers (*Panthera tigris*) at Turpentine Creek Wildlife Refuge. Tigers of a wide variety of ages were observed during environmental enrichment sessions and baseline sessions over the course of several years. Unexpectedly, there was no correlation between age in years and any of the three behavioral variables (activity level, behavioral diversity, and stereotypy) for either baseline or enriched sessions. When classified into 4 distinct age categories, no effect of age was found on behavioral diversity, activity level, or stereotypy. However, considerable individual differences were found when examining these variables.

Pets and sleep: Assessing the relationship between pet proximity and sleep quality

Chris Bass (Department of Psychology, University of South Alabama, Mobile, Al), Lindsey Johnson (Department of Psychology, University of South Alabama, Mobile, Al), LucyAnne Smith (Department of Psychology, University of South Alabama, Mobile, Al), & Heidi Lyn (Joan M. Sinnott chair of Psychology, Department of Psychology and Stokes School of Marine and Environmental Sciences, University of South Alabama, Mobile, Al)

P46 Cohabitating with animals like dogs and cats impacts our quality of life in subtle ways, such as how we sleep. This study investigated how pet ownership impacts quality of sleep, focusing on the relationship of the proximity of our pets when sleeping and sleep quality. Past research indicates that owning a pet may have positive impacts in mental and physical health. However, it is less often that research questions are aimed at understanding how pet ownership potentially affects

our quality of sleep. A survey of n = 138 participants with a mean age of 24.3 (SD=10.6) found a relationship between participants - pet owners and nonowners - who reported having their pet commonly sleep in their bedrooms with them having significantly more trouble falling asleep, t(118) = -2.45, p = 0.015 as well as staying asleep t(136) = -2.98 p = 0.007 compared to participants who did not. These findings suggest pets are interfering with their owners sleep provided they are in a close enough proximity to them. This study sets the precedent for future research looking into pet ownership's impact on quality of sleep, particularly as it relates to pets proximity to their owners while sleeping.

Exploring the factors affecting bumblebee microcolony architecture

Amy Dean, Zoey Gauthier, & Caroline Strang (The University of Western Ontario)

P47 Bumblebee microcolonies, worker bees isolated without a queen, are a commonly used tool in research on the negative impacts of pesticides and other environmental insults, but little work has been done to fully characterize behaviour of bees within microcolonies. We collected data from multiple bumblebee microcolonies to identify behavioural trends and factors that impact similarities and differences in microcolony behaviour. We created a total of nine microcolonies, each composed of 15 worker bees, with three colonies created from each of three queens. Microcolonies were housed in identical colony boxes, all of which contained humidity and temperature monitors. Bees were supplied with ad libitum sugar water and pollen. Our main indirect behavioural measure was honeypot architecture, for which we recorded the location, number, size, and colour of all honeypots. We collected additional direct behavioural measures including foraging, incubating, and general activity level. Each measure was assessed on a regularly scheduled basis for ten weeks. At the conclusion of the study, a final set of measurements were taken of honeypot construction. Initial data analysis shows a significant effect of queen on microcolony honeypot construction at the conclusion of the study.

Optimality may be determined by reinforcement history in a suboptimal choice procedure

Jessica Stagner Bodily (Auburn University at Montgomery), & Kent D. Bodily (Huntingdon College)

P48 The “suboptimal choice procedure” is a two-alternative concurrent chains procedure in which choosing the “optimal” alternative is reinforced more often but with less predictive signals than the “suboptimal” alternative. This procedure has been used to investigate suboptimal behavior across multiple species. Preference for an alternative has been the primary measure of optimality in extant research. We propose that comparing choice allocation to relative ratios of obtained reinforcement may be an illuminating approach to defining optimality. To explore this, we applied a reinforcement-derived model of optimality to our previously-published human data. We found that human choice was consistent with obtained-reinforcement predictions in 4 of 6 conditions. Participants in the remaining conditions chose the suboptimal alternative more than expected, demonstrating suboptimal choice in humans. In addition, we adapted the model to use programmed probabilities and applied it to extant research with humans, rats, and pigeons. This revealed a counter-intuitive relationship between choice allocation, obtained reinforcement, and optimality.

Why Do Doves Dart in Front of Cars? An Analysis of Their Escape Trajectory

Yuta Sato (University of Nagasaki), Takao Sasaki (University of Rochester), Travis L. DeVault (University of Georgia), & Yuuki Kawabata (University of Nagasaki)

P49 Roadkill is a serious global issue, and investigating animal escape responses to vehicles can help reduce collisions. While there are reports of animals unexpectedly darting from the roadside into the road as vehicles approach, it is still not well understood how and why this occurs. In this project, we investigated this by placing seven feeding stations along a road where no other cars could enter. We drove a car at 45 km/h while recording the feeder from above at the same time each morning over a period of 20 days. We tracked the escape trajectories of 141 doves and discovered an interesting relationship between road distance and escape trajectory. Doves farther from the road tend to escape away from it, while those closer to the road are more likely to fly toward it. To Investigate these behaviors from an evolutionary perspective, we developed an agent-based model, simulating their natural predators (e.g., hawks or foxes) with limited turning ability. Our model suggests that when a dove is near the predator’s path, flying toward it surprisingly increases the chance of escape. Our findings advance our understanding of seemingly maladaptive animal behaviors in nature and contribute to developing methods to mitigate animal-vehicle collisions.

An experimental approach to comparative psychology in plants

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

P50 Roots grow in complex environments with temporal and spatial heterogeneous resource distributions. Root growth, an irreversible process requiring spending photosynthates, represents foraging decisions to optimize resource acquisition while minimizing wasting photosynthates. This study applies a signature-testing approach on 15 plant species using increasingly complex challenges investigating the existence of cognitive behaviours in plants. We will track species-specific root foraging near and away from soil nutrient patches using imagery. By growing plants in soils with spatially repeating patterns of nutrient "rewards" and "blocks," we aim to determine whether plants retain and utilize spatial information about soil structure for future foraging. Increasing root growth in previously rewarding maze sections, and reducing growth in blocking

sections, will suggest memory-based foraging. Additionally, we will test associative learning by pairing a neutral conditioned stimulus (CS) with an appetitive unconditioned stimulus (US). Evidence of associative learning will appear as increasing root foraging following only CS presentation. By applying comparative psychology to highly novel organisms, plants, in organism-appropriate tests, we aim to find limitations of cognition across the tree of life.

A Contingency-Learning Procedure to Study the Conjunction Fallacy in Humans: The Role of Trial-Type Base Rates

Melissa (Chufei) Qiu, Cyrus Kirkman, Ikponmwosa Pat-Osagie, Robert Tsai, & Aaron P. Blaisdell (UCLA)

P51 We previously found that rats exhibit evidence for the conjunction fallacy heuristic using a trial-wise contingency learning procedure. The current study validated this non-verbal empirical procedure in humans and investigated the role of trial-type base rates on the conjunction fallacy. We trained human participants to move a Pac-Man avatar left or right to obtain points as reward. Response-reinforcer contingencies depended on both the background display color (green/blue) and the state of a light bulb (off/on). Different participant groups were trained with light off/on ratios of 25/75, 50/50, 60/40, and 75/25. After training, the light bulb was occluded with digital curtains to test whether participants thought the conjunction of two events (background + light on) was more likely than a single event (background + light off). Like rats, human participants in the 50/50 condition believed the occluded light was more likely to be on, displaying the conjunction fallacy. Unlike rats, humans did not show the fallacy in the 75/25 condition. The current findings suggest that, while humans also show a conjunction fallacy during trial-wise contingency learning, the fallacy is expressed in a narrower range of base-rates in humans than in rats.

The Role of Post-Choice Information on Associative Learning

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P52 Feedback is an essential element in learning. Prior studies in humans have shown that targeted informative feedback offering specific guidance is sometimes more effective than binary feedback alone. We explored whether informative feedback also aids learning in pigeons. We investigated informative feedback by breaking it down into core components and examining which were most beneficial for learning. Pigeons were trained on a delayed many-to-one matching task, and the relative learning speed of sample stimuli where choice was followed by "informative" or "non-informative" feedback was compared within subjects. Informative feedback involved the re-presentation of the pre-delay sample stimulus, while non-informative feedback varied across nine different experimental phases. Informative feedback produced enhanced learning compared to a blank delay period of similar duration, an identical non-informative cue for all stimuli, and varied non-informative feedback; however, learning rates did not differ between informative feedback compared to immediate food rewards, paired non-informative feedback, or binary signaled feedback. Informative feedback stimuli were also learned at the same rate as categorical feedback encoding the correct choice, but a pseudo-categorical control yielded worse outcomes than either. These results are discussed in terms of the role of primary rewards, information regarding similarity, conditional relations, and prospective coding.

Associative Learning in Ant Colonies

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P53 Associative learning is a fundamental set of processes underlying animal and human behavior and cognition. Models of associative learning successfully identify potential mechanisms that allow individual organisms to adjust their behavior to regularities in their environment. However, these models typically only account for how individual animals learn, even if the animals are normally gregarious. Social animals often learn with others, yielding outcomes that are often superior to those obtained by learning alone, a phenomenon known as collective learning. Although this is a well-known phenomenon, the theoretical work of collective learning has been underdeveloped compared to that of individual learning. Our research investigates the extent to which fundamental principles of associative learning, which operate at the level of individual organisms, contribute to collective learning using the rock ant, *Temnothorax rugatulus*, as a model system. Based on these empirical data, we aim to develop a theoretical model of collective learning inspired by the Rescorla-Wagner model.

The dynamic state of a prefrontal-hypothalamic-midbrain circuit commands behavioural transitions in mice

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Innate behaviors such as food intake, social interaction, and exploration of novel objects meet multiple needs adaptively and in a serial order. This suggests the existence of a brain dynamic that integrates representations of upcoming behaviors during selection. We investigated neural dynamics of behavioral transitions using electrophysiological recordings in freely behaving mice, neural decoding, and optogenetics. Our findings show that initiating a new behavior is driven by beta (15—30 Hz)-rhythmic inputs from the medial prefrontal cortex to the lateral hypothalamus (LH), synchronizing with LH 'transition cells' that encode multiple behaviors. Transition cells contribute to phase signatures of neuronal populations in the lateral hypothalamus (LH) that are active near beta oscillation peaks. Optogenetic recruitment of intrahypothalamic inhibition at this phase disrupted coordinated phase signatures and eliminated behavioral transitions. Upon behavior onset, phase signatures shifted sharply, becoming nearly anti-phase with those during transitions. Downstream of the LH, dopamine neurons in the ventral tegmental area increased firing during beta oscillations and encoded behavioral transitions. These results suggest that a hypothalamic transition state supports coordination with cognitive and reward circuitries, signals alternative future behaviors and the one most likely to be selected, and enables the transition to the chosen behavior.

Point Comprehension in Dogs and Toddlers

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Pointing is an ubiquitous social-communicative gesture humans use to communicate with each other and with other species, particularly dogs. Both dogs and young children can follow adult human points, but recent work has suggested that dog point-following may be more brittle than previously thought, and young children have yet to be tested on similarly complex pointing tasks. In this study, we utilize a multi-object search problem where participants (dogs and 17-24-month-old children) must follow a point from an experimenter to locate a hidden object inside one of four cups. We use cameras that provide dimensional data to track how points are physically executed. This allows us to quantify the points produced, and identifying potential vectors that could be followed. For both species, we evaluate how features of the pointing gesture, including pointer proximity, influence point following. We also examine whether pointing vectors that have shown particular promise in prior work in robotics, such as following the line from head to hand, are also used by our participants. The results of this study will impact our understanding of social communication across both species. Data collection is ongoing.

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