29th Annual International Conference on Comparative Cognition

Sponsored by the
Comparative Cognition Society
April 6th to 9th, 2022
Virtual Conference

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PROGRAM NOTE: Five-minute talks are designated by a talk number with a grey background. Five-minute talks are followed by two minutes for discussion. Ten-minute talks are followed by four minutes for discussion. Symposium talks are 15 minutes followed by four minutes of discussion.

11:00 AM Opening Remarks (Ken Leising)

11:15 AM Early Career Award Winner – Marisa Hoeschele

12:00 PM Canine Cognition (Chair: Jessica Stagner Bodily)

1

12:00 PM

Violation of expectation task in Canis lupus familiaris

Deirdre Yeater, Dawn Melzer, Larissa Brito, Angelina Failla, Hailey King, & Jordan Manning (Sacred Heart University)

Previous studies found that human infants look longer at an object if something unexpected has occurred and therefore violates their expectations. Canine studies with similar methodology have had inconclusive findings. To add to our understanding of canine object permanence, dogs were presented with a violation of expectation task, similar infant studies. The dogs were positioned in front of a stage with a concealed opening in the back and a ramp with a guided track. A wall was placed at the end of the ramp and an occluding wall was positioned to hide the right side of the stage. An additional wall was placed in the middle of the track within the dog's view. The experimenter rolled a ball down the ramp. The ball either stopped at the wall in the middle of the track (knowledge consistent event), or appeared to go through the wall (a knowledge inconsistent event). The experimenter then lifted the occluding wall to reveal the ball and dogs were given 10 seconds to look at the ball. All trials were video recorded and coded for gaze duration. Preliminary results suggest that dogs looked longer at the violation event, which suggests that dogs can demonstrate object permanence.

2

12:07 PM

Dogs take into account the actions of a human partner in a cooperative task

Mayte Martínez, Lauren M. Robinson (Domestication Lab - Konrad Lorenz Institute of Ethology - University of Veterinary Medicine Vienna. Language Research Center- Georgia State University- Atlanta), Sarah F. Brosnan (Language Research Center- Georgia State University- Atlanta. Departments of Psychology and Philosophy-Neuroscience Institute- Center for Behavioral Neuroscience- Georgia State University- Atlanta), & Friederike Range (Domestication Lab - Konrad Lorenz Institute of Ethology - University of Veterinary Medicine Vienna)

Humans stand out for their capacity to flexibly cooperate, possibly because they understand the role of their partners. To explore to what extent this understanding is uniquely human, researchers have tested whether non-human species wait to manipulate a cooperative apparatus until a delayed partner arrives. If animals do wait, then it is assumed that they recognize the need for a partner. However, success in these tasks may be the result of social facilitation. Moreover, this approach does not allow us to assess if animals take their partners' actions into account. In this study, we trained pet dogs to press a button simultaneously with their human partner. Afterwards, we tested them in several conditions to disentangle which elements of their partner's behaviour they take into account. Dogs refrained from pressing the button for up to 9 seconds until a) the arrival of a delayed partner, b) the button was available to the partner, and c) the partner pressed the button. Furthermore, success rate and frequency of pressing behaviour decreased immediately when they could not see their partner. We conclude that dogs take the presence of their partner and their actions into account when cooperating with a human partner.

3

12:14 PM

Same-different conceptualization in dogs (Canis familiaris)

Allison Scagel, & Eduardo Mercado (University at Buffalo)

Abstract concept formation was once thought to be a uniquely human ability. An increasing variety of non-human species have demonstrated aspects of this ability, however, suggesting that conceptualization is a widely shared aspect of cognition. The capacity to form a concept of same-different, in particular, has now been shown in pigeons, primates, bottlenose dolphins, sea lions, and more. Traditional methods of studying same-different conceptualization include matching-to-sample (MTS), same/different (S/D), and relational-matching-to-sample (RMTS) tasks, tasks that typically require animals to discriminate sets of planar images. Some of these methods may actually test familiarity, memory, associative learning, or other phenomena rather than a concept of same-different. We propose testing same-different concept formation in domestic dogs using a variation on the S/D task that requires subjects to discriminate sets of three-dimensional objects. This method may avoid some pitfalls of MTS and S/D tasks that use two-dimensional images. Dogs were able to learn to classify sets of objects as "same" and "different," and immediately transfer this ability to novel sets, including sets of only two objects. Domestic dogs are promising subjects for future studies of same-different conceptualization due to their widespread availability and willingness to work cooperatively with humans.

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12:21 PM

How dogs attend to goal-directed actions
Lucrezia Lonardo, Christoph J. Völter (University of Veterinary Medicine of Vienna), Claus Lamm (University of Vienna), & Ludwig Huber (University of Veterinary Medicine of Vienna)
The direct matching hypothesis postulates that an observer's motor representations are crucial to predict and understand others' goals. To test this hypothesis, we tracked the gaze of 16 dogs (Canis familiaris) observing a human and a conspecific execute a goal-directed action. On the first trial, although the human agent performed movements outside dogs' motor repertoire, dogs' gaze arrived at the goal object predictively. When the agent was a conspecific, dogs' gaze shifts to the goal object were reactive. When the human agent behaved more closely to the dogs' motor possibilities (e.g., crawling instead of walking), the dogs' gaze arrival times were intermediate between the other two conditions. On average, dogs were faster in predicting the goal of the human agent than that of the dog. Dogs looked longer at the conspecific than at the human, and longer at the human moving more similarly to a dog than at the human moving normally. Irrespective of condition, dogs looked longer at the agents' faces than bodies. These results suggest that goal prediction does not require a direct match between the observer's first-person motor representations and the observed actions and that dogs might rely on a different mechanism to anticipate humans' action goals.

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12:28 PM

Dogs understand the false beliefs of humans, but not like humans
Ludwig Huber, Lucrezia Lonardo, Christoph Völter (University of Veterinary Medicine Vienna), & Claus Lamm (University of Vienna)
Dogs show impressive abilities for interacting with us, because they are excellent 'behavior readers'. But are they also 'mind readers' by using information about the underlying mental states of us humans, like seeing, intending and believing? Here we provide evidence showing that dogs (n=260) distinguish between a human informant holding a true or false belief about the location of food. Subjects could retrieve a piece of sausage from one of two opaque buckets after watching its initial hiding in A, its subsequent displacement to B and finally a misleading suggestion (A!) by a human informant who held either a false (absent during the displacement) or a true (absent before or after the displacement) belief about the final location of food. The majority of dogs went straight to B, but from those dogs that followed the informant's misleading suggestion to A, more did so when the informant had a false belief than when she had a true belief. While their differential reaction to the experimental manipulation suggests that dogs take human belief states into account, they behaved in an opposite way to human infants and apes in similar paradigms. Possible reasons for this difference will be discussed.

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12:42 PM

Communication (Chair: Jessica Stagner Bodily)

12:42 PM

Meaning in practice: Finding culture in non-human animals
Rebecca Ring (York University)
Seeing nonhuman animals as cultural beings depends on perspectives and assumptions in theoretical frameworks and empirical methodologies. Typically, (mis)recognizing animal culture comes down to what counts as teaching, imitation or cultural social transmission of information. My model of culture shifts the focus to social ontology. Culture is a real social kind, meaning 'culture' can both do explanatory work and be explained in virtue of the causal and constitutive properties of social practices. Culture is dynamic meaning-making processes; ways of being wherein behaviours, objects, and places have salience/significance for social agents in virtue of their social practices (i.e., social meaning). Cultural phenomena are imbued with and carry information, knowledge and value that go beyond biological function and mere means to ends. I argue that some animals engage in meaning-making practices that are co-created, re-created (re)enacted, embedded, and transmitted in actions, interactions and relationships within social matrices; all of which constitutes culture. If information that is socially transmitted can be identified, and since meaning is immanent in information, then evidence of such meanings constructed in social practices can be revealed. I argue that finding such evidence rests on integrating theories, methodologies and empirical resources from the humanities, sciences, and other situated knowledges.

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12:49 PM

Kin Recognition in Bottlenose Dolphins
Rachel Hamrock (Oklahoma State University), & Jason Bruck (Stephen F. Austin State University)
Kin recognition is an important mechanism to prevent inbreeding in social mammal populations where kin and non-kin cohabitate. While many terrestrial species rely on their sense of smell to differentiate between kin, cetaceans do not possess this trait. Instead, bottlenose dolphins (Tursiops truncatus) use learned individually-specific contact calls known as signature whistles as a mode of transmitting social identity information. This project utilizes signature whistles to assess kin recognition and discrimination by dolphins. We hypothesized that the dolphins would display stronger responses to playbacks of signature whistles of kin than of non-kin. Furthermore, we predicted that male dolphins would display stronger responses to non-kin whistles than female dolphins would because of the social structure of wild dolphins in which bachelor pods are more likely to view non-kin as either mating opportunities or agonistic encounters to avoid. Overall, our results showed that the strength of response to a familiar signature whistle increased when the caller was related to the subject. These results indicate that dolphins are capable of kin recognition

and can identify kin through signature whistles. This suggests that there may be specific mechanisms within signature whistles and other modalities used for kin recognition which need to be explored.

12:56 PM *Break*

1:06 PM Concept Learning (Chair: Jessica Stagner Bodily)

1:06 PM
Testing for Cross-Modal Facilitation in Pigeon Same/Different Learning
Angelle Antoun (Emory University), Muhammad A. J. Qadri (College of the Holy Cross), & Robert G. Cook (Tufts University)
The capacity to form abstract concepts across different modalities is a key component of human intelligence. However, it remains unclear to what extent abstract concept formation is a shared higher-order capacity across the modalities in animals. We tested two groups of pigeons simultaneously learning a same/different (S/D) concept in the visual and auditory modalities. One group shared a common or consistent response mapping of the S/D relations across each modality (different was the positive stimulus set for both auditory and visual tasks), while the other group had them inconsistently mapped (different was positive for auditory task, while same was positive for visual task). Multiple different reversals of each group's mapping relationships suggested that independent and separate discriminations had been learned within each modality. Overall, the results offer little evidence of a high-order shared linkage in this species, suggesting that each S/D discrimination was modality specific.

1:13 PM
Sequential same/different concept use in pigeons using random dot motion
Muhammad A Qadri, & Luke C Bernier (College of the Holy Cross)
Evidence of same/different concept learning requires demonstrating transfer of a learned same/different discrimination to novel stimuli. Three pigeons were trained to discriminate a series of same-motion displays and different-motion displays in a go/no-go task. Individual motion displays were made from linearly transiting random dot fields, with a single display using a specific transit direction and transit rate. Pigeons learned the discrimination slowly and required several stimuli to accurately discriminate same/different sequences. Transfer tests with untrained values of transit direction and transit rate suggest that pigeons attended to both dimensions, though to varying degrees. Subsequent tests suggest the pigeons used the degree of difference over the preceding 4 s of stimuli to make their same/different judgments. These results will be compared to known results of sequential same/different concept learning with image and auditory sequences.

1:20 PM
Spontaneous Numerical Ability in Horses: Sequential Versus Simultaneous Presentation of Quantity Discriminations
Tammy McKenzie (Brandon University)
It has been suggested that the ability to discriminate based on quantity has survival value. For example, it may be beneficial to have the capacity to distinguish between foraging areas with larger and smaller food quantities, to detect differences in the number of competitors and/or predators present between locations/situations, etc. (Perdue, Talbot, Stone, & Beran, 2012). Relatively few studies have examined numerical competence in horses, either spontaneous (Henselek, Fischer, & Schloegl, 2012; Uller & Lewis, 2009) or trained (Gabor & Gerken, 2014; Petrazzini, 2014). Conflicting findings have been reported in the studies examining spontaneous numerical abilities in horses. The current research examined spontaneous numerical ability in horses. Horses were tested using a two-choice task which involved either simultaneous or sequential presentation of two varying quantities. The following quantity discriminations were presented: 1 vs. 2, 2 vs. 3, 2 vs. 4, 3 vs. 4, 4 vs. 6, and 8 vs. 16. There was no evidence of spontaneous numerical ability in horses when the quantity discriminations were presented sequentially. However, for some of the quantity discriminations that were presented simultaneously horses selected the larger quantity at a level significantly above chance performance.

1:27 PM
Size is relative: use of relational concepts by wild hummingbirds
Theo Brown (University of St Andrews), T. Andrew Hurly (University of Lethbridge), Susan D. Healy, & Maria C. Tello-Ramos (University of St Andrews)
Rufous hummingbirds (Selasphorus rufus) learn the location and the colour of rewarded flowers within their territory in just a couple of trials. But if these birds could apply a relational concept such as "the larger flowers have more nectar" they could forego learning the locations of hundreds of flowers. We investigated whether wild male territorial rufous hummingbirds can use "larger than" and "smaller than" relational rules and apply them to flowers of different sizes. Subjects were trained to feed consistently from one of two flowers. The flowers differed only in size and the reward was always contained in the same-size flower. The birds were then tested on a choice of two empty flowers: one of the familiar size and the other a novel size. Hummingbirds applied relational rules by choosing the flower that was of the correct relational size rather than visiting the flower of the size rewarded during training. The choices made by the hummingbirds were not consistent with alternative mechanisms such as associative learning or peak

shift. While hummingbirds are very good at remembering the spatial locations of rewarding flowers, we suggest that these birds could also use relative rules when foraging in new environments.

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1:41 PM

The use of a novel computerized system to test the planning abilities of a California sea lion (Zalophus californianus)
Kelley A. Winship, Amber M. Ramos, Alycia Coulombe (National Marine Mammal Foundation), & Mark J. Xitco Jr. (United States Navy Marine Mammal Program)
The ability of animals to plan provides insight into their utilization of past memories and anticipation of future events. While research on planning in animals has focused on terrestrial species, problem solving tasks investigating planning have been used with bottlenose dolphins (Tursiops truncatus). However, little is known about the presence of planning in pinnipeds even though they have performed well in cognitive experiments. A new computerized testing system, the Enclosure Video Enrichment system (EVE) was developed and introduced to marine mammals at the US Navy's Marine Mammal Program in San Diego, California. After completing introductory training sessions teaching cursor driving skills using a four-button controller over the course of eight months, a single adult male California Sea Lion (Zalophus californianus) was provided the MAZE game, modeled after previous research in humans and primates (Beran et al., 2015). While initial concepts of gameplay were deemed too difficult for the animal to conceptualize after the first introduction, adjustments to the training regimen proved successful in the animal learning the game mechanics. Results from the completed testing sessions with this individual will be discussed in comparison to terrestrial mammals, as well as plans for future testing with other individuals.

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1:55 PM

Assessing killer whale (Orcinus orca) creativity from an "innovate" task
Heather Manitzas Hill (St. Mary's University), Myriam Weiss, Isabelle Brasseur (MarineLand Antibes), Alexander Manibusan, Irene R. Sandoval (St. Mary's University), Todd Robeck (SeaWorld Inc), Julie Sigman, Kristen Werner (SeaWorld of Texas), & Kathleen M. Dudzinski (Dolphin Communication Project)
Previous research has demonstrated that a variety of mammals can learn the abstract concept of "innovate" with reinforcement training. Nine killer whales from two different facilities were trained to respond to an "innovate" cue, in which a behavior different from the previous behaviors was necessary to elicit a reward. Truly novel behaviors or responses were not required to receive reinforcement. The killer whales ranged in age from 5 – 29 yrs with 4 females and 5 males. The results indicated that the killer whales demonstrated high fluency (83% correct when all trials were examined) with few individual differences. The killer whales produced a range of unique responses before repeating a behavioral response, ranging between 3 and 59 different behaviors in consecutive trials. Two females did emit truly novel behaviors that were not part of their trained repertoire. Adult males produced fewer "original" behaviors than the females with the youngest animals producing the greatest numbers of different behaviors. These results suggest that killer whales can learn an abstract concept like other animals previously assessed and show variation in their originality. However, the role of training and previous reinforcement history need to be assessed to understand the extent of the creativity.

2:09 PM *Break*

2:19 PM Perception (Chair: Jessica Stagner Bodily)

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2:19 PM

Scent Discrimination in Two Species of Armadillos (Tolypeutes tricinctus & Chaetophractus villosus)
Joy Vincent, Taylor Crews, & Jennifer Vonk (Oakland University)
It is widely believed that armadillos have a strong sense of smell. This presumption is predicated on the enhanced development of neuroanatomical structures associated with olfaction, along with field observations that suggest a reliance on scent in navigation and foraging. There is a dearth of studies that have systematically analyzed their olfactory capabilities. This study set out to determine whether armadillos could discriminate between two novel scents (sage and lavender). Two tins, each with one of the scents, were placed in the testing area. One was baited, while the other was not; the S+ scent was randomized for each subject. Four armadillos (three 3-banded armadillos and one big hairy armadillo) were individually placed in a testing area and given two minutes to explore and interact with the tins. A correct choice was defined as the armadillo attempting to open the S+ tin first. All armadillos were able to successfully reach criterion (making 16 correct choices in 20 consecutive sessions) in under 35 sessions, suggesting that armadillos can rapidly acquire a novel scent discrimination. Implications of personality and motivation differences on learning rate will be discussed.

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2:26 PM

Susceptibility to the Delboeuf Illusion in Aldabra Tortoises (Aldabrachelys gigantea)
Bjorn Peterson (Fort Worth Zoo), Joy Vincent (Oakland University), Vicky Poole (Fort Worth Zoo), & Jennifer Vonk (Oakland University)
The way animals perceive their surroundings is central to how they navigate and interact with their environment. This study aimed to examine Aldabra tortoises' visual perception by presenting them with and observing their susceptibility to the Delboeuf illusion, wherein two identical sized discs (e.g., food reward), one encircled by a large

ring (e.g., plate) and one encircled by a small ring, are placed next to each other and compared. Humans tend to overestimate the size of the amount of food on a small plate and underestimate the amount of food on a large plate. Visual illusions have gained momentum in recent years as effective tools for studying visual perception in a variety of taxa. Reptiles, however, remain underrepresented in the literature. Our study consisted of three control conditions, wherein the plates were the same size, but the food amounts were different sizes, and one experimental condition, which presented the tortoises with the visual illusion. While the results of the experimental trials seem to point to the tortoises being susceptible to the illusion, they did not show a significant preference for the larger food amount in the control trials. Implications for how these results can be interpreted will be discussed.

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2:33 PM

Human spatial encoding depends on the goal's location
Alejandro Rodrigo (University of Guadalajara), Laurent Avila-Chauvet (Technology Institute of Sonora), Jonathan Buriticá (University of Guadalajara), & Debbie Kelly (University of Manitoba)
Animals, including humans, encode featural and geometric information from an environment. Using this information allows one to orient and determine a route from the current location to a goal. Several studies have examined if the characteristics of a goal's location govern an animal's encoding strategy and whether environmental cues influence task performance. To know whether the distance and direction of a goal location relative to an array of discrete visual cues (half hexagon shaped array) presented in a 2-dimensional virtual environment influenced humans' (N=2119) spatial searching, we tested participants in 3 different transformational tests (i.e., expansion, one cue absent, and two cues absent). We also explored if geographical factors such as place of residence (i.e., Winnipeg, Canada; Guadalajara, Mexico), biological factors such as sex (female and male), or participant age influenced the search accuracy and latency. Additionally, we examined whether the complexity of the environment (the geometric shape of the array) influenced task performance during the training phase (i.e., fewer trials) or search error during the testing phase.

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2:40 PM

Configural processing in dynamically occluded action recognition with pigeons
Suzanne L. Gray (Hunter College-CUNY and Tufts University), Muhammad A. J. Qadri (College of the Holy Cross), & Robert G. Cook (Tufts University)
Identifying the behavior of organisms is most challenging when the actors are dynamically occluded as they move behind other objects in the environment. Even when fragmented in time and across space, humans easily integrate and recognize the behavior of such actors. It remains unclear how animals process such fragmented information, especially involving motion. We investigated the ability of six pigeons to discriminate the actions (run vs walk) of digital animal models when being dynamically occluded. Using a go/no-go procedure, the pigeons were trained with three models transiting across a semi-realistic scene behind multiple occluders. Pigeons learned to discriminate between these behaviors despite never seeing the entirety of the animal models at any time. This discrimination transferred to a novel model, transit direction, transiting rates, camera perspectives, occluders, static poses and articulated movement. Critically, when presented with scrambled animal models pigeons (the body parts out of order), pigeons discrimination suffered, suggesting holistic processing of animal models in a manner similar to humans.

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2:54 PM

Tool Use and Problem Solving (Chair: Jessica Stagner Bodily)

2:54 PM

Fishing cashews. Tool-set use and transport in Goffin's cockatoos.
Antonio J. Osuna-Mascaró, Mark O'Hara (Messerli Research Institute. University of Veterinary Medicine Vienna), Sabine Tebbich (Department of Behavioural Biology. University of Vienna), Sarah R. Beck (School of Psychology. University of Birmingham), & Alice M.I. Auersperg (Messerli Research Institute. University of Veterinary Medicine Vienna)
Associative tool use (using >1 tools) is an extremely rare ability in non-human species; only few primates and birds have been reported to perform it in the laboratory, and only two species (chimpanzees and Goffin's cockatoos) use tool-sets (two or more tools used for the same goal, but with different functions) in the wild. Chimpanzees have even been observed to transport their tool-sets, prior to use, in a flexible manner depending on the need. Such transportation of several tool types together is considered evidence of a genuine tool-set, as a second tool selection and use is not just a response to the outcomes of a previous tool use, but requires a certain degree of planning. Goffin's cockatoos represent a fascinating species to study tool use; although Goffin's don't use tools in a species-wide manner, they depend on general domain cognition and are not adapted to tool use (as other bird tooling species), which likely results in extremely innovative capabilities. In these series of experiments, we tested Goffin's cockatoos in tasks inspired by the termite fishing of chimpanzees in the Goualougo Triangle. Goffin's cockatoos have proven to be able to flexibly use and flexibly transport a tool-set for an immediate use.

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3:01 PM

The use of tool sets in wild Goffin's cockatoos (Cacatua goffiniana)
Mark O'Hara, Berenika Mioduszewska (University of Veterinary Medicine Vienna), Roger Mundry (Georg-August-University Göttingen), Yohanna, Tri Haryoko, Rini Rachmatika, Dewi Prawiradilaga (Indonesian Institute of Sciences), Ludwig Huber, & Alice Auersperg (University of Veterinary Medicine Vienna)

Here we present our recent finding of wild Goffin's cockatoos (Cacatua goffiniana) using a set of up to three types of tools to access the embedded seed matter of a tropical fruit (Cerbera manghas). Two out of 15 individuals held in a capture-release aviary instantly and repeatedly manufactured and used tools upon the first provision of the fruit. These Goffins manufactured wooden tools using two distinct techniques (severing and splitting). The tools differed in their physical properties (sturdy, fine, medium), and each type seemingly served a specific function (wedging, piercing, extraction). Furthermore, the order of tools was flexibly adjusted to the fruit properties. Wild Goffins forage on a multitude of readily available resources and thus do not rely on tool-obtained food. Indications from free-ranging individuals and repeated observations of the two skilled tool users suggest that this behavior occurs naturally in the wild but is not a species-wide trait. This first report of a tool set in a non-primate species suggests that advanced flexible tool use may have evolved convergently. The presence of tool sets in animals distantly related to humans significantly diversifies the phylogenetic landscape of technology and might provide insights into the underlying factors promoting this skill.

Thursday

11:00 AM Choice (Chair: Lauren Guillette)

11:00 AM

A tomato a day keeps the apes at play: Gorilla food preferences across methods and seasons

Jordyn Truax, Jennifer Vonk (Oakland University), & Molly McGuire (Zoo Miami)

Understanding individual food preferences is essential to facilitate training and enrichment activities with captive animals. Traditionally, food preferences were assessed by paired forced choice tests using actual foods, but researchers have recently begun presenting images of food on touchscreens, which control for biasing factors. However, use of these methods necessitates validating whether animals see the images on the screen as representing real food items. To validate the use of touchscreens to assess food preferences in three adult male gorillas, we assessed food preferences using real food items and images on a touchscreen over a three month period and assessed the stability of these preferences using the touchscreen for an additional 17 months. Ranked food preferences were correlated across methods and across seasons. All gorillas showed a strong preference for tomatoes. In addition, we presented the gorillas with a two alternative forced choice task where we paired images of highly preferred and less preferred foods using non-differential reinforcement. Two of the three gorillas spontaneously chose images of preferred food items over images of non-preferred food items, and all three gorillas chose the preferred food images at above chance rates, suggesting that they perceived the images as representative of real foods.

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11:07 AM

Non-instrumental information-seeking in goldfish

Victor Ajuwon, Tiago Monteiro (Department of Zoology University of Oxford UK), Mark Walton (Department of Experimental Psychology University of Oxford UK), & Alex Kacelnik (Department of Zoology University of Oxford UK)

Paying a cost to reduce uncertainty can be adaptive, because better informed decision-makers can align their preferences to opportunities. However, puzzlingly, in an experimental protocol referred to as 'paradoxical' or 'suboptimal' choice, mammals and birds display an appetite for functionless (non-instrumental) information that cannot be used to modify outcomes. A question of importance for the theoretical interpretation of this phenomenon is its taxonomic ubiquity: If the same phenomenon were to be found in other distant animal lineages, this would support its interpretation as an adaptation to common characteristics of natural foraging scenarios, rather than as a maladaptive cognitive bias. Here, using a novel, closed-loop operant chamber based on real-time video tracking, we present paradoxical choice experiments exploring whether goldfish (Carassius auratus) display a preference for non-instrumental information. Fish chose between two equally profitable options delivering food probabilistically after a fixed delay. In the informative option (Info), the outcome (food/no food) was signalled immediately after choice, whereas in the non-informative option (NoInfo) outcomes were uncertain until the delay lapsed. Unlike in birds and mammals, we did not find a preference for the informative option in goldfish, raising interesting questions about the evolutionary origins of non-instrumental information value.

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11:14 AM

Influence of Increased Options on Performance Generalization Across Two Variations of the Monty Hall Dilemma

Robert Southern (Georgia Southern University), Jessica Stagner Bodily (Auburn University at Montgomery), Kent Bodily (The Learning Tree Inc.), & Lawrence Locker (Georgia Southern University)

The Monty Hall dilemma (MHD) is a probability puzzle at which humans consistently fail to adopt the optimal winning strategy. The contestant chooses between three identical doors, behind one of which is a valuable prize. Next, the host reveals that one of the unchosen doors does not contain the prize. Then the contestant is asked if they would like to switch to the remaining unopened door or stay with their original choice. Contestants that switch are twice as likely to win the prize compared to those who stay. Previous studies successfully improved performance by increasing the number of available doors. However, prior studies that examined whether this improved performance generalizes to different contexts have been inconclusive (Franko-Watkins et al., 2003; Watzek et al., 2018). To

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examine whether human performance can generalize across two computerized MHD variations, the present study explored how previous experience involving trials presented with eight options affects switching percentages in subsequent trials with three options. The results failed to replicate findings from previous studies. Implications of and explanations for this replication failure are discussed. Further exploration of the MHD is needed before definitive conclusions can be made regarding which cognitive and behavioral factors facilitate performance generalization.

11:21 AM

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Justification of Effort for Physical and Cognitive Tasks in Pigeons (Columba livia)
M.S. Murphy (Coastal Carolina University)
Justification of effort, in which there is a preference for a stimulus that a subject has worked harder for, has been demonstrated in several animal species using different techniques. Largely, the conditions differ in physical task difficulty, but existing studies do not test this effect for cognitive tasks. Initial human results suggest that there is an effort justification effect for physical tasks but no preference for cognitively difficult tasks. We will compare results in an effort justification paradigm for physical tasks (different number of pecks) and cognitive tasks (different discriminability) in pigeons.

11:35 AM # Social Learning (Chair: Lauren Guillette)

11:35 AM

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Copy, camouflage or do neither? The role of social and asocial information in nest-building decisions
Gopika Balasubramanian, Andrés Camacho-Alpízar, Connor T. Lambert, Tristan Eckersley), & Lauren M. Guillette (University of Alberta University)
Social information obtained from other individuals and asocial cues obtained directly from the environment can influence an animal's choices. How do animals evaluate and prioritize these different information sources while making decisions? Here we examined this question in the context of nest building. We tested the extent to which nest material choice was driven by a preference to camouflage the nest against a background (asocial) or match a conspecific's nest (social) in the zebra finch Taeniopygia guttata. Following an initial preference test among three differently colored materials, zebra finch pairs were given social information about nest material via conspecifics that built a nest with one of the pair's initially non-preferred colours. Later, the pairs had an opportunity to build their own nest against a colored background (asocial cue), also of an initially non-preferred color which either conflicted or agreed with the social information. We found birds that received conflicting information prioritised using social over asocial. Birds that received social and asocial in agreement however did not show an increased preference to use the socially demonstrated (also camouflaging) material. These results suggest that decisions made by nest building birds when multiple sources of information are available are likely nuanced.

11:42 AM

25

Social Hunting by Archerfish: Exploring Social Cues with a Biomimetic Robot
Michael F. Brown (Villanova University), Alexander A. Brown, Brent A. Utter, Spencer R. Folk (Lafayette College), Sara Glass, Christina Folan, Heather Hall, William McCarthy, Isabella McIlvaine, Ryan Pluck, Griffin Richards, & Nicole Xiong (Villanova University)
Archerfish (Toxidae spp.) are well known for their unusual hunting technique.They shoot jets of water at insect prey above the water surface and obtain them when they thereby fall to the water surface. Archerfish are social foragers, with individuals sometimes obtaining prey that was downed by another fish (Kleptoparasitism). We have developed and used a robotic fish, designed to swim, hunt, shoot, and appear like an archerfish, to begin analysis of the social cues involved in this aspect of hunting behavior. "Swimming" and "hunting" in the robot were distinct sets of behaviors, the latter being a deterministic sequence of stages: XY positioning, rising to the water surface, pitching, squirting, and acquiring the food. In a group of three archerfish, some cues (those centered on taking the shot at the prey) affect the behavior of the fish even when they have little or no experience with the robot and its relationship to food falling on the water surface. Following experience with the robot and its shots being followed by food on the water surface, the fish also respond to more subtle changes in the robot's behavior that occur earlier in the hunting sequence.

11:56 AM

26

Environmental effects on the expression of personality in snakes
Noam Miller, Morgan Skinner, Stefaniya Brown (Wilfrid Laurier University), & Tamara Kumpan (University of Toronto)
There is a growing body of work on personalities in animals, but less has been done to elucidate the factors that shape the expression of personality traits. We examined two factors likely to affect personality-driven differences in behavior: development and social experience. We gave 52 socially-housed eastern garter snakes (Thamnophis sirtalis) boldness and sociability assays every two months between the ages of two and eight months (4 tests). We then isolated 9 snakes for one month and re-tested them alongside size- and sex-matched conspecifics that remained group-housed. We find that weight is a better predictor of personality than age (with which it correlates). Larger snakes are bolder and are more social if they are female, but less social if male. Boldness was more consistent across development than sociability. Surprisingly, isolating snakes had no discernable effect on sociability, but did affect boldness. Isolated female snakes decreased in boldness more than group-housed snakes or males, and this effect was stronger in smaller snakes. These results demonstrate that personality, though consistent by definition, is expressed

differently across development and is affected by social (and likely other) experiences. Quantifying these effects is key to identifying the mechanisms that underlie animal personalities.

12:10 PM *Break*

12:20 PM Discrimination Learning (Chair: Lauren Guillette)

12:20 PM **A model of joint stimulus control in a timing task**
Carlos Pinto (University of Minho)
In the present work we studied how more than one stimulus can be used jointly to learn a temporal discrimination task. Fifteen pigeons learned a symbolic matching-to-sample task with three durations as samples (2, 6, and 18 s of keylight) and two colors as comparisons. A 30-s intertrial interval (ITI), illuminated with a houselight, separated the trials. Previous results suggested that both keylight and houselight could control responding. To better understand this instance of joint stimulus control, two tests were introduced. In the no-sample test, the keylight was not illuminated and the comparisons immediately followed the ITI; in the dark-ITI test, the houselight was not illuminated. Results were consistent with both stimuli controlling choice, and the more a pigeon relied on one stimulus, the less it relied on the other. We present a quantitative model of the combined effect of the two stimuli.

27

12:27 PM **Spatial behavior of pigeons with varying levels of landmark stability and predictability**
Jordan Nerz, Taryn Pittman, Sara Bond, Nate Jones, Zoe Brous, & Ken Leising (Texas Christian University)
In a feature-positive discrimination, responding to a target stimulus (A) is reinforced only when presented with a feature stimulus (X), but not when presented alone (XA+/A-). The present experiment used a spatial occasion setting procedure with pigeons to examine the ability of a feature (a diffuse background color) to modulate responding to a landmark (LM). For two of the feature-positive trial types, the feature and LM were presented simultaneously, and the LM and goal were always in the same spatial location (simultaneous/static). During other trial types, the feature preceded the presentation of the LM and the location of the LM and goal varied across trials (serial/dynamic). Responding was reinforced at the location to right or left of the landmark when presented with an occasion setter (static: +<-- WA, XB -->+, dynamic: +<--YC, ZD-->+), but not on LM-only trials. Transfer tests differentiate between how the feature supports responding to a different LM (WB, XA, YD, ZC). During training, reliable differences were found when collapsing across static and dynamic trial types, with birds' performing more accurately on simultaneous/static trials. The results of LM transfer tests will be discussed with respect to the mechanisms of occasion setting.

28

12:34 PM **Delay Length does not Alter the Nature of Learning in a Two-Response Feature-Positive Discrimination in Rats**
Sara Bond, Nate Jones, Jordan Nerz, Krista Randall, Sophia Jones, & Ken Leising (Texas Christian University)
In a typical operant feature-positive discrimination, the operant response is reinforced during the target stimulus on trials with the feature stimulus (XA+), but not on target alone trials (A-). In the current study, one response (e.g., left lever press) was reinforced on feature-positive trials (XA+) and a different response (e.g., right lever press) was reinforced on target alone trials (A+). Two groups of rats received serial presentations of the feature and target, (X→ A+), with either a 5-sec or 15-sec interval between the stimuli. A third group received simultaneous presentations of the stimuli (X:A+). All groups were also presented with A alone trials (A+). Following training, responding to X, XA, and A was examined before and after extinction of X. In the serial groups, extinction disrupted responding to XA and X, indicating direct control by X. In the simultaneous group, extinction disrupted responding to X, but not to XA, indicating that X set the occasion for responding to A. The results of direct control and occasion setting in our groups are opposite of previous literature. The difficulty of the discrimination, the dual roles of the target, and the proximity of the feature to the reinforced response will be discussed.

29

12:41 PM **Amphipod escape performance in an modified aquatic T-maze.**
Joshua Wolf, & Susan Lewis (Carroll University)
Amphipods (Gammarus pseudolimnaeus) may be a useful model for studying the navigational strategies and discrimination abilities of invertebrate species. We 3-D printed a modified T-maze to create an apparatus to study how the amphipods navigate and escape from an aversive maze. Amphipods were placed at end of the single long arm of the modified T-maze submerged in water. Because amphipods are photophobic we utilized a bright light to illuminate the entire maze and provided a small hole in one of the two short arms of the maze to allow the amphipods to swim beneath the maze and escape the aversive light stimulus. The purpose of the research was threefold. First, we wanted to determine if amphipods demonstrate a natural right/left bias when initially navigating a T-maze. Second, we wanted to find out if amphipods could learn to escape the T-maze over successive trials and days. Finally, we added visual intramaze cues to evaluate whether amphipods could discriminate between the arms and if the cues would facilitate escape performance. We evaluated escape performance by recording number of errors committed (i.e., entering the wrong arm of the maze) and latency to escape the maze.

30

12:48 PM

12:48 PM

Temporal Processes (Chair: Lauren Guillette)

Food quality affects the structure of fruit fly groups when foraging collectively

Tanya T. Shoot, Noam Y. Miller, & Tristan. A. Long (Wilfrid Laurier University)

Being part of a group has known costs and benefits. Examining the factors associated with the formation and composition of groups can help identify which benefits apply. Third instar Drosophila melanogaster fruit flies have been observed to engage in group feeding clusters, which have been shown to provide individuals within the group more access to food than when alone in harsh environments. As clustering progresses, food is broken down, making it easier to eat but degrading its nutritional value. To understand the dynamics of clustering, we manipulated the quality of available food. We tested two different resource patterns, each with two levels of food quality. Food quality was either of standard or low (50%) nutrition. Groups of 100 larvae were randomly assigned to either standard nutrition, low nutrition, or a combination of both with different spatially-layered patterns for and monitored 5-7 days later. The number of clusters, number of individuals within clusters, and the dimensions of the clusters were recorded. There was a significant effect of food quality and observation day on the number of individuals clustering and the cluster structure. These results highlight the plastic nature of this group behavioural phenotype in the face of a fluctuating environment.

31

32

12:55 PM

Plateaus of time perception in Timberlakean systems

Robert I. Bowers (Bilkent University)

There is a temporal aspect to behaviour systems models. The familiar three-mode model of rat predatory behaviour posits that rat predation involves three qualitatively distinct motivational states. These three states are distinct not only in the form of behaviours produced, but occur in bouts with different time courses as well. One remaining question concerns whether these different time courses involve corresponding levels of subjective time perception. Initial results are described of an experiment using mid-session reversal, a technique for studying temporal sensitivity in animals, while biasing expression of specific motivational states. I discuss what the presence of motivational influences on subjective time perception means for an understanding of temporal cognition.

1:02 PM   Break

1:30 PM

In Honor of the Contributions of Sally Boysen

Odor Memory in Dogs (Canis familiaris)

1:30 PM

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

This presentation focuses on a series of our studies on olfactory memory in dogs. First, we created a dog-adapted odor span task (i.e., incrementing non-matching-to-sample task) which demonstrated dogs' ability to successfully perform the task with up to 72 odors (the max tested) and actively remember up to 14 odors within a single session. Second, we developed an olfactory delayed matching-to-sample (dMTS) task and manipulated delay length (0, 30, 60, 90 s) and stimulus set (48, 6, 2 odors) to uncover the differential effects of decay and proactive interference on forgetting. These manipulations revealed a decrease in matching with delay and interference. These results will be discussed in terms of contemporary models of memory. In addition, comparison with humans and rats tested in similar conditions indicate the extent to which the underlying processes of memory are shared amongst them.

33

34

1:49 PM

Sequential and Temporal Mechanisms in Organizing Avian Behavior

Robert G. Cook (Tufts University)

Understanding the mechanisms underlying the sequential and temporal organization of behavior in animals has been a long-standing goal. Efficiently selecting among your behavioral options at any point is critical to survival across any number of time scales (minutes, days, seasons). Recent experiments with pigeons using categorical and multiple phased variations of the mid-session reversal task are reviewed in this talk. Their results are placed within the context of other discriminative approaches and representational mechanisms that might account for this type of sequential learning. The implications for the timing, ordering, and attention by animals to categorical and item-specific information is discussed.

2:08 PM

35

I'll (Not) Take That: The Reverse-Reward Contingency Task as a Test of Self-Control and Inhibition

Michael J. Beran (Georgia State University)

While searching for more evidence of quantitative skills in chimpanzees to add to what she already had found, Boysen discovered something else. When training chimpanzees to point at what they would not get, and not pointing at what they would get, none could do this for piles of food items. Even when those items in the pointed-at set were given away to another chimpanzee, and even with experience in the task, failure persisted. This test, the reverse-reward contingency test, has now been used with many species, as a means of assessing inhibitory control and perhaps self-

control in animals. Typically, the task is difficult, and only specific manipulations have worked to allow primates to overcome the reversed contingencies. This includes using symbolic stimuli, adding another layer to the story and more value to the task itself as a measure perhaps of forms of cognitive control in other species. I will discuss some of these empirical results, including from other chimpanzees who were given variations of the task.

2:27 PM

36

Use of Arabic numerals in chimpanzees: an attempt to teach up to 19 in decimal
Tetsuro Matsuzawa (California Institute of Technology), & Akiho Muramatsu (Kyoto University Institute for Advanced Studies)
The study of numbers is an important topic in animal cognition. Sally Boysen is one of the pioneers in teaching Arabic numerals to chimpanzees (Boysen & Berntson, 1989; Matsuzawa, 1985). The authors have also studied a female chimpanzee named Ai in the Ai project of Kyoto University. Ai can numerically answer the number of real objects of different types and colors and the number of dots on the touch monitor screen. She can do the task of reading numerals as well. These are the properties of numbers called "cardinal numbers". On the other hand, there is a property of numbers called "ordinal numbers". She learned the numerical sequence from 0 to 9 by introducing 0 as well. Ai gave birth in 2000. Three pairs of mothers and offspring were born in the same year. The other five chimpanzees also started with 1 and 2 and learned the numerical sequence from 1 to 9. By using it, we have tested working memory, SNARC effect, and the division of roles between two individuals. Then, we tried to teach numerals from 1 to 19 using the notation system of decimal numbers. The present study reports an overview of decimal notation learning in chimpanzees.

2:46 PM   *Break*

3:00 PM   Master Lecture & Celebration – Sally Boysen
(Comparative Cognition Project, Purdue University)

CCS Mentoring Event (Chair: Katherine Bruce)

10:00 AM

Do you have nightmares about being "Reviewer #2"?

A panel of current Editors-in-Chief will address common questions that new ad hoc reviewers have about how to write a useful review for some of our favorite journals.

This event is open to all attendees, and we especially encourage graduate students, post docs, and new lecturers and assistant professors to join us for conversation about this topic in a live zoom session. Each panelist will offer insights about effective reviewing, and then we will have breakout rooms in which you can ask specific questions about the submission and review process.

11:00 AM Ron Weisman Outstanding Student Presentation Competition (Chair: Ken Leising)

11:00 AM

37

Functional Dissociation in the Japanese Quail Hippocampal Formation

Chelsey C. Damphousse, Noam Miller, & Diano F. Marrone (Wilfrid Laurier University)

The mammalian temporal cortex can be functionally segregated into regions that encode spatial information and others that are predominantly responsible for object recognition. In the present study, we report comparable functional segregation in the avian brain. Using Japanese quail, we find that bilateral lesions of the hippocampus (Hp) produce robust deficits in performance in a foraging array (FA) spatial memory task, while sparing spontaneous object recognition (SOR). In contrast, lesions to the adjacent area parahippocampalis(APH) compromise both SOR and FA. These observations demonstrate a functional dissociation between Hp and APH that is comparable to the distinctions seen in mammals between the hippocampus and surrounding temporal cortex.

11:07 AM

38

Not in the balance: Goffin's cockatoos fail to learn a 'two-way' balance task.

Poppy Lambert (University of Veterinary Medicine Vienna), Sabine Tebbich (University of Vienna), & Alice Auersperg (University of Veterinary Medicine Vienna)

To what extent do animals understand physical causality? Balance tasks have been used to explore knowledge in human infants and chimpanzees about the effect of the object property of weight. We tested an avian species, the Goffin's cockatoo, on a novel 'two-way' balance task with weighted objects. Here the correct use of objects to access a food reward depended upon which of two windows, placed at different heights, was open: for example, if the higher window was open, the light object was the correct choice because it moved the arm the appropriate distance downwards (i.e. less far than the heavy object). Despite thorough training where birds could learn the affordances of the balance, by compressing the balance arm to the height of the two windows with their legs, they did not spontaneously solve the task with weighted objects. Furthermore, subjects did not learn to reliably solve it during the course of 100 trials. We discuss these results in light of the Goffin's cockatoo's ability to quickly learn to discriminate between objects of different weights. Our results strengthen the idea of a 'hierarchy' of weight-related information, which can (or cannot) be used and encoded by animal minds.

11:14 AM

39

Males makes more the merrier, while females feel the fewer, the better fare

Eszter Matrai, Shaw Ting Kwok, Paolo Martelli, Michael Boos (Ocean Park Hong Kong), & Ákos Pogány (Eötvös Loránd University Hungary)

Cognitive enrichments represent a special group of environmental enrichments that provide cognitive stimulations while reducing negative welfare indicators. Earlier tested two-way cooperative enrichments were found adequate for such purpose, promoting cooperation in dolphin pairs. Building on the successful use of the two-way cooperative enrichment, we designed two novel devices allowing multi-partner interactions. Two groups of dolphins were tested, a group of five adult males (male group) and a group of six females with one male calf (female group). The devices were made of PVC pipes and caps, equipped with rope handles. The three-way, T-shape device allowed simultaneous interactions for up to three dolphins; while the four-way, TT-shape device could be manipulated by up to four animals. Each device was tested on 12 trials, with both groups. Males succeeded on 20/24 trials and cooperated in pairs, trios and once even as a quartet, females succeeded on 6/24 trials, and were only recorded in pairs. These findings may reflect differences between the two sexes' disposition towards cooperation and alliance formation and are in line with our earlier findings using the two-way device. Moreover, this first successful application of multi-partner devices demonstrates the value of cognitive enrichments promoting group activities in male dolphins.

40

11:21 AM

Do sex differences in nest construction behavior relate to differences in physical cognitive abilities?

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

The study of physical cognition has long focused on tool use and folk physics, while the ecologically important behavior of nest building has been overlooked. Nest building, particularly in birds, is wide-spread, crucial to successful reproduction, and involves learning, but the relationship between nest building and physical cognition is unknown. In the laboratory we tested if nest-building ecology is related to physical cognitive abilities using zebra finches (Taeniopygia guttata). We predicted that males, which select most of the nest material and are the primary nest builders, would have enhanced physical cognitive abilities compared to females. We tested 16 male and 16 female finches, all of whom had previous nest-building experience, on three discrimination tasks: (1) length discrimination, (2) flexibility discrimination, and (3) color discrimination, using an in-cage foraging board. Contrary to our predictions, male and female zebra finches did not differ in learning speed (trials to criterion) across the three tasks. Our results suggest that sex-differentiated roles in nest building either do not relate to physical cognitive abilities or may relate to other cognitive demands more specific to building behaviour. This is the first experiment examining potential evolutionary link between nest building and physical cognition.

41

11:28 AM

Which foot to the bill?: Limb lateralization in the Goffin's cockatoo

Jennifer A. D. Colbourne (University of Veterinary Medicine Vienna), Léo Hanon (Université de Bourgogne), Irene Pepperberg (Harvard University), & Alice Auersperg (University of Veterinary Medicine Vienna)

Very few species are limb lateralized to the same degree as human handedness. Yet nearly every species of cockatoo shows extreme levels of "footedness," with most members exhibiting a consistent preference for the use of the left foot when feeding. In our sample of nine Goffin's cockatoos (Cacatua goffiniana), we investigated whether tasks with different physical requirements and cognitive complexity affected footedness. In line with previous research, we found in our baseline task that 86% of the Goffin's cockatoos were left-footed when holding and consuming a food item. The subjects were subsequently given simple and complex versions of a food extraction task, a string-pulling task and a reaching task. Our results indicate that posture may be the most influential factor affecting foot use, as most of the cockatoos changed from their dominant preferred foot in both reaching tasks, which necessitated balancing on one foot, including the right-footed cockatoos. We discuss these findings in light of the predictions made by MacNeilage's postural origins hypothesis and Roger's enhanced cognition hypothesis.

42

11:35 AM

The connection between vocal harmonics, octave equivalence, and consonance preference

Bernhard Wagner (Acoustics Research Institute of the Austrian Academy of Sciences), Daniel L. Bowling (Stanford), & Marisa Hoeschele (Acoustics Research Institute of the Austrian Academy of Sciences)

Most sounds that animals produce are harmonic sounds, meaning they feature overtones occuring at integer multiples of the fundamental frequency. The structure of this "harmonic series" prominently features "consonant" (i.e. pleasant) musical intervals. The doubling in frequency between fundamental frequency and first overtone constitutes an "octave" - the most consonant interval. Notes separated by an octave are at times treated as identical by humans, a phenomenon referred to as "octave equivalence". The harmonic series has therefore been hypothesized to be a biological basis for preference to musical consonance and octave equivalence. I will present results from cross-species research with humans and budgerigars, finding that budgerigars neither perceive octave equivalence nor prefer musical consonance. This is in line with the hypothesis suggesting a connection between those phenomena and the harmonic series, because in budgerigars vocal harmonics are obscured compared to humans. Our results, in combination with a review of existing research, suggest a more complex interplay of factors accounting for consonance preference and octave equivalence. I conclude with an outlook on future prospects for cross-species studies on consonance and octave equivalence.

43

11:42 AM

Having a ball (python): Social behavior in non-social snakes

Morgan Skinner, & Noam Miller (Wilfrid Laurier University)

Testing personality across species can provide important insights into the evolution of behavior. We examined sociability and boldness in ball pythons (Python regius; n=12). As ball pythons are commonly considered non-social, we hypothesized that they would demonstrate consistency in boldness but would largely avoid social contact. To assess personality, we tested for consistency in sociability and boldness across two contexts (group and individual). For the group context, 2 separate groups of 6 snakes were placed into a large arena for 7 days. The arena contained 6 shelters, and a camera mounted above the arena took pictures every 5 seconds for the duration of the experiment. We quantified sociability as 'time spent with other snakes' (i.e., the social network measure 'weighted degree'), and we quantified boldness as time spent outside the shelters. For the individual context, we tested snakes alone for consistency in preferences for a shelter that smelled like conspecifics versus a control shelter (i.e, sociability), and for time spent outside a shelter in an otherwise empty arena (i.e., boldness). Contrary to our hypothesis, we found that ball pythons are social and show consistency in both sociability and boldness within a context but not across contexts.

11:49 AM

44

Impact of Value and Familiarity on Dog's Food Preferences

Madeline H. Pelgrim (Brown University), Julia Espinosa (University of Toronto), & Daphna Buchsbaum (Brown University)

How do dogs form preferences and make decisions? The present study explores two potential contributing item characteristics, familiarity and value. Dogs are more willing to work for a food item they value more, and when choosing between toys of equal value, dogs tend to prefer the novel item. However, the interaction between familiarity and valuation as they relate to object choice is currently unclear. We aim to explore how item familiarity and item value intersect to form dogs' preferences for one food over another in a two-alternative forced choice task. Dogs (N = 36) are presented with a total of four distinct food items (high value familiar & unfamiliar; low value familiar & unfamiliar) across six possible pairings, allowing for the exploration of the impact of familiarity and value in isolation, as well as their combined impacts (i.e., if dogs are willing to take a risk on a novel food when the alternative is of low value). Data collection is through zoom with owners acting as experimenters, and all participating dogs previously completed an initial baseline visit using a two-alternative forced choice task between a treat and an empty plate, also conducted over zoom. Data collection is ongoing.

11:56 AM

45

Learning about construction behaviour from observing an artefact

Andrés Camacho-Alpízar, Tristan Eckersley, Connor T. Lambert, Gopika Balasubramanian, & Lauren M. Guillette (Department of Psychology – University of Alberta)

The enduring products of behaviour, called 'artefacts' (e.g., a bird nest) are a potential source of social information. To learn from an artefact, an individual must first recognize an item as an object that can provide relevant information (i.e., the artefact should be recognized as a nest). Using zebra finches Taeniopygia guttata we examined whether observing a conspecific using a nest facilitates future recognition of a nest as a source of social information. Half of the subjects observed a pair incubating eggs in a nest, while half did not get this opportunity. All subjects then observed an unoccupied nest (the artefact) of their non-preferred colour material after which they built their first nest. As predicted, birds that observed conspecifics nesting used information from the artefact by increasing their use of the artefact-material colour in their nest building. This was not true for control birds. Our data show that observing conspecifics and their nest facilitates information use from a future artefact, affecting how first-time builders use social information. Social learning is not limited to observing behaviour, but also gathering information from an artefact of behavior.

12:05 PM *Break*

12:15 PM Memory (Chair: Ken Leising)

12:15 PM

46

Effects of Picture Valence on Serial Pattern Learning in Humans

Shannon M. A. Kundey (Hood College)

Comparative work to date has explored humans' and nonhuman animals' sensitivity to sequence structure, usually under conditions attempting to maximize learning. However, conditions in organism's everyday life may not match these ideal circumstances. Thus, organisms must detect and learn about events' sequencing even when distractions or threats are present. Irrelevant information can decrease sequence learning in both humans and rats (e.g., Hersh, 1974; Kundey & Fountain, 2011; Kundey, De Los Reyes, & Taglang, 2011). Additionally, perception of threat or heightened anxiety can interfere with learning and performance (e.g., Hodges & Spielberger, 1969; Straughan & Dufort, 1969; Mueller, 1976; Mathews & MacLeod, 1986; Johns, Inzlicht, & Schmader, 2008). Tasks involving explicit learning seem to be more susceptible to such disruption (e.g., Rathus, Reber, Manza, & Kushner, 1994; McDowell & Allison, 1995). In two experiments, we investigated college students' pattern learning while they were exposed to emotionally-valenced pictures. Brief exposure to negatively-valenced pictures decreased patterned sequence learning relative to brief presentation of positively-valenced pictures or a control condition in which no pictures were presented. This suggests the process needed for pattern learning was disrupted by the negatively-valenced information and that this process is explicit.

12:22 PM

47

Novel Object Recognition Memory in North American River Otters (Lontra canadensis)

Jessica Wegman, Hunter Ansari, Kelsey Beers, Kera Hampton (Rochester Institute of Technology), Catina Wright, Brian Sheets, Danielle Newport (Seneca Park Zoo), & Caroline DeLong (Rochester Institute of Technology)

Memory is a critical ability for many cognitive functions, though little research has investigated any kind of memory in any otter species. Object recognition memory has been investigated in a variety of non-human animals using the novel object recognition (NOR) task. This study was the first to investigate long-term object recognition memory in North American river otters using the NOR task. We studied three memory intervals (10 minutes, 1 hour, and 24 hours) with an adult male otter residing at the Seneca Park Zoo. The multimodal stimuli contained both visual and olfactory aspects since both are frequently used by wild otters. Video recordings were taken of all familiarization and test trials and viewed by three independent coders (r > .80). The otter spent time near and interacted with (touched) the stimuli primarily in the first five minutes of the familiarization trials. Based on these findings, the video coding and analyses for the test trials were restricted to the first five minutes. Video coding of the test trials is underway.

This research adds to our limited knowledge of memory and cognition in otters, and contributes to otter enrichment for those residing in zoos and aquariums and conservation efforts for this species.

12:29 PM

Episodic Memory Impairment Following Mild Traumatic Brain Injury
Gabriel Nah, Mira N. Antonopoulos, Nicholas Port, & Jonathon D. Crystal (Indiana University)
Mild traumatic brain injury (mTBI) is the most common type of traumatic brain injury, and it leads to temporary memory impairment and an excitotoxic response in the brain. While many animal models of mTBI exist, it is difficult to fully replicate the injury seen in humans, and the effects of mTBI on the microenvironments of the brain are unclear. Notably, the Wayne State modified weight drop model recapitulates key elements of a sport-related injury, as well as the excitotoxic response in the hippocampus. Yet, this model has not previously been evaluated using a complex memory task. Here, rats were trained in an odor-based item-in-context task that dissociates episodic and non-episodic memory (Panoz-Brown et al., Current Biology, 2016). The animals then underwent either a weight drop or sham. After the manipulation, animals were assessed in the item-in-context task. Episodic memory was significantly impaired in the injured rats, but not in the sham rats. Non-episodic memory was not impaired in either group. Additionally, immunohistochemical analysis of the hippocampus documented morphological changes in astrocytes and microglia in injured rats compared to sham rats. This study is the first to document episodic memory impairment in an animal model of mTBI.

12:36 PM

Episodic-like Memory in Rats in the Odor Span Task: Context and Consequence as Cues
Katherine Bruce, Hawken V. Hass, Emily Burrell, Mary Catherine Weeks, Jordan Clemmons, Sophie Shea, Rebeka Barba, Amanda Burke, & Mark Galizio (University of North Carolina at Wilmington)
The Odor Span Task (OST) has been used to study both working and episodic-like memory in rats. We used two procedural variations of the OST to examine episodic-like memory in rats. In the OST, selection of a session-novel odor results in reinforcement, but odors are not reinforced on subsequent presentations. In the Consequence variation, a different odor was designated each day as a replenishing odor, while the other OST odors did not replenish after their first presentations. Selection of the replenishing odor was reinforced with a berry-flavored pellet, while other odors were baited with sucrose pellets. Four rats remembered which odor was associated with berry (what consequence) each day (when). In the Context variation (cf. Panoz-Brown et al., 2016), three rats were trained on the OST in two distinct apparatuses each day; selection of context-novel odors resulted in reinforcement. Six daily probe tests after two context transitions indicated above chance performance even controlling for familiarity cues. These data further support the OST as a procedure that is effective for investigating episodic-like remembering in laboratory rats. Such animal models have clinical implications for developing treatments for disorders characterized by loss of episodic remembering, such as Alzheimer's disease.

12:50 PM

Cryptographic-like mechanism underlies caching and retrieval behaviors in animals
Oren Forkosh (Hebrew University)
The brain's extraordinary abilities are often associated with its ability to learn and to adapt. But memory has its limitations, especially when faced with the task of retrieving tens or even hundreds of thousands of cached food items annually - such as in the case of scatter-hoarding animals. Here, we present a brain mechanism that works by utilizing cryptographic principles in lieu of plasticity. Rather than memorizing their cache locations as previously suggested, we propose that cache-hoarding animals use a single cryptographic-like mechanism during both caching and retrieval. The model we developed is similar to hippocampal spatial cells, which respond to an animal's positional attention, such as when the animal enters a specific region (place-cells) or gazes at a particular location (spatial-view-cells). We know that the region that activates each spatial cell remains consistent across subsequent visits to the same area but not between areas. This remapping, combined with the uniqueness of cognitive maps, produces a persistent crypto-hash function for both food caching and retrieval. We further show that the model can maintain temporal information that might help animals prioritize food items that are perishable or according to their nutritional value.

1:04 PM *Break*

1:14 PM Associative Processes (Chair: Ken Leising)

1:14 PM

The number sense of animals: Associative or computational mechanisms?
Catarina Soares (University of Minho), Armando Machado, & Marco Vasconcelos (University of Aveiro)
Humans and other animals may share a primitive number sense. A lingering question is whether simple associative processes suffice to account for the main behavioral properties of the number sense, or more complex, computational processes are called for. To address the issue, we tested pigeons in a Number-Left Task. After producing x light flashes, pigeons had to choose between two options: a standard option (S), in which a fixed additional number of flashes had to be produced to receive reinforcement and, a number-left option (NL), in which the additional number of flashes required to reinforcement varied inversely as a function of x. We asked whether pigeons would choose optimally – the standard option whenever S<NL, and the number-left whenever NL<S. To dissociate different mechanisms of numerosity discrimination, one group of pigeons was trained with all possible values of x whereas

the other was trained only with the two extreme values. Then, both groups were tested on generalization probe trials: rewarded for the first group and unrewarded for the second. Pigeons' preference for the number-left option increased as x increased and indifference occurred slightly before S=NL, indicating a small but consistent bias for the number-left option.

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1:21 PM

Extrinsic Reward Enhances Intrinsically Motivated Lever Pressing in Rats

Ken Leising, Sara Bond, Tanner Raab, Marisa Melo, & Jordan Nerz (Texas Christian University)

Intrinsically motivated behavior is not followed by any apparent reinforcer, whereas extrinsically motivated behavior is followed by a separate, observable reinforcer. The overjustification hypothesis states that after engaging in a behavior paired with an extrinsic reinforcer, there will be a reduction in intrinsically motivated behavior. The current studies examined whether the overjustification effect occurred with lever pressing in rats. Lever pressing without a reinforcer (intrinsically motivated) was measured in Phase 1 and 3. In Phase 2, Reinforcement was delivered after a lever press for one group. In Experiment 1, extrinsic reinforcement elevated lever pressing initially but resulted in a floor effect during subsequent sessions. In Experiment 2, all lever presses were followed by the illumination of a light, and in Phase 2 the number of extrinsic reinforcers was reduced. Overall lever press rates increased, but rats in the extrinsic group lever pressed at the same rate as control rats. In Experiment 3, the number of extrinsic reinforcers was increased. The extrinsic reinforcement group emitted more lever presses initially and stabilized at a higher rate than the control group. The overjustification effect was not observed in any experiment.

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1:35 PM

Evolving Memory: From Simple Foraging Associations to Cognitive Map Construction

Ekaterina Gribkova, & Rhanor Gillette (University of Illinois at Urbana-Champaign)

Cognitive mapping builds internal representations of the world and is essential to episodic memory and mental imagery. Here we show how circuitry of basic foraging decision can be straightforwardly expanded for affective valuation and cognitive map construction in the agent-based foraging simulation, ASIMOV, reproducing potential evolution. Behavioral choice in foraging is governed by reward learning and motivation, which interact to assign subjective value to sensory stimuli. These qualities characterize foraging generalists that hunt in variable environments and are precursors to more complex memory systems. ASIMOV's core decision network is based on neuronal circuitry of cost-benefit decision in the predatory sea-slug Pleurobranchaea californica. ASIMOV's virtual forager affectively integrates sensation (olfaction, nociception), motivation (hunger), and learning to make cost-benefit decisions for approach or avoidance of prey. We developed a Feature Association Matrix (FAM) for simple cognitive mapping in ASIMOV. Sequence memorization is achieved by chaining pair-wise associations made through simple higher-order conditioning mechanisms. Spatial learning for obstacles and distant landmarks is enabled by a simple path integration system with homeostatic plasticity mechanisms. Addition of the FAM's spatial and episodic memory to ASIMOV's forager shows how the neuronal circuitry of foraging decision can serve as the framework for cognitive mapping in evolution.

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1:49 PM

Spatial Cognition (Chair: Ken Leising)

1:49 PM

The influence of head-posture on three-dimensions spatial orientation

Zohar Hagbi, & David Eilam (Tel-Aviv University)

Rodents from different habitats cope with three-dimensional structures that may impact their spatial behavior (slopes, branches, rocks, etc.). To find how they do that they were tested in three-dimensional laboratory apparatuses. On a multilayer pyramid, rodents displayed characteristic spatiotemporal organization of behavior as seen on horizontal surfaces, perhaps since they could maintain a natural head posture (parallel to substrate, perpendicular to gravity). Nevertheless, rodents living in flatlands favored to travel on the floor or the lower pyramid levels whereas those living in structured habitats traveled on higher pyramid levels, hardly reaching the floor. Then, rodents from different habitats were tested on a flat surface tilted in seven different inclinations between 0° to 90° degrees. As happened on the pyramid, the rodents preserved the typical spatiotemporal structure as seen in two-dimension horizontal surfaces; however, the distribution of activity was significantly altered. On steep inclinations, rodents shift to traveling mainly up and down or sideways (horizontally) at the bottom of the tilted surface. They hardly traveled diagonally up or down the slope while attempting of the rodents to level their head parallel to the ground (and perpendicular to gravity); a dynamic posture that seems a prerequisite for spatial orientation and environment perception.

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1:56 PM

Detour Learning on a Tree in Nocturnal Bull Ants, Myrmecia midas

Muzahid Islam, Sudhakar Deeti (Macquarie University Sydney), Zakia Mahmudah (University of New South Wales), J. Frances Kamhi (Oberlin College), & Ken Cheng (Macquarie University Sydney)

Many animals navigate in a structurally complex environment that requires them occasionally to detour around physical barriers that they encounter. We investigated detour learning in the nocturnal Australian bull ant, Myrmecia midas, which primarily uses visual landmarks in navigation. We first placed a barrier on the ants' foraging tree, which they ascended each night. Initially, 46% of foragers were unsuccessful in detouring the obstacle. In subsequent trips, the ants became more successful and eventually established a new route. We then tested trained foragers in a series of manipulations including changing the position of the barrier, making a gap in the middle of the obstacle, or removing the barrier altogether. The ants mostly showed the same learned motor routine, detouring with a similar

path as in training trials, suggesting that foragers were not relying on barrier cues and had therefore learned a new route around the obstacle. In additional tests, when new olfactory or tactile cues were presented or when the visual environment was blocked, the foragers' navigation was profoundly disrupted. These results suggest that changing sensory information drastically affects the bull ants' route behavior.

2:10 PM *Break*

2:20 PM Attention (Chair: Ken Leising)

Attention bias to threat in capuchin monkeys?

2:20 PM

Olivia T. Reilly (Department of Psychology and Language Research Center Georgia State University), & Sarah F. Brosnan (Department of Psychology Language Research Center and Neuroscience Institute Center for Behavioral Neuroscience Georgia State University)

Reacting rapidly to threats in the social environment is a response that has evolved throughout the primate taxa. However, the degree to which individuals respond to such threats may differ. We investigated whether capuchin monkeys showed differential attentional biases toward social and nonsocial threatening stimuli when paired with neutral stimuli. We measured the response times of 20 capuchin monkeys (7 males, 13 females) to reach a target that appeared in a position that was either congruent or incongruent to a threatening stimulus when paired with a neutral stimulus on a computerized dot probe task. Categories of stimuli were familiar capuchin faces, unfamiliar capuchin faces, familiar objects, and unfamiliar objects. Stimuli from these categories were presented in three trial types: congruent, incongruent, or neutral (in which no threatening stimuli were present). Subjects completed 60 trials from each category for a total of 480 trials. Results showed variation in individual response times, but we found no evidence of an attentional bias toward threat in any category. Future work should explore the mechanisms driving this variation in response time, such as the influence of cortisol on the threat response.

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2:27 PM **Effects of delay and category change on pigeons' ability to detect changes in a visual discrimination task**

Adam Davila, Jordan. G. Smith, Emma Cox, & Jeffrey Katz (Auburn University)

We tested three pigeons on a change detection task to determine whether hallmarks of human change detection are present in pigeons. Humans show increased accuracy in detecting changes between categories as opposed to within, such that changes are easier to detect when they are between categories. Pigeons learned a simple within category change detection discrimination, where a display of either one, two, or three items was presented, followed by a single item that was either part of that display or not. After reaching criterion, pigeons were tested with between and within category changes within the same session over several sessions. Pigeons showed an advantage for between category over within category changes. Further, session one between category discriminations were significantly more accurate than on later sessions. This suggests increased attention to new pairings influenced change detection. A follow-up experiment added a series of probe delays (e.g., 100ms, 400ms, 1600ms, and 6400ms). During variable probe delay sessions, within category changes were harder to detect than between category changes for all but the longest delay. Mechanisms of pigeon change detection (e.g., attention and perception) will be discussed. Pigeons, like humans, are better able to detect between category changes than within category changes.

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2:34 PM **Gaze cueing effect in pigeons (Columba livia)**

Daisuke Nakauchi, Tomokazu Ushitani, & Arii Watanabe (Chiba University)

Being sensitive to conspecific's gaze direction is a useful ability, not only when interacting with others but also when foraging and avoiding danger. Therefore, orienting to other's gaze direction may be a shared response in species with and without complex sociality. Here, we investigated whether pigeons' attention can be captured by conspecific's head and body direction by using a Posner-like paradigm where the subjects were reinforced for responding to the target stimulus. In experiment 1, we tested pigeons with pictures of conspecifics facing towards the target (congruent condition) or away from it (incongruent condition). There were no differences in response times between the two conditions when they were presented at equal frequencies. However, when we manipulated the frequencies, 3 out of 4 pigeons' reaction times became significantly shorter in the more frequent condition, suggesting that the pigeons learned to use conspecifics' gaze direction as a cue for target location. In experiment 2, we replaced conspecific pictures with non-social cues and showed that such learning did not occur under this context. We conclude that, despite the lack spontaneous responding to conspecifics' gaze direction, pigeons have a predisposition to learn socially significant cues.

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2:41 PM **Attention to delay: Response contingency effects on impulsive decision-making**

Travis Smith (Kansas State University), Anderson Fitch (University of Florida), Aubrey Deavours, & Kimberly Kirkpatrick (Kansas State University)

Impulsive choice is a preference for a smaller-sooner (SS) reward over a larger-later (LL) reward. Behavioral interventions to improve self-control involve experience with fixed-interval (FI) or fixed-time (FT) schedules of reinforcement. The FT schedule delivers reward automatically, whereas the FI schedule includes a response

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contingency. The present study compared the effects of FI and FT schedules in interventions and impulsive choice tasks to evaluate effects on self-control and timing behavior. The impulsive choice task evaluated preference for an LL option (2 pellets after 30 s delay) and an SS option (1 pellet after 10, 15, 20, 25, and 30 s delay, increasing across 2-session blocks). The intervention task included forced choice SS (1 pellet after 10 s) and LL (2 pellets after 30 s) sessions under FI or FT schedules. FI schedules produced greater sensitivity to SS delay in the impulsive choice task. Both FI and FT interventions improved self-control. Following choice testing, temporal discrimination was evaluated and the FT choice and FT intervention group showed the worst temporal discrimination. Overall, the FI contingency appeared to better engage temporal attention, but both FI and FT interventions increased the willingness to wait for an LL reward.

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Stagewise multidimensional discrimination of compound visual stimuli by sorting out dimensions in pigeons.
Olga V. Vyazovska (V.N. Karazin Kharkiv National University)
Pigeons (Columba livia) were trained on a stagewise go/no-go visual discrimination task. 16 compound stimuli were created from all possible combinations of two stimulus values from four separable visual dimensions: shape (circle/square), size (large/small), line orientation (horizontal/vertical), and brightness (dark/light). Starting with 1 S and 1 S- that differed in all 4 dimensional values, in later steps, we added one by one S-s stimuli by sorting out all 4 dimensions. When pigeons clearly have shown attending to each of four dimensions we presented all 16 stimuli. In this last stage pigeons rejected correctly most of S- stimuli at once. Thus, to discriminate 16 unique multidimensional stimuli it was not necessary to learn all of them as compound stimuli. However, in such approach learned 4 dimensions did not give fully comprehensive information about all unique new compound stimuli presented in the last stage. Mistakes were associated with similarity to S+ (most pigeons confused S- stimuli shared 3 (some 2) dimensions with S+). Moreover, knowledge of the first learned dimension of compound stimuli was less reliable than dimensions learned in the later stages.

3:09 PM

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Control of Attention in Rhesus Monkeys Measured Using a Flanker Task
Robert Hampton., & T.C. Hassett (Emory University)
Multiple processes determine whether information we encounter is attended to or ignored. Attentional capture occurs when attention is drawn automatically by "bottom up" processes to distinctive, salient, rewarding, or unexpected stimuli when they enter our sensory field. "Top down" attentional control can direct cognitive processing towards goal-relevant targets. Attentional control is measured using tasks that require subjects to selectively attend to goal-relevant stimuli in the face of distractions. We describe four experiments in which we systematically assessed attentional control in rhesus monkeys using a flanker task. In Experiment 1, monkeys responded according to the identity of a central target, and accuracy and latency varied systematically with manipulations of flanking stimuli. We then tested for converging evidence of attentional control across three experiments in which flanker performance was modulated by the distance separating targets from flankers (Experiment 2), luminance differences (Experiment 3), and differences in associative value (Experiment 4). The approach described is a reliable measure of attentional control in rhesus monkeys that can be applied to a wide range of situations with freely behaving animals.

10:00 AM Undergraduate Engagement Session: Graduate School Panel (Chair: Reggie Gazes)

11:00 AM CCS Business Meeting

12:15 PM Replicability Symposium (Chair: Noam Miller)

The crisis isn't coming

12:15 PM *Charles Beasley (London School of Economics and Political Science; department of Philosophy Logic and Scientific Method)*

Is comparative psychology on the brink of a replication crisis? In this talk I will argue no. In showing why, I will take a recent replication study on scrub jay theory of mind by Amadio et al. (2021) as my organizing example to put forward a novel account of what a replication is, its relationship to reliability assessments, and the conditions for the possibility of a replication crisis. I will argue that replications are experiments and that we should evaluate them in terms of their validity. Assuming that the validity of first order experiments can come in degrees, replications should also be seen as having degrees of validity. In doing so, I model replications along four dimensions: (1) 'With what degree of certainty is the phenomenon under investigation characterized and individuated?', (2) 'With what degree of certainty is the target experiment characterized and individuated?', (3) 'What is the goal of performing the replication?', (4) What are the criteria for relevant similarity between the causal structure of the replication experiment and its target? By adopting a multidimensional approach to replication that centers uncertainty I will argue that any talk of a crisis is premature.

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"Multiversing in Comparative Cognition"

12:34 PM *Konstantinos Voudouris (Department of Psychology University of Cambridge)*

A lack of transparency in data-collection and statistical decision-making has been argued to be a key causal factor of Replication Crises in several sciences, including comparative cognition. Some methodologists have recently called for researchers to present a multiverse of potential datasets and analyses to increase transparency. Multiversing generates several datasets using different arbitrary inclusion and exclusion criteria and covariates, with the same statistical procedure applied to all of them. Similar results across a range of arbitrary assumptions lend greater credence to interpretations, since they suggest that the results aren't simply an artefact of a single researcher-selected analysis path, or worse, due to p-hacking. However, it is often unclear what counts as an arbitrary decision, leading to calls to temper the use of multiversing. In this talk, I argue that this problem is especially acute in the case of comparative cognition. However, I then appeal to recent arguments made by philosophers of science to overcome these concerns. Even when there is uncertainty about what should be included in the multiverse, exploring several possible analysis paths is still more fruitful than performing just a single analysis. It could also potentially ameliorate the issues that arise where we have limited theoretical guidance.

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Doing Reliable Research in Comparative Cognition: Challenges and Proposals for Improvement

12:53 PM *Emma C Tecwyn (Birmingham City University UK)*

Unlike some other areas of psychology that have experienced a 'reproducibility crisis', the extent to which research findings in comparative cognition are reliable is only just coming under the spotlight. I will briefly introduce concerns regarding the reliability of research findings in psychology more broadly, before outlining where we as a field stand. I will highlight some unique features of comparative cognition research that may give cause for concern, including issues related to task design, data collection and analysis and comparing across testing sites. I will then suggest ways in which we as comparative cognition researchers might improve our practices, through replication of previous studies, careful design of new studies, more considered reporting of our findings, and engagement with open and collaborative science practices. Finally, I will highlight the crucial role of institutions and gatekeepers in facilitating necessary structural change. I argue that by reflecting on our current approach to research, acknowledging the potential for reliability issues, and being willing to take steps to improve our practices, we are more likely to succeed in our quest to understand animal cognition — and crucially, we can have more confidence that our findings and the resultant claims we make are reliable.

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1:12 PM

Big Team Science in Comparative Cognition
Julia Espinosa (University of Toronto)
Two central challenges to the field of comparative cognition are the common reliance on small sample sizes and the use of idiosyncratic methodologies across experiments. These factors attenuate the impact of findings by curtailing between-study and species comparisons. They also keep conclusions speculative due to the lack of generalizability to the greater population from so few data points. Often, these limitations result from practical constraints not directly under the researcher's control, such as the time-intensiveness of behavioral research, access to limited numbers of subjects, and adapting a paradigm to fit a new species. In my talk I will present one method of overcoming these obstacles, which involves adopting the big team science approach by uniting researchers in common, open-science projects. I will illustrate this approach via ManyDogs – a multi-lab consortium of canine research I co-founded. ManyDogs unites geographically distant, diverse researchers into a unified field of canine scientists, cooperatively promoting the use of open science tools such as pre-registration, publicly available data, and open-access publishing, setting up a high level of scientific rigor in an evolving field. I will conclude by reflecting on advantages and challenges of big team science in the broader context of comparative cognition.

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1:31 PM   *Break*

1:41 PM   Animal Emotions (Chair: Noam Miller)

1:41 PM

New Caledonian Crows are optimistic after using tools
Dakota E. McCoy (Stanford University), Martina Schiestl (University of Auckland and Max Planck Institute for the Science of Human History), Patrick Neilands, Rebecca Hassall (University of Auckland), Russell D. Gray (University of Auckland and Max Planck Institute for the Science of Human History), & Alex H. Taylor (University of Auckland)
What makes animals happy? In humans, many adaptive behaviours are reinforced not only by material reward but also by positive emotions. For decades, scientists have wondered whether animals also experience positive emotions during complex behaviors. Work to date on animal optimism, as an indicator of positive affect, has generally focused on how animals react to changes in their circumstances (e.g., receiving enrichment or being manipulated), rather than whether complex actions improve emotional state. Here, we show that wild New Caledonian crows are optimistic after tool use, a complex, species-specific behaviour. Optimism is an indicator of positive mood; in other words, crows appear to enjoy using tools. We further demonstrate that this finding cannot be explained by the crows needing to put more effort into gaining food. Therefore, perhaps intrinsic motivation (enjoyment) shapes the evolution of tool use and other complex behaviours.

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1:48 PM

Development of attachment bonds in dogs
Emma Cox (Auburn University Department of Psychology), Lucia Lazarowski (Auburn University's Canine Performance Sciences), Jordan Gillespie Smith (Auburn University Department of Psychology), Lyndsey Elrod (Auburn University's Canine Performance Sciences), Jordan Reckmack (Auburn University Department of Psychology), Kelsey Mitchell (George Mason University College of Science), Gopikrishna Deshpande (Auburn University College of Engineering), Frank Krueger (George Mason University College of Science), & Jeffrey Katz (Auburn University Department of Psychology)
Investigations of attachment in dogs has predominantly focused on long-term pre-established bonds such as the pet-owner relationship. However, the development of new attachment bonds between dogs and humans remains relatively unexplored. The current study evaluated the formation and stability of attachment bonds over an extended period of time. Dogs (n = 19) were assigned a human partner to interact with during one-hour bonding sessions that occurred three times per week for a period of four weeks. Prior to the first bonding session and following the last bonding session, dogs and their human partners participated in a Secure Base Test and a Paired Attachment Test to assess attachment style of each dog towards their human partner, as well as preference for their partner versus an unfamiliar individual. Dogs displayed a variety of attachment styles, with some dogs' attachment styles remaining stable across bonding duration and others' changing following the bonding period. Additionally, after the bonding phase dogs showed a preference for proximity and interaction with an unfamiliar person versus the bonded partner, perhaps as a result of dogs' neophilia and/or hyper-sociability towards humans.

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1:55 PM

A Rich View of Affiliation Using Multiple Measures: Which Dolphins are "Friends"?
Wendi Fellner (Disney's The Seas), Heidi E. Harley (New College of Florida Disney's The Seas), & Barbara A. Losch (Disney's The Seas)
For social species, the ability to form appropriate bonds is central to survival for multiple reasons, e.g., mate selection, reproduction, predator avoidance, enhanced foraging success. Within the fission-fusion society of bottlenose dolphins, males often form close associations, sometimes lifelong, with another male, a benefit correlated with larger spatial ranges. Studying the details of behavior between these bonded pairs in the wild can be difficult given limited access, and understanding bonded partnerships in aquarium settings gives us information about animals' wellbeing.

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Here we assessed affiliation between four male bottlenose dolphins (Tursiops truncatus) at The Seas across 16 years by using several indices of dyadic interactions based on frequency of association and synchronous movement, symmetry of seeking to be in the same location, tenor as a ratio of positive and negative interactions, stability, and the frequency of receiving rake marks from a conspecifics' teeth. Multiple measures revealed that one pair had a strong association along several dimensions, another individual was moderately affiliated with both members of the bonded pair, and the last individual had more casual associations that varied between the other members of the group. Using multiple measures gives a richer understanding of affiliation than any single measure alone.

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Pet-directed speech attracts horses' attention more than adult-directed speech on video-projections

Plotine Jardat, Ludovic Calandreau, Vitor Ferreira, Chloé Gouyet, Céline Parias, Fabrice Reigner, & Léa Lansade (University of Tours- Nouzilly France)

Studying the human-animal relationship allows to better understand how our behaviour can influence the one of animals. For example, it has been revealed that horses have exceptional sociocognitive skills toward humans. They perceive our emotions and they can detect our intentions. Recently, we showed that horses also respond to a kind of speech used to talk to companion animals, called pet-directed speech (PDS). Indeed, horses reacted more positively when an experimenter talked to them in PDS compared to adult-directed speech (ADS). Nevertheless, the mechanism underlying this response is still unexplored. In this study, we showed horses videos of humans using these two types of speech in order to determine whether PDS draws horses' attention and arouses them, or if it helps to place them in a more positive emotional state. Horses showed higher attention and a greater increase in heart rate during PDS. However, their emotional expressions did not reveal a more positive state during PDS than ADS. We conclude that PDS improves horses' attention toward humans and arouses them, so that this type of speech can be used by horsemen and horsewomen. Moreover, these results confirm that video projections can be used to study horses' perception of humans.

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Bonobos' (Pan paniscus) and chimpanzees' (Pan troglodytes) understanding of, and pupillary responses to, others' needs

Christopher Krupenye (Durham University), Moritz Köster (Universität Regensburg), & Zanna Clay (Durham University)

Humans are uniquely impressive cooperators, and yet it remains unclear exactly which cognitive and motivational mechanisms set human cooperation apart. Our closest relatives, bonobos and chimpanzees, have also demonstrated a range of prosocial tendencies across experimental and observational contexts. Critically, however, we do not yet know whether their helping behavior, like that of humans, is motivated by an acute sensitivity to others' needs. We investigated this question in a novel eye-tracking task, with a large sample of captive chimpanzees and bonobos. While their gaze and pupils were tracked, apes viewed controlled videos of an agent reaching toward objects that ultimately would or would not be attainable without help. If apes are acutely sensitive to others' needs, we predicted that they would show greater pupil dilation (arousal) when the agent could not complete a goal on his own. Our findings shed light on the mechanistic and evolutionary bases of human social cognition, prosociality, and empathy.

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Emotional reactivity of dogs measured with heart-rate variability and behavior relates to dog-owner relationship and owner interpretation

Sanni Somppi (University of Helsinki), Heini Törnqvist (University of Jyväskylä), Aija Koskela (University of Helsinki), Antti Vehkaoja (Tampere University), Katriina Tiira (University of Helsinki), Heli Väätäjä (Lapland University of Applied Sciences), Veikko Surakka (Tampere University), Outi Vainio (University of Helsinki), & Miiamaaria V. Kujala (University of Jyväskylä)

Do dog owners influence the reactivity of their dogs? We examined the association of dog-owner relationship on dog emotional reactivity from three aspects: heart rate variability (HRV), behavioral changes (video recordings and physical activity level) and dog owner interpretations. 29 adult dogs encountered five emotional situations with their owners: stroking, a feeding toy, separation, reunion, a sudden object. Both negative and positive situations provoked signs of increased arousal in dogs. During negative situations, owners scored the dogs' arousal higher while HRV decreased, physical activity increased, and dogs exhibited behaviors that typically index arousal and fear. Dog-owner relationship related to the dog HRV depending on the aspect of the relationship. Emotional Closeness of dogs and owners was related to dogs' increased HRV (i.e. lower arousal), suggesting its association with secure base effect. Shared Activities factor showed a trend toward lower HRV and more owner-directed behaviors, reflecting attachment-related arousal. Instead, Perceived Costs factor was related to higher HRV along with less fear and less owner-directed behaviors, which appears to reflect the dog's independent character. Thus, dogs' emotional reactivity is linked to the quality of dog-owner relationship, but the influence depends on the aspects of the relationship and characteristics of the dog.

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Object neophobia in the Goffin's cockatoo

Alice Auersperg, Alejandra Cespedes, Antonio Osuna-Mascaro, & Mark O'Hara (University of Veterinary Medicine Vienna)

Being selective within novel object approaches can optimise foraging while avoiding predation or intoxication. Here we tested to what extend Goffin's cockatoos (Cacatua goffiniana) exhibit intrinsic neophobia towards specific object

properties. The cockatoos were presented with novel objects grouped into four distinct categories, each with unique features. We therefore used object properties that were previously proposed to elicit approach hesitancies for different reasons: size, colour, reflective capacity and shape. Twelve Goffin's cockatoos were tested by measuring their latency for approaching a high quality food reward for both novel and control scenarios. The cockatoos were significantly more hesitant to approach objects larger than their own body size compared to objects smaller or of similar size. They were also more hesitant to approach elongated objects than compact objects. Both phenomena can potentially be explained by ecologically relevant predator shapes.

2:51 PM *Break*

3:01 PM Cognitive Processes (Chair: Noam Miller)

3:01 PM

Familiar and Unfamiliar Human-Directed Behavior in Captive Carnivores During an Impossible Task

Victoria L. O'Connor (Oakland University), Brittany Greene (Panther Ridge Conservancy), & Jennifer Vonk (Oakland University)

In captivity, humans play an important role in the lives of captive carnivores that includes training, hand-rearing, and caretaking. The nature of that relationship or the amount of contact between humans and captive carnivores may shape their cognition in important ways. For example, human-rearing may instill a greater reliance on humans during problem-solving tasks, expressed in longer looking times to familiar humans and less perseverance in the task. We investigated whether captive carnivore species looked more to a familiar keeper than an unfamiliar researcher when attempting to solve an Impossible Task. We also examined perseverance across species and with regard to rearing history. This is the first study using the Impossible Task in captive, non-domestic carnivores, providing relevant and necessary knowledge regarding the effects of human relationships on captive carnivores.

3:08 PM

Validation of a Rodent Model of Episodic Memory Replay

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

Vivid episodic memories in humans have been described as the replay of the flow of past events in sequential order. Recently, Panoz-Brown et al (2018) developed an olfactory memory task in which rats were presented with a list of trial-unique odors in an encoding context; next, in a distinctive memory assessment context, the rats were rewarded for choosing the second to last item from the list while avoiding other items from the list. In a different memory assessment context, the fourth to last item was rewarded. Notably, events presented sequentially differ in memory trace strength, allowing a rat to use the relative familiarity of the memory traces, instead of episodic memory replay to solve the task. Here, we directly manipulated memory trace strength by manipulating the odor intensity of target odors in both the list presentation and memory assessment. The rats relied on episodic memory replay to solve the memory assessment in conditions in which reliance on memory trace strength is ruled out. We conclude that rats are able to replay episodic memories.

3:15 PM

Does neotic style predict innovative problem-solving success?

Theresa Rössler (University of Veterinary Medicine Vienna; Department of Cognitive Biology University of Vienna), Mark O'Hara (University of Veterinary Medicine Vienna; Research Center for Biology Indonesian Institute of Sciences), Berenika Mioduszewska (University of Veterinary Medicine Vienna; Max Planck Institute for Ornithology), & Alice M.I. Auersperg (University of Veterinary Medicine Vienna)

Every innovation inevitably inheres novelty, which is already evident from the term itself (loosely translated = "a novel change"). May it be an original idea, a novel application, a new technique or other. It is therefore crucial for understanding the innovative process, how an agent perceives and acts on novel encounters or generates novelty through e.g. behavioral changes. The reaction to novelty of species or individuals can be described through their "neotic style". While neophobia is the avoidance of novel stimuli, neophilia is the active approach towards novelty. Although they seem opposite at the first glance, they are not necessarily ends of a scale but can function independently as described in the 2-factor model by Mettke-Hofman (2001). Technical innovations require an agent to physically engage with objects. Therefore, the neotic style in reactions to novel objects is relevant when investigating its influence on kinematic problem-solving behavior. We examined individuals of the Goffin´s cockatoo (Cacatua goffiniana) and studied whether each individuals' reaction was consistent over time and towards different objects to evaluate a personality score. Further, we investigated whether neotic style predicts success in a separate innovative problem-solving task.

3:22 PM

Monkeys learn abstract rules more slowly than arbitrary ranks, but gain flexibility from doing so, in transitive inference

Rael Sammeroff, & Dr. Robert Hampton (Emory University)

In transitive inference animals may organize arbitrary stimuli into series using a spatial representation (A>B, B>C, so A>C). Animals may also use rules, such as "choose large", to organize series when stimuli allow. Given that rhesus monkey social rank is not determined by size, it is of interest to determine the extent to which they use rules

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to organize stimuli, or instead memorize specific features of stimuli. We initially tested whether rhesus monkeys would organize sets of ordered stimuli, such as circles arranged by size, more easily than disordered sets or random scene sets. Ordered sets could be learned by memorization or by learning a rule. Disordered and scene sets could only be learned by memorization. Monkeys learned random scene sets significantly faster than ordered sets and never learned disordered sets. After confirming that monkeys had learned rules, we trained the monkeys to reverse a single pair of images (A>G ◊ G>A) for ordered and scene sets. During testing, monkeys fully reversed their ranking for ordered sets but were unable to fully reverse scene sets. Our results show that rules are represented more abstractly and are more manipulable than spatially represented random image sets.

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3:29 PM

Pushing it to the limit: Determining Asian elephant (Elephas maximus) olfactory sensitivity and discrimination through a behavioral choice task
Matthew S. Rudolph (Department of Psychology - City University of New York), Melissa Schmitt (University of California – Santa Barbara)), Sarah L. Jacobson (Department of Psychology - City University of New York), & Joshua M. Plotnik (Department of Psychology – City University of New York; Hunter College)
Elephants have shown remarkable olfactory capabilities. Their sense of smell impacts a variety of behaviors, from their foraging choices to their social decision-making. Being able to detect a target odor can allow elephants to locate specific resources, identify threats, and find sexually receptive conspecifics. Previous studies have shown that elephants can consistently detect target odors, but have not identified the limits of this detection. Thus, to investigate the extent of elephants' capacity to detect odor, we tested Asian elephants (Elephas maximus) in a two-step odor discrimination task. We found that elephants could reliably detect the target odor in successive dilutions with a sensitivity down to 0.01% concentration by volume. The addition of a complex odor background (i.e., a masking odor) had no significant impact on the elephant's ability to detect the target odor or the dilution limit at which they could do so. This research contributes to our understanding of the elephant's olfactory sense and the importance of considering non-visual sensory perspectives in the design of cognitive tasks. Exploring the elephant's sensory systems can also enhance our understanding of their physical and social cognition, as well as contribute to the study of the impact of anthropogenic change on elephant behavior.

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3:36 PM

Resource type but not productivity determines the movement decisions of wild common marmosets (Callithrix jacchus)
Filipa Abreu (University of Osnabrück), Paul A. Garber (University of Illinois), Andrea Presotto (Salisbury University), Antonio Souto (Federal University of Pernambuco), & Nicola Schiel (Rural Federal University of Pernambuco)
The ability to encode, recall, and integrate spatio-temporal and ecological information in navigating to distant feeding sites across their home range has been reported in several primate species. Here, we hypothesize that navigation by common marmosets is influenced by the spatial distribution of resting and feeding sites, resource type (fruit, flower, or exudate), and resource productivity. Furthermore, we expect a negative relation between the intensity with which an area is reused and the number of times the group reuses route segments. We followed a group of Callithrix jacchus over 46 consecutive days and collected behavioral and GPS information using a two-minute instantaneous focal animal sampling technique. Additionally, we collected the GPS location and resource productivity of each feeding tree and the GPS location of each resting tree. We found that marmosets navigated greater distances to reach resting (334 m) than feeding sites (139 m). Resource type also influenced the group's travel distance, path straightness, and travel speed, but these variables were not affected by the productivity of food sources. As expected, marmosets reduced route segment repetition in areas used most frequently. Our findings suggest that in small-scale space or in intensive use areas, common marmosets may rely on Euclidean awareness.

4:00 PM Poster Session (4:00 - 5:30)
See Poster Abstracts Starting on Page 25

5:30 PM Closing Remarks (Ken Leising)

Posters

Saturday Afternoon

Can an invertebrate add and subtract?: Testing a numerical cognition methodology with bumblebees (B. impatiens)
William McCarthy, & Michael Brown (Villanova University)

P1
Invertebrates such as honeybees (Apis Mellifera) learn about abstract number concepts when solving quantitative tasks. However, simpler quantitative strategies for processing number may be lurking where abstract, symbolic numerical abilities have been attributed. To clarify the strategies underlying the decision-making processes of bees in numerical choice tasks, this study tests the capacity of bumblebees (Bombus impatiens) to learn an arithmetic (addition/subtraction) rule. The proposed experiment is a conceptual replication of Howard et al.'s (2019a) honeybee research. The physical apparatus features several innovations, such as transparent walls, one-way doors, and easily removable reinforcement chambers which enhance video recording and subsequent behavioral coding. Results from the proposed study will show if bumblebees can learn to follow an addition/subtraction rule and will indicate whether they are an appropriate study species for future studies of numerical cognition.

The top gamer hen: introducing a touch-screen device with a serial reversal learning and a generalization task
Rachel Degrande, Fabien Cornilleau,, Lansade Léa, Jardat Plotine (CNRS IFCE INRAE Université de Tours Nouzilly), Colson Violaine (INRAE LGPG Rennes), & Calandreau Ludovic (CNRS IFCE INRAE Université de Tours Nouzilly)

P2
Improving farm animal welfare requires to deepen our knowledge about their cognitive capacities, which will enable us to understand their subjective point of view. Fundamental and applied cognition research may gain to develop automated testing devices adapted to farm animals. We developed a fully automated touch-screen device enabling to test a large range of cognitive capacities in the domestic hen. With this device we implemented a simple and a more complex task, respectively a serial reversal learning task (SRL) and a generalization test implemented through a delayed matching-to-sample task (dMTS). For the SRL task, a first stage consisted in rewarding hens either when it pecked on a red or a green item; then hens passed through three successive reversal stages (i.e., peck on the other colour). Already at the third reversal stage, hens performed as well as at the first learning stage, showing that they rapidly integrated the long-term switch-rule of the task. For the generalization task, hens were first successfully taught to respond to a dMTS task, with four colors. The generalization test consisted in measuring hens' performance with two novel colors. The results suggest that hens are able to generalize an identity concept to a novel stimulus.

Conditioned territory defense in Madagascar hissing cockroaches (Gromphadorhina portentosa)
Macy R. Albaitis, Casey L. Mack, & Reggie Paxton Gazes (Bucknell University)

P3
In male blue gourami fish, signaled presentation of a male rival produces an aggressive conditioned response (Hollis, 1984). We replicated Hollis's (1984) study in a species that also shows territorial aggression: Madagascar hissing cockroaches (MHC; Gromphadorhina portentosa). During training, four adult male MHCs were designated as "CS+" animals and received a light (NS) followed by visual access to a rival male (US) in their home cage. Simultaneously, another group of four adult male MHCs designated as "CS-" animals received the light (NS) and visual access to a rival male (US) in their home cage at random intervals separated by an average of 90 minutes (range 70-120 min), such that the light was not predictive of the appearance of the male. During testing, each CS+ animal was paired with a CS- animal, the light was presented, and the animals were given direct physical access to each other for the first time. CS+ animals won all four of these test fights, indicating conditioned territorial aggression in MHCs. These results suggest an important ecological role for classical conditioning in MHCs.
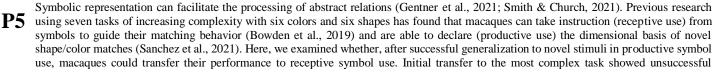
Color is a Salient Cue for Goldfish Discriminating Between 3D Stimuli Rotated in the Picture and Depth Planes
Kaitlin Gunther, Jessica Wegman, & Caroline DeLong (Rochester Institute of Technology)

P4
Goldfish have demonstrated the ability to discriminate between 3D objects rotated in different planes in the presence of color cues (green turtles and yellow and red frogs) with high performance accuracy (M = 93%). In the current experiment, six fish were presented with 3D stimuli that do not vary in color (the same turtles and frogs painted black). The fish were trained with a two-alternative forced choice task with stimuli at 0 degrees, and tested with one familiar aspect angle (0 degrees) and three novel aspect angles (90, 180 and 270 degrees). Only four fish met the training criterion. Overall test performance accuracy for the four fish was 59% when the stimuli were rotated in the picture plane, and 60% when the stimuli were rotated in the depth plane. Fish appear to struggle with this task as only one of four fish succeeded across the two test sessions (M = 71%). In a previous similar experiment, six of seven fish failed to discriminate between stimuli made of black LEGO bricks rotated in the picture and depth planes. These experiments, taken together with our previous research, shows the importance of color cues when goldfish visually discriminate among rotated objects.

Receptive and productive uses of symbols: The bidirectionality of symbol learning in rhesus macaques.
Andres Sanchez, Barbara A. Church, & J. David Smith (Georgia State University)

P5
Symbolic representation can facilitate the processing of abstract relations (Gentner et al., 2021; Smith & Church, 2021). Previous research using seven tasks of increasing complexity with six colors and six shapes has found that macaques can take instruction (receptive use) from symbols to guide their matching behavior (Bowden et al., 2019) and are able to declare (productive use) the dimensional basis of novel shape/color matches (Sanchez et al., 2021). Here, we examined whether, after successful generalization to novel stimuli in productive symbol use, macaques could transfer their performance to receptive symbol use. Initial transfer to the most complex task showed unsuccessful

performance. However, transfer starting with a task that still required symbol understanding but used less-complex stimuli demonstrated stronger transfer performance. Monkeys could not bidirectionally transfer performance when all the choices had both color and shape information. However, if you simplified the task to only include one color choice versus one shape choice monkeys' knowledge about the symbols did seem to transfer bidirectionally. These results may suggest that this use of symbolic representations is at the brink of the monkeys' abilities, and that their working memory capacity may be the primary limitation.

The Effect of Pre-Exposure on Family-Resemblance Categorization Decisions in Macaques

Brooke N. Jackson, Barbara A. Church, & J. David Smith (Georgia State University)

P6 The ability to make family-resemblance category decisions is vital for successful navigation of the natural world. Some theorists posit that there is a single system for category learning (Bruner et al., 1956; Hull, 1920; Levine, 1975) while others theorize there are multiple systems (e.g., Ashby et al., 2011; Smith & Church, 2018). In the current study, I focused on whether perceptual learning facilitates family-resemblance category learning. I tested rhesus macaques to see whether they were able to learn about family-resemblance categories through mere exposure and then generalize to new members of the category with no direct category training. It was predicted that receiving exposure to relevant category members would provide benefits in the later categorization test, because they would build representations of the prototypes during exposure through perceptual learning. Results showed that performance criteria were met faster, and performance was more accurate after relevant exposure. This suggests monkeys may build prototype representations during mere exposure. This finding is not predicted by important categorization and perceptual learning theories and, therefore, can help distinguish between competing theories in both fields. Future research will determine if exposure is also beneficial in learning multiple categories.

Abbreviated Fixed-Interval Interventions Promote Self-Control in Rats

Kelsey Panfil, Lexe West, Travis Smith, Kourtney Rumback, Robert Southern, & Kimberly Kirkpatrick (Kansas State University)

P7 Time-based interventions increase self-controlled choices in humans and animals. However, it is unclear how long the intervention must be delivered to be effective. In a previous study where rats were exposed to a fixed-interval intervention ranging 6 to 45 sessions, all rats made more self-controlled choices post-intervention. Interestingly, rats that received the shortest amount of training made the most self-controlled choices at the longest smaller-sooner delay, suggesting as few as six sessions of training successfully promoted self-control. In the previous study, the amount of training was confounded with a break between the pre-intervention choice test and intervention delivery which may have affected the results. In the current study, we investigated the abbreviated (6 session) intervention condition by assessing the effects of a pre-intervention choice test and 30-day break delivered between the pre-intervention choice test and intervention on post-intervention choices all compared to a no-delay control condition. The experimental conditions were effective at promoting self-control compared to the no-delay control group as evident in increased self-controlled choices and reduced sensitivity to delay changes. This suggests experimental timeline manipulations do not negatively affect intervention efficacy. Altogether, the abbreviated time-based intervention may be an effective tool in situations that may necessitate short timelines.

Spatial dynamics of behavior and conditional place preference with aversive stimulation: An ecological approach

Isiris Guzmán, Alejandro León, Varsovia Hernández, María José Palmeros, Samantha Beck, Víctor Quintero, & Joao Santibáñez (Universidad Veracruzana)

P8 In studies developed under the Conditioned Place Preference paradigm (CPP), an aversive event, generally an arbitrary stimulus (i.e., electric shock/drug), is presented in one segment of the experimental arena, and the emergent place preference is evaluated. In such studies: 1) the intensity and sudden presentation of the stimulus produce high levels of activation that can interfere with the establishment of an aversive conditional function and restrict the defensive behavioral patterns to freezing; and 2) the spatial dimension of the behavior is usually reduced to time spent in a given zone, ignoring translation patterns that could be sensitive to the contingencies. The purpose of the study was to analyze the modulation of the spatial dynamics of behavior under a CPP paradigm with ecologically relevant aversive stimulation (flooding). Sixteen Wistar rats were assigned to four experimental conditions, according to the number of segment-aversive stimulus pairings (1 to 4). Time spent in zones, distance to the crossing line between segments, total distance traveled, and entropy were analyzed. The results show a differential effect of the number of pairings on the spatial dynamics of behavior and the emergence of conditional place preference. The paradigm's implications with ecological stimuli and the proposed analysis are discussed.

The Blind Avoiding The Blind: Schooling Behavior in Zebrafish and Blind Cavefish

Britney Sekulovski, & Noam Miller (Wilfrid Laurier University)

P9 Schooling can be advantageous for many reasons, such as predator avoidance and group foraging. However, it is not seen in all fish species nor populations. Cave-dwelling populations of Astyanax mexicanus, commonly known as blind cavefish, have apparently lost the behavior, along with their eyes, though it persists in riverine populations of the same species. With their complete loss of sight has come an improved lateral line system. In this study, we examined groups of blind cavefish and compared their schooling behaviors (nearest neighbor distances, mean distances, polarization, and thigmotaxis) to those of sighted zebrafish (Danio rerio) and to null models that assume random movement in our featureless tank. We find that blind cavefish not only fail to school but actively avoid each other, while zebrafish form tight schools. Cavefish groups were also significantly less polarized than zebrafish and not different from random. Avoidance of conspecifics might be advantageous in the cavefish environment, which has extremely scarce food and no predators. Overall, our findings suggest that blind cavefish do not fail to school because they are not capable, but because, due to their ecology, it is not advantageous for them to do so.

Behavioral dynamics under a signaled spatiotemporal schedule in rats

Joao Alexis Santibáñez Armenta, Alejandro León Maldonado, Isiris Reyes Guzmán, & Ara Varsovia Hernández Eslava (Universidad Veracruzana)

P10
A paradigm of stimuli schedule contingent on the spatial dimension of the organism's activity is presented. The behavioral dynamic was analyzed on a water-delivery temporospatial schedule contingent on the organism's location with an acoustic signal in rats. The experimental space was segmented in two (DS and ΔS zones). Every segment was associated with a different probability of water delivery: p=1 for DS and p=0 for ΔS. A fixed-time (FT) 15s schedule operated when the organism was located in the DS zone. We had three different conditions of signal presentation: a) tone (7 kHz) while the organism was in DS; b) tone (7 kHz) while the organism was in ΔS; c) no tone. Four rats per each condition were exposed to 40 sessions. Routes, time spent in zones, recurrence patterns, water deliveries, and contacted deliveries were analyzed. Results suggest that the behavioral dynamic of the rats was functionally integrated to the programmed contingencies, and this dynamic was different according to the experimental conditions. Indistinctly of DS or ΔS condition, this integration was facilitated by the signal. The implications of the proposed analysis and paradigm are discussed.

Differentiation of space in pre-locomotor infants: The process revealed in the analysis of the behavioral continuum

Iván López-Ortiz, Alejandro León, & Varsovia Hernández-Eslava (Universidad Veracruzana)

P11
Studies that have used the paradigm of spatial orientation and its procedural variations have reported conflicting results regarding the effect of variations in surface distinctiveness (homogeneous vs. heterogeneous) of the environment on the differentiation of space in infants under eight months. These studies have been characterized by measures focused on behavioral achievement (i.e., a dichotomous response type, egocentric vs objective responses) obtained during test trials, preventing the analysis of space differentiation process. This study analyzed the behavioral continuum of pre-locomotor infants using an adaptation of the spatial orientation paradigm. Three infants were exposed to a homogeneous environment (walls of the same color), and three other infants were exposed to a heterogeneous environment (presence of a yellow star around a target location). The activity continuum was recorded, emphasizing visual orientation as a measure of the directionality of behavior. Differences were found in the Spatio-temporal organization of behavior depending on the homogeneity or heterogeneity of the environment. These results indicate that the analysis of the behavioral continuum makes it possible to capture aspects of the spatial differentiation process that are not noticed when an analysis focused solely on the record of behavioral achievements is carried out.

Energy level predicts training time for awake and unrestrained MRI in dogs

Jordan Smith, Lucia Lazarowski, Adam Davila, Lane Montgomery, Gopikrishna Deshpande (Auburn University), Frank Krueger (George Mason University), & Jeffrey Katz (Auburn University)

P12
In recent years, dogs trained for awake, unrestrained MRI scans have been utilized to better understand the structure and function of the dog brain. However, the training to prepare dogs for such MRI scanning can require significant time and resources. While some studies have evaluated training methods, little research has been done on how individual subject characteristics may affect training success. To answer this question, we examined whether age, sex, and temperament traits (assessed using the Canine Behavioral Assessment and Research Questionnaire [C-BARQ]) predicted number of training sessions until the first usable 5-minute MRI scan in a group of Labrador retrievers (n = 10) trained for awake, unrestrained MRI. While we did not find a significant effect of sex, we did find a trend of age such that older dogs required fewer training sessions than younger dogs. Only the C-BARQ subscale for "Energy level" was predictive of training time, with dogs scoring higher on the subscale requiring more training sessions to achieve a usable MRI scan. These results can inform recruitment and selection of dogs for future research using awake, unrestrained MRI.

Enrichment and cognition in Western Hognose snakes

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

P13
Environmental enrichment is rarely studied in snakes, but recent evidence suggests they can benefit from it. However, little is known about reptilian behaviour, which complicates gauging which enrichments are effective. We aimed to assess snake enrichments using Western Hognose snakes (Heterodon nasicus; n=16). Snakes were housed for 7 days in an enclosure which was divided into standard and enriched areas. Snake locations were recorded 4 times daily. Snakes then completed 4 training trials and an unrewarded probe on an odor-cued Barnes maze, and a 1-hour open field. We found that snakes had an overall preference for the enriched environment, which interacted with the side on which a heat source was placed. Some snakes were able to learn to solve the Barnes maze and all snakes habituated to the open field, as indicated by a decrease in tongue-flicking over the session. Thigmotaxis in the open field correlated with time spent at the goal in the Barnes Maze probe trial, but there were no other strong correlations between tasks. Future experiments will repeat the cognitive battery after several months spent in either enriched or standard housing, to assess the effects of enrichment on cognition in this understudied taxon.

Comparison of local responses and locomotion patterns between healthy and vestibular-syndrome rats under continuous reinforcement

José Abraham Rivera Uribe, Isiris Guzmán Reyes, Varsovia Hernández-Eslava, & Alejandro León (Universidad Veracruzana)

P14
In the present study, the spatiotemporal dynamics (derived from locomotion measures and response rates) between healthy and Vestibular Syndrome (VS) Wistar rats were compared. Four water-deprived subjects were exposed to 30 sessions of a Fixed Ratio (RF) 1 schedule in a standard operant chamber. Two subjects were healthy rats and two subjects presented VS. The spatial dynamics of behavior (routes, time spent in zones, distance to the lever and dispenser, and recurrence), as well response rate, number of head entries to the dispenser, and an index of contacted water were analyzed. Subjects with VS showed notably more vigorous and varied spatial patterns than healthy rats, as well as notably higher response rates in one of them, but with a lower index of contacted water deliveries. The results suggest that in subjects with VS there was an integration of locomotion patterns with the responses to the lever and head entries to the dispenser, while, in healthy rats, the

behavior was limited to the functional relation between lever pressing responses and head entries to the dispenser during water delivery. The relevance of incorporating the analysis of spatial dynamics in the experimental analysis of behavior is discussed.

Fractals are food: Domesticated chickens categorize images without relying on their real-world equivalents

Jad Nasrini, & Robert Hampton (Department of Psychology and Yerkes National Primate Research Center - Emory University - Atlanta GA)

P15 Category learning by animals is often tested with arbitrary exemplars that bear no significance for the tested animals. Yet learning categories functionally may be critical for visually diverse stimuli that share significance context. Functional categories allow an animal to generalize the appropriate behavioral response to diverse features in the environment without repeated learning. We trained four domesticated chickens to categorize images using a touchscreen. Images belonged to one of four categories based on putative functional significance: inanimate objects, predators, food, and non-competing animals. Images were chosen to be visually diverse within each category to encourage functional categorization. In Experiment 1, chickens learned to categorize 20 exemplars of each category on at least 70% of trials. Chickens then generalized significantly better than chance on 3 successive generalization tests on which 20 new exemplars were introduced. In Experiment 2, chickens reliably categorized fractals as "food" ($X^2(3, N = 40) = 26.4,21.6,83.6,31.00$, p<.001), suggesting that the learned categories were not based on functional significance. Under these conditions, chickens likely categorized images based on shared visual characteristics, not by relating them to their real-world equivalents. These results reiterate constraints in our ability to use computer images to assess functional categories in animals.

Midsession Delays in the Rodent Odor Span Task

Dylan Marshall, Mark Galizio, & Katherine Bruce (University of North Carolina at Wilmington)

P16 The Odor Span Task (OST) is considered a 'gold-standard' animal model for developing treatments for working memory loss in schizophrenia. In the OST, selection of a session-novel odor results in reinforcement, but odors are not reinforced on subsequent presentations. We separated 24-trial, daily OST sessions into two halves, with a delay (0 min, 10 min, 60 min, 240 min) inserted midsession; rats were returned to their home cages during the delay. On each trial of the second half, choices consisted of a session-novel odor, a negative comparison that had been presented in the first half, and a negative comparison that had been presented in the second half. Most rats (3 males and 3 females) made few errors in the second half of the OST after 10-min delays, though accuracy for two rats (1 male and 1 female) was impaired. The other six rats did not show significant decreases in accuracy until the 1-hour delay. When errors were made, they were consistently to the less familiar negative comparison. No sex differences in performance were evident. These results were compared to previous midsession delay research from our lab and underscore the utility of the OST as a memory model.

Spatial behavior is modulated by both housing and companions under food searching task in rats

Fryda Díaz, Varsovia Hernández, Alejandro León, Abraham Rivera, Bernardo Castro, & (Veracruz University)

P17 Previous studies have reported that gregarious vs. individual-task presentation affects spatial behavior in a food-searching task. Also, it has been reported that individual vs. gregarious-housing conditions affects this dimension of behavior. The effect of task presentation and housing conditions on spatial behavior is less know. The present study evaluated the effect of early exposure to individual vs gregarious housing and two conditions (dyadic vs individual) of presentation of a food-searching task in the spatial behavior of rats. Six male-Wistar rats (38 days old) were exposed, for 19 weeks, to two housing conditions (Individual N=3; Gregarious N=3); Then, they were exposed to an individual and dyadic food searching task for 12 sessions. We compared the spatial behavior (entropy, recurrence of animal movement, time spent in zone and routes) between housing and food-searching task conditions. Results suggest an interaction effect between food-searching task and housing conditions on spatial behavior. We discuss the results in terms of the modulating function of these variables over the spatial behavior dynamics in a food-searching task.

Retention interval effects with pigeons and humans in a spatial change detection task

Sophia Jones, Sara Bond, Emma Gilbert, Rachel Kundinger, Nate Jones, Jordan Nerz, & Ken Leising (Texas Christian University)

P18 Experiments testing visuospatial memory have revealed different behavioral patterns after short (<1 s) and medium (1 to 30 s) delays, suggesting two memory systems. Iconic memory is active at short delays and has a large capacity, whereas working memory operates after long delays and has a limited capacity. In support of this, research has found that increases in set size disrupt behavior only after long delays. In the present experiments, pigeons and humans were trained to select an item (colored circle) on a touchscreen that changed location after varying delays (0, 100, 1000, 2000, 4000, and 8000 ms) with varying set sizes (2 to 8 items). Pigeons were less accurate on medium (1000 and 2000 ms) and long (4000 and 8000 ms) delays than on short (0 and 100 ms) delays. Humans performed similarly on short and medium but were less accurate on long duration trials. For both species, performance was similar across the differing set sizes after the short delays, but differences emerged after long delays. Pigeons only performed very well at the long delay with 2-item trials. These findings extend our knowledge of the effects of delay and set size on working memory across species.

Voluntary Oral Administration of Cannabidiol (CBD) as an Anxiolytic in Rats

Nate Jones, Sara Bond, Cokie Nerz, & Ken Leising (Texas Christian University)

P19 Recent studies have found an anxiolytic effect of injections of cannabidiol, or CBD. (Blessing et al., 2015). In two experiments, we sought to replicate these findings using voluntary oral administration of non-pharmaceutical grade CBD in Long-Evans rats. In Experiment 1, each rat received 10 mg/kg of either CBD or coconut oil for 14 days. Rats were tested in an elevated plus maze, an open field, and a running wheel. In the elevated plus maze, it was hypothesized that the rats in the CBD group would spend more time on the open arms of the maze compared to rats receiving only coconut oil, indicating an anxiolytic effect of CBD. Analyses revealed an effect of sex in the running wheel, but no effect of CBD in any apparatus. In Experiment 2, we increased the CBD dose to 60 mg/kg and rats were given only one opportunity to consume

CBD two hours before testing. Results again indicated no effect of CBD. Results will be discussed with respect to the route of CBD administration, as well as methods for revealing anxiolytic effects.

P20

Risk-taking and learning capacities in the ironclad beetle (Asbolus verrucosus)
Sydney Scott, Robert Marku, & Martha Escobar (Oakland University)
Although it has been recently suggested that personality traits may be correlated to learning capacities, a recent study by Harris et al. (2020) found no relationship between risk-taking behavior and associative learning capacities in females of the carabid beetle Nebria brevicollis. Using a similar procedure, we assessed risk-taking behavior in male and female ironclad beetles (Asbolus verrucosus). The expectation was that the relatively long life span of these beetles may allow for a more successful exploration of the relationship between personality traits (risk-taking behavior) and learning capacity in a T maze. All animals exhibited strong biases toward certain stimuli and responses and, although personality traits were strongly correlated to each other, the relationship between these traits and associative learning was not as robust.

P21

The effects of feature-target temporal relationship on a two-response discrimination in rats
Taryn Pittman (Texas Christian University), Sara Bond, Nate Jones, Jordan Nerz, & Ken Leising (College of Science Engineering)
In a feature-positive discrimination, responding in the presence of a target stimulus (A) is reinforced when presented in compound with a second, feature stimulus (X), but not in the presence of the target alone (XA+, A-). The current studies examined whether the target stimulus could control one response when paired with the feature (e.g., XA+, a left lever press) and a different response when encountered alone (e.g., A+, pressing the right lever). In Experiment 1, one group of rats was trained with a feature and target presented serially (X → A+), whereas X and A were presented simultaneously (X:A+) for another group. Both groups also experienced target-only trials (A+). Test trials of X-, A-, and XA- occurred prior to and following extinction of X. In both groups, responding to X, but not XA, was disrupted after extinction indicating possible occasion setting. Experiment 2 was conducted in the same manner as the first, except a 5-s delay was inserted between X and A in the serial group and the salience of X was increased. In Experiment 2, extinction of X resulted in a disruption in responding to X and XA in both groups, indicating direct control of X.

P22

Studying the Illusory Object-Based Warping Distortion of Space Between Objects in Non-Human Primates
Joseph W. McKeon (Georgia State University), Audrey E. Parrish (The Citadel), & Michael J. Beran (Georgia State University)
Object-based warping is a visual illusion demonstrated in humans wherein spatial distances within an object are perceived as larger than those in ground regions. Although nonhuman animals have shown other quantity-based illusions, this particular illusion has not been tested. The current project investigates this illusion in rhesus macaques (Macaca mulatta) and tufted capuchin monkeys (Sapajus apella). In the experimental task they are presented with two visual arrays containing two pairs of vertically aligned dots against a black background or contained within a grey square. Monkeys must choose the array with the larger distance between the dots. The task contains baseline trials wherein the background (black ground or grey square) is the same, or congruent (dot stimuli within the box are farther apart), incongruent (dot stimuli within the box are closer together), and equal (no difference in distance between the two arrays) probe trials. Should monkeys demonstrate this illusion, it would imply that the origin of this visual illusion extends further back in our evolutionary history. Conversely, if they do not demonstrate a bias for object-contained stimuli, it will suggest that susceptibility to this illusion is uniquely human, and we will discuss possible explanations for why this would be true.

P23

The difficulty of learning same-different discrimination in pigeons (Columba livia)
Kiwako Shimada, Arii Watanabe, & Tomokazu Ushitani (Chiba University)
Gibson et al. (2011) used a change detection task to compare visual short-term memory of pigeons and humans, and suggested a similar underlying system between the two species. In our first experiment, we replicated their paradigm and required pigeons to report whether two sequentially presented displays, which contained 8 items respectively, were the same or different. Only one out of four pigeons accomplished the task, which implied that they were having difficulty with the same-different discrimination. In the following experiment, we used the procedure based on that of Katz & Wright (2006) to train pigeons on the same-different discrimination before testing them on the visual short-term memory task. Our experiment required pigeons to report whether two displays, which were located one above the other, were the same or different. The number of presented items and the location of response keys were manipulated to encourage them to learn the same-different discrimination, but the pigeons still showed difficulties with the discrimination. Thus, same-different discrimination performance in pigeons may be largely affected by individuals' experimental histories.

P24

Ethogram of Limulus Polyphemus (American Horseshoe Crab)
Dylan Davidoff, Erin Frick, & Eron Higgins (Eckerd College)
The North American horseshoe crab (Limulus polyphemus), is often referred to as a living fossil species tracing back 445 million years in the geologic record (Rudkin et al., 2008). They have remained virtually unchanged for at least 350 million years (Bicknell and Pates, 2019), possibly making them the most successful animal in evolutionary history. However their behaviors, like many invertebrates, are not well documented in scientific literature. This study presents the first ethogram of Limulus polyphemus, defining 39 behaviors. Horseshoe crabs were observed in-situ via videos (179 videos which ranged from 5-45 seconds) provided by John Anderson from Terramar productions. This ethogram may be useful in understanding more about horseshoe crab behaviors in order to create improved conditions in future experimentation and in biomedical bleeding practices, for the purpose of implementing best practices in managed care environments, as well as to aid in education and conservation efforts.

Information use in gopher tortoises.

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

P25 The gopher tortoise is an environmental keystone species under serious threat of extinction from rapid urban expansion. To date, efforts to conserve these tortoises have mainly followed the traditional routes of conservation. Current approaches do not take into account crucial factors which determine how animals find, access and return to resources - the cognitive processes underlying their behavior. To investigate what aspects of the environment tortoises learn about, 7 gopher tortoises were presented with a discrimination in which they could use color information, shape information, or both to solve a task. Each animal was trained to discriminate between 3 positive and 3 negative stimuli that differed in both color and shape. Once an animal had reached learning criterion it was given a cue conflict test in which the positive colors were paired with the negative shapes and vice versa. The animals rapidly learned the discrimination and the findings will be discussed in the context of species conservation.

Learning in the Pigeon; Implicit or Explicit?

Daniel Peng & Thomas Zentall (University of Kentucky)

P26 Human learning can be categorized into two types: explicit or implicit. Implicit learning can be thought of as procedural, that is learning that occurs by stimulus-response associations. Explicit learning on the other hand is typically rule-based and can be identified with verbalizable rules. One way to distinguish explicit learning in non-verbal animals is to use a conditional discrimination task (matching to sample), with delayed reinforcement. In this task, feedback for a particular trial is delayed until after a response is made on the following trial. This is the 1-back task. In the present experiments, pigeons were trained in a matching to sample task under a 1-back schedule of reinforcement. In experiment 1, pigeons were trained on red/green matching. Following introduction of a correction procedure, all pigeons showed significant levels of learning. In experiment 2, pigeons were tasked on symbolic matching, with yellow and blue sample stimuli and red/blue choice. Again, pigeons showed significant levels of learning. The results of these experiments suggests pigeons can learn a conditional discrimination task under a 1-back schedule of reinforcement. However, whilst Smith, Jackson and Church claim this learning is explicit, we do not believe this procedure adequately distinguishes between implicit and explicit learning.

Two-item same-different categorization in pigeons

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P27 Research on same-different categorization has shown that abstract learning of these twin concepts can be affected by the number of items in the array to be categorized. Evidence for two-item same–different categorization in pigeons is decidedly mixed: although some investigations have succeeded, others have failed. No research has documented successful conditional same–different categorization using just two items, nor has research explored how pigeons' responses in this paradigm might be influenced by perceptual characteristics of the training stimuli. We trained 4 pigeons in a conditional same-different categorization task using pairs of randomly generated color patches which were never repeated during training. Birds were simultaneously presented with two pairs of stimuli and were reinforced for pecking the pair that consisted of two identical or different items depending on the color of the surrounding frame. Results provide evidence that pigeons can perform two-item conditional same–different categorization to a high degree of accuracy; further, they can do so without the support of item repetition. We also show for the first time that the perceptual disparity between the items in pairs of different stimuli plays a key part in pigeons' same–different categorization performance.

Implicit and Explicit Learning in Humans and Pigeons Using the 1-Back Task

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P28 There are at least two different ways a task can be learned - it can be learned explicitly, in which an individual can describe the rule used to incur reinforcement, or implicitly, in which an individual can consistently respond correctly but is unable to describe the rule used in order to do so. The 1-back procedure refers to a task for which outcome feedback occurs after the end of the next trial. It is assumed that pigeons who can learn this task to a respectable degree of accuracy learn it implicitly - that is, without the necessity of a single explicitly defined "rule". We provided human participants and pigeons with a symbolic matching-to-sample task for which trial feedback occurred after the end of the next trial to determine if there was a difference between species in the expression of implicit (i.e., intuitive) or explicit (i.e., rule-based) learning. In addition, we provided human participants with one of three sets of instructions to encourage either implicit or explicit learning. Although we did not find a significant effect of instructions, backward learning curves suggested that contrary to the pigeons, the humans learned explicitly.

The Influence of Environmental Symmetry on Adult Reorientation Strategies

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P29 This study examined whether environmental symmetry influences the use of featural and geometric cues when adults reorient in one of two octagonal arenas. The arenas contained a distinct feature, but different geometric information. One arena was bilaterally symmetrical along the main dividing axis, whereas the other was bilaterally asymmetrical. Adult participants searched for a hidden target, located in one of the eight corners, in one of the arenas. Reorientation using only geometry was examined by removing the feature (Geometry Only test). The relative weighing of the featural and geometric information was examined by creating a conflict situation through moving the feature one or two wall lengths clockwise (One-Move Cue Conflict and Two-Move Cue Conflict tests, respectively). Sex differences in the use of featural and geometric cues for reorientation was also examined. Results showed that environmental symmetry influenced cue reliance. Test order influenced the use of featural and geometric cues during cue conflict. Overall, a significant sex difference was not found.

Measuring Humans' Trust in Dogs with the Multi-Dimensional Measure of Trust (MDMT)

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P30 Humans rely on domestic dogs for tasks ranging from emotional support to life-saving measures. Trust is a key element in successful partnerships, yet we have a limited understanding of how humans trust dogs. Prior work has explored humans' trust in other humans as well as in robots. In this study, we adapt the Multi-Dimensional Measure of Trust (MDMT) to investigate humans' trust in dogs. Participants will be presented with 4 brief vignettes about dogs with real-world jobs. Participants will complete the MDMT after reading each vignette (baseline), and a second time after reading a modification to the vignette (manipulation). Participants' trust in the dogs will be manipulated in 2 directions (increase/decrease) along the 4 trust dimensions (reliable, competent, ethical, benevolent) captured by the MDMT. Results from this study will be used to compare humans' trust in dog agents to that of human and robot agents in the literature. Additionally, the 4 trust dimensions measured by the MDMT will allow for a fine-grain analysis of human-dog trust. Findings related to humans' trust in dogs have the potential to inform the training and use of working dogs as well as contribute to the ever-growing body of literature on human-animal relationships.

Shell use patterns of thinstripe hermit crabs (Clibanarius vittatus)

Katie West, Jennie Christopher, Rebecca Luenser, Lindsey Johnson, Joclyn Villegas, & Heidi Lyn (University of South Alabama)

P31 n recent years, it has become more and more difficult to fund and run a comparative lab with vertebrate animals. At the same time, Undergraduate research experience has become more and more desirable for those intending to apply for graduate school. One solution has been for established comparative psychologists to explore invertebrate teaching labs. At the University of South Alabama, the Comparative Cognition and Communication Lab has focused on the very understudied thinstripe hermit crab. The thinstripe is a marine hermit crab and so offers the undergraduates the opportunity to learn about maintaining a marine colony and studying behavioral patterns, including shell choice. As an initial study, over 100 shells were measured for weight, height, width, aperture height and width, and volume and the shell use patterns of 16 hermit crabs were tracked over 4 months. We will report on shell use trends as well as the setup and maintenance of a hermit crab lab.

Investigating Guatemalan Beaded Lizards' Foraging Efficiency in a Radial Arm Maze

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P32 Cognition in non-avian reptiles has been largely unstudied, and previous research with Guatemalan beaded lizards has remained inconclusive regarding their cognitive abilities. To provide more insight, this ongoing study utilizes an 8-arm radial maze to assess cognition, behavior, memory, and sensory modalities in beaded lizards. In the first experiment, five lizards were placed within the maze to observe patterns of movement and behavior. The lizards received 30 minutes during each trial to navigate the maze and maximize their food rewards, which were placed at the end of each of the eight arms. To date, results from this first experiment show individual variation, but with most lizards increasing efficiency and received rewards as the study progresses. The behaviors seen are indicative of potential strategic movement patterns and learning processes. This study, in combination with planned future experiments utilizing the radial arm maze, will form a good comparative base for the evaluation of evolution of cognition in lizards, initially with regards to existing studies involving other species of lizards, and eventually in anticipation of increased cognitive research across all non-avian reptiles.

Sprague Dawley rats display episodic-like memory in an object recognition task

Ryan Pluck, Dr. Michael Brown, & Sara Glass (Villanova University)

P33 In animals, episodic memory has been studied by observing if animals are capable of recalling the "what", "where", and "when" of a particular event. Their memory of this what-where-when representation has been called episodic-like memory. This study used a three-part object recognition task that has previously been used in episodic-like memory in rodents. The task consists of three exposure phases, a first exposure in which there are four identical objects in the field while the rat explores, a second exposure with four new objects that are identical to each other, and a final exposure with two objects from the first exposure and two from the second. One object from each exposure is in the same location as it was previously experienced, but the other two are in new locations. We found that the rats preferred to explore the objects from the first exposure over those from the second. We also found that the subjects preferred the displaced objects over the stationary objects. These results are consistent with episodic-like memory in rats because the rats explored the objects differently based on when and where they were experienced, suggesting that they establish a memory of the what-where-when representation for the objects.

Food and water deprivation and spatio-temporal organization of behavior in Wistar rats

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P34 The effects of food or water deprivation conditions on food or water consumption has been extensively reported in the literature. The effect of the simultaneous presentation of both deprivation conditions on food and water consumption and on the temporal organization of behavior is less known. The purpose of the present study was to evaluate the effects of four different conditions of food and water deprivation on the spatio-temporal organization of behavior when food and water were concurrently available. Six rats were exposed to each of four different conditions of food and water deprivation: a) food deprivation, b) water deprivation, c) food plus water deprivation and d) no deprivation. Six experimental sessions were conducted under each deprivation condition. Sessions consisted in simultaneously presenting a food pellet and a drop of water using a Concurrent Fixed Time 30s schedule on dispensers located on opposite walls of an extended experimental chamber. The results show similar and strong effects in measures of displacement and consumption under food and food plus water deprivation, then with no deprivation and lastly under water deprivation conditions. We discuss our results in terms of the role of deprivation conditions on different behavioral dimensions.

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