



ASAB Winter Meeting 2023

Abstracts



Plenary Speakers

Outreach lecture: Prof Gillian Forrester University of Sussex, UK



Hand to mouth: The language puzzle

Language is what makes us uniquely human. Yet, how language evolved and over time remains a mystery. We cannot ask our ancient ancestors because they are all extinct, and we cannot find all of the answers in the archaeological remains of our ancestors because cognition does not fossilise. However, we can turn to our great ape cousins as a window into our pre-linguistic past to consider what ancient behaviours may have played pivotal roles in the emergence of human language. I'll take you on a journey from hand to mouth, exploring one of the leading theories behind the emergence of modern human language.

Biography:

Gilly is a Professor of Evolutionary & Developmental Psychology at the University of Sussex. She earned a BSc in Cognitive Science from the University of California, San Diego and a PhD in Experimental Neuroscience from the University of Oxford. By studying the brains and behaviours of human and non-human primates, Gilly is on a quest to better understand how we became the upright-walking, talking, tool-using great apes that we are today. Gilly is dedicated to science engagement and directs the Me, Human project (www.mehuman.io, Twitter: @Me__Human). She runs public science exhibits, features at festivals and makes regular contributions to television, radio, newsprint and podcasts. You can find out more about Gilly here: www.gillianforrester.com or follow her on Twitter: @ForresterGilly and Instagram @GillyForrester.

Dr Alice Auersperg
University of Veterinary Medicine, Vienna, Austria



Tool use and Manufacture in the Goffin's cockatoo

The Goffin's cockatoo is not a population-wide tool user and lacks traits that are usually associated to the onset of tool use in birds. Nevertheless, it shows highly adaptable extractive foraging techniques, a psychological drive to combine objects, the ability to instantly memorize profitable motor sequences and the ability to innovate and socially transmit tool use and manufacture in the lab as well as in the field. Our research started with an accidental observation of an individual tool innovation in an aviary in Austria. This prompted us to study the triggers, social transmission, and mechanisms underlying tool innovation abilities in this species well over the past decade. I will present selective examples of our research in Austria as well as in the Goffin's natural habitat, the Tanimbar archipelago in Indonesia, and discuss the meaning of our findings in a comparative framework.

Biography:

Alice is a Cognitive Biologist interested in the evolution of technical behaviour and innovation. Her current research focus is the emergence of tool use behaviour. Her approach is interdisciplinary and comparative including birds, primates, robots, and children. Nevertheless, she is best known for her work on Goffin's cockatoos that her team has studied intensively in lab and field settings over the past decade. She works as an Associate Professor at the Messerli Research Institute at the Vetmeduni Vienna. She is a former FWF Schrödinger and current START Prize fellow and a member of the Young Academy of the Austrian Academy of Sciences.

Prof Elli Leadbeater
Royal Holloway, University of London, UK



Ecology and the value of insect memory

“Ecological intelligence hypotheses” predict that the evolution of animal learning and memory is shaped in part by ecological challenges, and particularly those inherent in searching for food. Yet testing these ideas can be enormously challenging, not least because of the major hurdles implicit in measuring confound-prone cognitive traits and fitness proxies in wild animals. In this talk, I will discuss work in insects that sheds light on how ecology may shape the evolution of memory. Memory is not a single entity, but a collection of shorter- and longer-term processes that can be instigated in parallel and are semi-independent in their underlying physiology. These processes may well serve different roles in different ecological niches, such that animal memory is best viewed as neither “good” nor “bad”, but as customized to specific environmental conditions.

Biography:

My research centres around the ecology and evolution of social insects, and specifically (1) the evolution of bee cognition (2) the threats faced by insects in a rapidly changing world. I’m a Professor of Ecology and Evolution at Royal Holloway University of London, where I’ve been based for 10 years. Prior to that, I studied social wasp societies (including the endearing but unpleasantly-behaved Mexican honey wasp) at the Institute of Zoology in London and the University of Sussex. Sometime a bit too far back in the early 2000s I completed my PhD at Queen Mary University of London.

Tinbergen Lecture: Prof Giorgio Vallortigara
University of Trento, Italy



A sense for animacy: imprinting, predispositions and the building of a social brain

To what extent are filial responses the outcome of spontaneous or acquired preferences? The case of domestic chicks (*Gallus gallus*) illustrates the connection between predisposed and learned knowledge in early social responses. In the absence of specific experience, chicks prefer to approach objects that are more similar to natural social partners (e.g. they prefer face-like configurations, biological motion, self-propelled objects and those that move at variable speed). Spontaneous preferences are complemented by filial imprinting, a powerful learning mechanism that enables chicks to quickly learn the features of specific social partners. While neurobiological studies have clarified that the substrates of spontaneous and learned preferences are at least partially distinct in chicks, evidence shows that spontaneous preferences might orient and facilitate imprinting on animate stimuli, such as the mother hen, and that hormones facilitate and strengthen preferences for predisposed stimuli. Subpallial regions of the so-called Social Behaviour Network (including e.g. lateral septum and nucleus teaniae) seem to be involved in spontaneous preferences while pallial regions in learning-plasticity associated with imprinting. Preferences towards animate stimuli are observed in human neonates as well. The remarkable consistency between the perceptual cues attended to by newborn babies and naïve chicks suggests that the attentional biases observed in babies are unlikely to result from very rapid post-natal learning, and confirms that research on precocial species can inform and guide human infant research with regards to both typical and atypical development. This has potentially important biomedical implications, opening new possibilities for the early detection of subjects at risk for autism spectrum disorders.

Biography:

Giorgio Vallortigara is Professor of Neuroscience at the Centre for Mind/Brain Sciences of the University of Trento, Italy. His main research interest is the study of cognition from a comparative and evolutionary perspective, with particular reference to the origins and mechanisms of number, space and object cognition. He also studied brain and behavioural

asymmetries, developing a seminal theory of the evolution of directional asymmetries. He has been the recipient of several honours and prizes, including, among others, the Geoffrey de St. Hilaire Prize for Ethology, and a doctorate honoris causa from the University of Ruhr in Germany.

Talks

Self-control vs. Inter-temporal Choice: two contrasting frameworks

Alex Kacelnik

University of Oxford, UK

Many behavioural studies implement scenarios where otherwise preferable goals take longer to achieve. Often, greater preference for Larger-Later (LL) over Smaller-Sooner (SS) rewards is interpreted as indicating more advanced cognition, higher self-control, or lower impulsivity. I shall argue that these interpretations unjustifiably assume a divided self, with an ‘impulsive’ moiety that favours SS and an ‘executive’ one that favours LL. Further, sustaining that stronger executive means higher cognition perpetuates the misleading practice of placing organisms in an ordinal cognitive scale. A preferable research program models decisions by integrating inter-temporal choice with foraging theory. The idea is that choices depend on two components of prospective outcomes’ utility, an increasing function of magnitude and a decreasing one due to temporal devaluation. Because both functions are non-linear, large differences in preference occur regardless of cognitive sophistication. Intervening variables in this approach are experimentally accessible and functionally interpretable, supporting proximate and functional behavioural research.

Do free-ranging dogs learn from one another?

Giulia Cimarelli¹, Clemence Helleu², Leo Hanon¹, Flavia Mercuri¹, Sarah Marshall-Pescini¹, Friederike Range¹

University of Veterinary Medicine Vienna, Austria¹; University of Jean-Monet, France²

Free-ranging dogs (FRDs) live in a complex, human-dominated environment, where learning from others could be advantageous. No study has investigated intra-specific social learning in FRDs, despite its relevance for dogs’ survival, human-dog conflicts, and conservation. We hypothesized that FRDs would be influenced by more knowledgeable others. Two novel food sources were introduced in the territory of four groups of FRDs. Beforehand, in three of the groups (as the fourth acted as a control), a male was trained to only approach one of the two food sources. During testing, dogs approached the new food sources at least once and, when making their first choice, they were influenced by previous choices of others. Afterwards, dogs explored also the second source and their choices were generally not influenced by others anymore. The influence of social relationship components (e.g. dominance) will be analysed to understand whether FRDs employ social learning strategies in such context.

Inhibitory control in two gull species: examining the subcomponents of stopping across contexts

Camille A. Troisi, Alizée Vernouillet, Reinoud Allaert, Sophia Knoch, An Martel, Luc Lens, Frederick Verbruggen

Ghent University, Belgium

Inhibitory control, the stopping of behaviour and thought, is crucial to deal with changes in the environment. Inhibitory control is, however, multifaceted in nature: many different components determine whether an individual can stop or not. This multifaceted nature may explain why many studies find little correlation between tasks measuring inhibitory control. Using 120 young herring and lesser black-backed gulls, we examined the relationship between different components of inhibitory control across 3 contexts. We found that going behaviour and stopping a discrete action were correlated across context, but stopping a continuous action was not. We also found that herring gulls were slower at going and stopping a discrete action compared to lesser black-backed gulls, and were more variable in their behaviour. Such species differences may be related to their use of the environment. Disentangling the different components of inhibitory control allowed us to examine such species differences in more detail.

Short talk

Fool me twice, shame on me. Can corvids adjust their caching behaviour depending on the identity of the observer?

Alizée Vernouillet¹, Nanxi Huang², Debbie M. Kelly²

Universiteit Gent, Belgium¹; University of Manitoba, Canada²

Caching species rely on food stores to survive when resources are scarce. Caching birds can lower the risk of losing their caches to others by modifying their behaviour to limit available information to observers. These cache protection behaviours can differ between species. However, evidence of whether individuals adjust their caching behaviour depending on the identity of the observer remains scarce. Here, we investigate whether caching birds can learn to distinguish between an observer that always pilfers their caches and an observer that never does. To do so, birds cache in the presence of a pilfering observer and of a bystander observer. We also compare the caching behaviour of two corvid species that depend on cached food but differ in their sociality – highly social pinyon jays and less social Clark's nutcrackers – to determine whether social species are better equipped to recognize individuals and adjust their behaviour accordingly.

Short talk

In the shadow of thought: exploring chimpanzees' perception of live and dead animals through categorization

André Gonçalves, Yuko Hattori

Kyoto University, Japan

Animals navigate through a sea of sensory input having to discern critical information – nutrition, danger, and conspecifics. Through the act of categorisation, they must distinguish between signals/cues involving the grouping of objects/occurrences into distinct categories mediated by concepts. Crucially, within this dynamic tapestry, corpses emerge as essential cues in their environment, signalling a spectrum of implications, including predation events, pathogens, or food resources. Visual markers of death are encapsulated by three core cues: inertia, injury, and decay. Given the evolutionary affinity between humans and chimpanzees, the latter serves as a promising avenue for probing the intricacies of categorisation and concept formation pertaining to death-related stimuli. Using touchscreen technology, we assessed chimpanzees' ability to symbolically and indexically categorise images of live and deceased animals. Our preliminary findings indicate a challenging process of symbol-matching, contrasted by promising outcomes in image prototype-matching providing insights into the elusive topic of death-perception in experimental settings.

Short talk

Conscious and unconscious vision in bumblebees?

Andrew Crump^{1,2}, Sam Gibson, Joanna Brebner³, Lars Chittka³, Anna Einarsson¹,
Jonathan Birch¹

London School of Economics & Political Science, UK¹; Royal Veterinary College, UK²; Queen Mary University London, UK³

Do animals have separate conscious and unconscious visual pathways? Humans have a subjective visual threshold (where the person reports perception) and an objective visual threshold (where the person detects the stimulus, without reporting perception). We tested 39 bumblebees (*Bombus terrestris*) in two interconnected arenas, with Arena 1 leading into Arena 2. Both arenas had black floors showing four grey dots, which yielded sugar rewards, and four no-dot locations, which yielded aversive quinine. Once bees learned to approach the grey dots, we reduced the dots' luminance, reducing contrast with the black background. We took opting-out behaviour (leaving Arena 1 for Arena 2) to indicate the bees' subjective visual threshold. Arena 2 was a forced version of the same task, so chance performance here indicated the objective visual threshold. However, there was no difference between the opt-out and chance thresholds. We, therefore, found no evidence of distinct subjective and objective visual thresholds.

Elephant cognition matters in efforts to conserve them

Joshua M. Plotnik

City University of New York, USA

As wildlife species continue to face human-driven impacts on their natural environments, the research of animal cognition scientists has grown increasingly more relevant for understanding how animals adapt to anthropogenic change. Asian elephants, an endangered species known for their social and cognitive complexity, face rapid habitat loss and increasing conflict with humans over resources across their entire range. In this talk, I propose that studying the cognitive abilities of elephants has important implications for their conservation, particularly in the development of conflict mitigation strategies that consider both human and elephant perspectives. I will briefly review my team's research on the elephant's physical and social cognition over the past 18 years, as well as the elephant's use of olfaction when making foraging decisions. I will also discuss our development of a long-term field site aimed at integrating the study of wild elephant cognition into the development of sustainable human-elephant conflict mitigation.

Short talk

Domestic pigs taking sides: rank and friendship effects in a two-choice test

Ariane Veit, Isabelle Fuxjaeger, Marianne Wondrak, Ludwig Huber

University of Veterinary Medicine Vienna, Austria

Pigs of mostly very young ages have been shown to use social learning to gather information about food locations. This study aimed to investigate whether also adult pigs use information of their group mates and whether this is based on their rank or relationship quality. Per observer (N=20) four demonstrator dyads were selected, differing either in rank or relationship quality to the respective observer. Observers were exposed to two minutes of presentation, in which the two demonstrators were eating each a differently scented food. The observer pig was then allowed to enter a test hut and given the choice between two food bowls, which were marked with the olfactory cues associated with the respective demonstrators. Results show that dominant observers preferred, as predicted, the affiliative demonstrator. Furthermore, pigs could quickly deduce their conspecifics' relative ranks, as observers preferred to stay near the relatively lower-ranking demonstrator during presentation.

Short talk

Where did I come from? Where will I go? Spatial learning and memory in geckos

Isabel Damas-Moreira¹, Eva Ringler², Birgit Szabo²

University of Bielefeld, Germany¹; University of Bern, Switzerland²

Spatial learning and memory are well studied in rodents, but especially understudied in non-avian reptiles, hampering our understanding of how different animals navigate space. We studied spatial learning and memory using a vertical and horizontal radial arm maze in the arboreal Tokay gecko (*Gekko gecko*), which likely evolved specific spatial cognitive adaptations to navigate vertical and horizontal space. Across 15 trials, geckos had to learn to only enter arms in which a live cricket was accessible while avoiding arms in which the cricket was blocked by inhibiting responding to movement cues produced by blocked crickets. We also investigated if geckos used maze internal or external cues and if they remembered the maze location after a week without training. We tested 10 adults and 8 sub-adult captive-bred males and females to understand how differences in maze orientation, sex, and age might influence learning and memory.

Short talk

Visual motion adaptation in the shore crab Carcinus maenas

Christian Drerup¹, James E. Herbert-Read^{1,2}, Martin J. How³

University of Cambridge, UK¹; Lund University, Sweden²; University of Bristol, UK³

The motion aftereffect (MAE) is a visual illusion that makes static objects appear to move following exposure to a moving visual scene. While MAEs have been described to occur in some animals when exposed to ecologically unrealistic scenes, it remains unknown whether natural visual stimuli elicit MAEs. A ubiquitous dynamic stimulus found in shallow aquatic habitats are caustics, mesh-like light patterns cast onto the substrate through wave-induced light flicker. In this study, we tested whether prior exposure to caustics affects the object detection in the shore crab *Carcinus maenas*. Individuals showed low response rates to objects immediately after being exposed to caustics, but object detection increased with prolonged time gaps between exposure to caustics and object presentation. This indicates *C. maenas* undergoes a neural adaptation to dynamically moving caustics which can persist after the caustics have ended, resulting in a MAE that temporarily impedes the visual system of *C. maenas*.

Short talk

Memory for stimulus sequences in bonobos

Johan Lind¹, Vera Vinken^{1,2}, Markus Jonsson³, Stefano Ghirlanda^{1,3,4}, Magnus Enquist¹

*Stockholm University, Sweden¹; Newcastle University, UK²; City University of New York, USA³;
Brooklyn College, USA⁴*

Humans exhibit a range of complex behaviours that are absent in other species (e.g., language, math). Various studies have investigated the potential mechanisms that underlie this apparent cognitive gap. Recently, it was proposed that instead of the cognitive processing of information, the preceding recognition and memorization of sequential information differentiates us from our closest relatives. As this idea has not been explicitly tested on non-human apes, we tested the hypothesis in bonobos' (*Pan paniscus*) and humans by exploring memory for single stimuli, discrimination between short stimulus sequences, and testing the memory-trace model (Ghirlanda et al., 2017). Results show that bonobos' general working memory decays rapidly and that they did not learn to discriminate between stimulus sequences. Contrarily, humans solve this task almost immediately. Our test of the memory-trace model was inconclusive. Overall, this study supports the idea that non-human animals lack a faithful memory for stimulus sequences.

Short talk

Gravity doesn't need to be learned: newborn chicks prefer stimuli that move against gravity

**Elisabetta Versace¹, Larry Bliss¹, Vera Vasas¹, Laura Freeland¹, Robyn Roach¹,
Elisa Ferrè²**

Queen Mary University of London, UK¹; Birbeck, University of London, UK²

At the beginning of their life, inexperienced animals use evolutionary-acquired preferences (predispositions, priors) to decide what stimuli to attend and approach. Stimuli that contain cues of animacy, such as face-like stimuli, biological motion and changes in speed, are particularly attractive across vertebrate taxa. A strong cue of animacy is upward movement against terrestrial gravity, because only animate objects consistently move upward. To test whether upward movement is spontaneously considered attractive already at birth, we tested the early preferences of dark-hatched chicks (*Gallus gallus*) for upward- versus downward-moving visual stimuli. We found that, without any previous visual experience, chicks consistently exhibited a preference to approach stimuli that move upward, against gravity. A control experiment showed that these preferences are not driven by avoidance of downward stimuli. These results show that newborn animals have a gravity prior that attracts them toward upward movement. Movement against gravity can be used as a cue of animacy to orient early approach responses in the absence of previous visual experience.

Baboon school bullies: constraints to individual performance on a multi-touchscreen cognitive study with wild chacma baboons

Simon P. Kenworthy¹, Guy Cowlshaw², Alecia J. Carter¹

University College London, UK¹; Institute of Zoology, UK²

The number of cognitive experiments utilizing touchscreen technologies has increased in recent decades. However, most studies have been conducted in captivity, limiting the applicability of conclusions to wild populations. This study forms the first multi-touchscreen cognition experiment in wild primates using desert chacma baboons (*Papio ursinus*). Four touchscreens were housed in separate cages presenting either a two-choice or a two-sequence rewarded task. Following a study on subject participation, where data were collected in two troops (149 individuals) over 21 days, individual baboon task performance was analysed alongside factors that have been demonstrated to impact primate cognitive functioning. Overall, task success was correlated with screen use for choice but not sequence tasks. Individual success was impacted by age, sex, rank, and presence of dominant individuals within 20m of touchscreen users. This study is the first to highlight constraints on the cognitive ability of wild primates in natural social conditions using touchscreens.

Short talk

Learning and reversal learning in wild bumblebees

Felicity Muth, Leeah Richardson, Smruti Pimplikar

University of Texas at Austin, USA

Species' cognitive traits are shaped by their ecology, and even within a species, cognition can reflect the behavioural requirements of individuals with different roles. Bumblebees have a number of discrete behavioural roles (castes) within a colony of closely-related individuals and thus offer a useful system to determine how behavioural requirements shape cognition. Queens are a critical point in the colony lifecycle, with presumably strong pressure for individuals to learn associations rapidly, yet they are greatly understudied when it comes to their cognition. Here I present work showing that queens of both captive (*Bombus impatiens*), wild (*B. vosnesenskii*) and parasitic (*B. insularis*) species are better at learning associations than foraging workers. A high learning performance may trade-off with learning new, or conflicting associations. I will also present results from a second experiment, where we test this in queens vs. workers of four wild-foraging bumblebee species.

Short talk

Does environmental enrichment impact reptile social cognition?

Agnese Crisante, Erin L. Rickman, Oliver Burman, Tom Pike, Anna Wilkinson

University of Lincoln, UK

Gaze following (aligning gaze direction with that of another individual) is considered adaptive as it alerts individuals to the presence of important stimuli in their environment. Environmental enrichment is an effective way to improve welfare and the additional challenges it provides impact cognition in mammals and birds, however, little is known about this in reptiles, particularly the impact of enrichment on social cognition. As reptiles are commonly kept as pets, it is critical to understand the effect that their captive environment has on their cognitive abilities. We therefore investigated how different housing conditions (standard vs. enriched) impact gaze following in bearded dragons. The lizards (n = 12) individually experienced each housing condition (order counterbalanced across subjects) for a period of 4 weeks before being given cognitive tests. Results showed that animals living in enriched environments gaze follow significantly more than animals housed in standard environments.

Short talk

Exploring pastoralist-elephant interactions in northern Kenya using an experimental playback design

Jemima Scrase, Lucy Bates, George Wittemyer

University of Sussex, UK

Human elephant conflict has overtaken poaching as the leading cause of human-induced elephant fatalities in Northern Kenya. It is presumed that a proportion of conflict events occur when elephants encounter pastoralists guarding livestock. Pastoralists produce a specific call to deter elephants from sites of resource competition. Here, I assess whether elephants respond appropriately to human cues, and explore whether inter-species communication could function to mitigate conflict interactions. Using an experimental design, we compared the behavioural reactions of free-ranging elephant families in response to recordings of pastoralist voices of opposing valences (neutral conversation or deterrent calling) accompanied with or without livestock sounds. Previous research indicates that elephants have advanced categorisation abilities and can discriminate different human groups from vocal cues alone. Given the role matriarchs play in translating threat-categorisation into appropriate group responses, we predict that families led by younger, inexperienced matriarchs, will exhibit inferior decisions in response to the simulated threats.

Canine perspective taking

Ludwig Huber, Lucrezia Lonardo, Christoph Völter

University of Veterinary Medicine Vienna, Austria

Research about the dog-human relationship has provided evidence for the ability of dogs to discriminate our facial expressions, copy us, follow us, and even take on our perspective. By being sensitive to where we look and what we see, dogs manage to infer and anticipate what we do next. In recent experiments, we could further show that dogs take our perspective by using geometrical gaze-following and by reacting differently to misleading suggestions of human informants that have either a true or false belief about the location of food, which, until very recently, was only conceded to humans and great apes. Especially the latter findings gave us reason to suggest that pet dogs might be sensitive to what others see, know, intend, and believe. The cumulative knowledge of how dogs perceive and understand us is important for our appraisal and appreciation of the very nature of *Canis familiaris*.

Endothermy - the cognitive revolution

Mathias Osvath

Lund University, Sweden

Major transitions in animal evolution are often accompanied with neuroanatomical changes. One of the most dramatic transformations occurred with the emergence of endothermy, resulting in a twentyfold increase of brain neurons. Endothermy evolved independently in mammals and dinosaurs, and today birds and mammals share cognitive functions and a flexibility seemingly unmatched by ectotherms. Despite that endothermy likely sparked a cognitive revolution, this area remains surprisingly understudied. The Sauropsida offer an ideal context to investigate the cognitive shift from ectothermy to endothermy, because of the wide array of related extant species falling on both sides of the thermoregulatory spectrum. I will present some of our ongoing comparative research on sauropsids ranging from palaeognath and neognath birds, to crocodylians, turtles, and lizards. I will also speculate on why endothermy might have extended the mind of animals. Further, I will suggest future avenues of research.

Sleep loss impairs cognitive performance in Australian magpies

Robin D. Johnsson¹, Farley Connelly², Juliane Gaviraghi Mussoi³, Alexei L. Vyssotski⁴, Kristal E. Cain³, Timothy C. Roth II¹, John A. Lesku⁵

Franklin and Marshall College, USA¹; Alameda County Resource Conservation District, USA²; University of Auckland, New Zealand³; University of Zurich/ETH Zurich, Switzerland⁴; La Trobe University, Australia⁵

Sleep supports optimal brain functioning and facilitates behavioural flexibility while awake. Compared to mammals, we know little about the role of sleep in facilitating cognition of birds. We investigated how sleep deprivation (SD) over a full-night (12 h) or half-night (6 h) affects performance on a reversal learning task in Australian magpies (*Gymnorhina tibicen*), relative to that after a night of undisturbed sleep. Each sleeping condition (12, 6, or 0 h SD) was preceded and followed by a baseline and recovery night of sleep, respectively. We found that sleep-deprived magpies were slower to attempt the reversal learning task, less likely to perform and complete the task, and those that did the test performed worse than better-rested birds. These results indicate that sleep loss impairs motivation and cognitive performance in a social songbird.

Short talk

Understanding collective behaviour across systems and scales

Jitesh Jhawar

Ahmedabad University, India

Animal groups are fascinating examples of collective behaviour systems present in nature - from flocks of birds to schools of fish and societies of social insects such as ants and bees. To predict and understand such behaviours, it is important to understand the mechanisms that the individuals use within a collective. Recent advances in this direction have led to generating complex and large datasets. In the past, my work involved analysing such big data of movement of animals and building mathematical models that can explain the observed patterns using simple rules of behaviour. In this talk, I will introduce my work across these different collective systems including fish, beetles, and honeybees. Through this talk, I hope to highlight how mathematical models and certain quantitative techniques can help to understand animal behaviour across scales of collective systems.

Short talk

Innovative problem solving by wild falcons

Katie J. Harrington¹, Remco Folkertsma¹, Alice M. I. Auersperg¹, Laura Biondi^{2,3}, Megan L. Lambert¹

University of Veterinary Medicine Vienna, Austria¹; National University of Mar del Plata, Spain²; National Scientific and Technical Research Council, Spain³

Innovative problem solving is an expression of behavioural flexibility that affects species ecology and evolution by enabling new resource and niche exploitation. We introduce a new and highly relevant model species for innovation and problem solving, striated caracara (*Phalacrocorax australis*), a falcon species that shows levels of curiosity and neophilia rarely found in birds. We presented wild individuals with a novel, 8-task puzzle box to assess individuals' manner, rate and flexibility of innovative problem solving over repeated exposure. Striated caracara performed at rates comparable to tool-using parrots, reaching near ceiling levels of innovation in a remarkably short number of trials, repeatedly and flexibly solving the tasks and displaying rapid learning of responses as they did so. We attribute our findings to the birds' ecology including their geographic restriction, resource unpredictability, and extractive foraging and generalist lifestyle, and encourage future work investigating the cognitive abilities of these birds in the wild.

Short talk

Revisiting the baby schema by a geometric morphometric analysis of infant facial characteristics across great apes

Yuri Kawaguchi¹, Koyo Nakamura², Tomoyuki Tajima³, Bridget M. Waller¹

Nottingham Trent University, UK¹; University of Vienna², Austria; Osaka University, Japan³

Infants across species are thought to exhibit specific facial features ("baby schema"), with an adaptive function to induce caretaking behaviour from adults. There is abundant empirical evidence for this in humans, but the existence of a baby schema in non-human animals has not been scientifically demonstrated. We investigated which facial characteristics are shared across infants in five species of great apes: humans, chimpanzees, bonobos, gorillas, and orangutans. We analysed eight adult and infant faces for each species using geometric morphometric analysis. We found three features characterizing infant faces consistently observed across species. These included (1) relatively bigger eyes located lower in the face, (2) a rounder face shape, and (3) an inverted triangular face shape. While these are shared, human infant faces are unique in that the second characteristic is more pronounced, whereas the third is less pronounced than other species. We also found some species-specific infantile features.

Short talk

Too hot to reason? The effect of experimental heatwaves on cognitive traits in the guppy

Merel C. Breedveld, L. Dudine, S. Padovan, C. Gasparini

University of Padova, Italy

Heatwaves are occurring at increasing frequency and intensity under ongoing climate change. By inducing thermal stress, heatwaves could impact cognition, including the processes through which individuals collect, process, retain, and use information gathered from the environment. As cognition underlies essential fitness-related behaviours, understanding how heatwaves affect cognition is crucial. Here, we exposed male guppies (*Poecilia reticulata*) to an experimental heatwave, to determine the effects on cognitive performance. Immediately after heatwave exposure in one group we tested spatial memory and learning ability in a mate-search maze, and in another group a suite of other cognitive tasks. The preliminary results indicate heatwaves can deteriorate learning and spatial memory and that they may influence cognitive capacities underlying anti-predatory responses. These findings promise to add evidence to a small but growing body of studies pointing to negative consequences of heatwaves on cognition, which could underlie behavioural responses under the current scenario of climate change characterized by extreme events.

Chimpanzees intercepting moving prey in virtual environments

**Sarah E. Koopman¹, Emilie Rapport Munro¹, Ken Schweller², Sean P. Anderson³,
Francine Dolins⁴, Max Kleiman-Weiner⁵, Richard Lewis³, Lauren Robinson³,
Josep Call¹**

University of St Andrews, UK; Ape Initiative, USA²; University of Michigan, USA³; University of Michigan-Dearborn, USA⁴; Massachusetts Institute of Technology, USA⁵

Chimpanzees hunt in groups in the wild, but the cognition underlying this behaviour is debated, and difficult to study in detail due to poor visibility and other constraints. Virtual environments provide a way to study behaviour and cognition in these kinds of complex scenarios, as they afford greater control over environmental variables than field studies and the ability to use larger environments in captive settings. I will present studies examining the ability of chimpanzees to intercept moving prey in virtual environments presented on a touchscreen. We first investigated whether chimpanzees could intercept prey that moves too fast to catch by chasing, and how adaptable this ability is to different situations. We then examined whether chimpanzees could learn to intercept by watching a virtual ape demonstrator.

Short talk

Apples and oranges? The case of comparative cognition in avian and insect pollinators

Maria C Tello-Ramos¹, T. Andrew Hurly², Susan D. Healy¹

University of St Andrews, UK¹; University of Lethbridge, Canada²

The size of a hummingbird's brain is not only orders of magnitude larger than that of a bee, but its morphology is also vastly different. And yet, their foraging from hundreds of flowers in a day is equally effective. While hummingbirds and bees seem to converge in the types of information they can learn when foraging from a single flower (e.g., colour, location, time of day), recent experiments suggest that when solving multiple-destination problems, these animals use different strategies: from the outset hummingbirds develop repeatable routes by visiting each nearest neighbouring flower, while bees develop optimal routes through trial and error. Does this mean that hummingbirds and bees use information differently? I will discuss how comparing the development of foraging routes can help us understand how different brains faced with solving a similar task may direct attention, manage, perceive, or process information in different ways.

Short talk

The value of non-instrumental information in a teleost fish

Tiago Monteiro^{1,2}, Victor Ajuwon², Mark Walton², Alex Kacelnik²

University of Aveiro, Portugal¹; University of Oxford, UK²

Pigeons, starlings, rats, monkeys and even humans show strong preference for advanced information, even if it does not improve future outcomes, a phenomenon known as 'paradoxical choice'. We investigate this in goldfish, aiming to compare widespread principles of reinforcement learning in vertebrates and gain insight into the evolutionary origins of information-seeking behaviour. Goldfish (*Carassius auratus*; n=8) chose between two alternatives, both offering a 50% chance of reward after a short delay. Choosing the 'informative' alternative caused the onset of stimuli that anticipated the trial's outcome (reward/no reward), while choosing the 'non-informative' option triggered stimuli that were not predictive of that trial's outcome. Goldfish discriminated these stimuli, but in contrast to mammals and birds, showed no preference for the informative alternative in choices. Overall, our results open the possibility that the utility of advanced information differs across species, which have implications for our understanding of its mechanistic underpinnings and evolutionary origins.

Short talk

Performance in a reversal learning task predicts the outcome of aggressive interactions in pigs

Victoria E. Lee¹, Lucy Oldham¹, Agnieszka Futro¹, Mark Brims¹, Marianne Farish¹, Gareth Arnott², Simon Turner¹

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The outcomes of animal contests influence fitness and can impact evolutionary processes. Learning plays an important role in contests, but less is known about how individual variation in learning abilities influences contest dynamics and resource holding potential (RHP). We investigated the relationship between learning performance and RHP in domestic pigs, by training pigs on a spatial discrimination task to assess acquisition learning and a reversal learning task to assess cognitive flexibility. The relationship between learning performance and RHP was examined by staging dyadic contests between unfamiliar individuals. After accounting for relative weight, pigs that succeeded in the reversal learning task had a higher probability of winning the contest than pigs that failed the task. Acquisition learning performance did not predict contest outcome. Our findings highlight the important role of cognitive flexibility in animal contests, which could be applied to mitigate aggression in farmed pigs, particularly as this is a major welfare issue.

Short talk

Syntax in wild bonobos

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Through combining words, humans can generate an infinite number of meaningful constructions. Recent work suggests that our closest-living relatives, chimpanzees, also combine calls in non-random ways potentially serving to help manage social interactions specifically in low-ranked individuals. Here, we follow-up these findings through investigating whether bonobos, *Pan paniscus*, also combine calls, and how they use these combinations. We conducted 150h of focal recording of wild bonobos at the Kokolopori Bonobo Research Project (DRC). Using collocation analyses, an approach initially developed in computational linguistics, we found that bonobos can combine calls in non-random ways. Furthermore, whilst most call combinations are bidirectional (e.g. we observe AB and BA combinations), some only occur in one direction: for certain combinations, order may be important. Further statistical analyses show that combinations are used differently between contexts and individuals, suggesting that, like in chimpanzees, bonobo combinatorial capacities are driven by a variety of socio-ecological factors.

How nest-building ecology influences behaviour, learning, and memory

Lauren M. Guillette, Connor T. Lambert, Julia Self, Cailyn Poole, Nicole Gerle, Harleen Kooner, Maryam Abdelhamad

University of Alberta, Canada

The Animal Cognition Research Group asks questions about the roles of learning and memory in nest-building behaviour. We used a foraging board to measure learning speed (i.e., trials to criterion) over a series of material (string) discrimination tasks with more than 70 zebra finches. Some tasks tested aspects of physical cognition directly relevant for nest building (e.g., discriminating material length and flexibility), which we predicted would be easier for males to learn because they are the primary nest builder. Another task, colour discrimination, was not directly relevant for nest building, so we predicted no advantage for males. While we found sex differences in how males and females interacted with the tasks, these differences did not translate to differences in learning speed in the predicted directions. Females learned one task significantly faster than males, but males had better memory for the learned discrimination when tested up to a year later.

(Very) Early Career Poster Session

1. Use of social information in Critically Endangered Bali myna, Leucopsar rothschildi

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Social learning is an important skill for adaptation, particularly in relation to rapidly changing environments for threatened species, which can provide flexibility of learning at a lower cost. Bali myna (*Leucopsar Rothschildi*) is a Critically Endangered bird species, which is the focus of reintroduction initiatives with mixed results. Gathering cognitive and behavioural data is important for improving conservation strategies involving pre-release behavioural manipulation and assessment of individual suitability for release. This study tested social influences on learning in 25 captive Bali myna. In four problem-solving tasks, subjects had the opportunity to observe a model before interacting with various stimuli for rewards. We found evidence for enhancement, where subjects attended to the same location as the model, and adults interacted more quickly than subadults. Further, social context influenced Bali myna behaviour as singly housed birds interacted more than socially-housed birds. This information will prove valuable to optimizing pre-release training strategies.

2. Adaptive acclimatisation in the mouse model to improve welfare standards

Kirsty A. Brunt

Flinders University, Australia

Moving any research animal from one facility to another is stressful, so allowing them time to acclimate into new surroundings before procedures start is crucial to their wellbeing. But is it enough to just weigh them and make sure they look ok each day? Working closely with the team veterinarian and using cognitive learning, we have adapted our acclimatisation period to include decision making whilst being introduced to a variety of project-specific and species-specific experiences. Alongside improved housing conditions, and improved researcher training, our mice are calmer, more willing to actively engage with handlers and their environment and have shown no negative behaviours typically associated with distressed research animals. This presentation is to share the techniques we have used, the long-term benefits that we have witnessed and how easily this could be adapted to improve welfare at all stages of their lives.

3. Investigating the effect of visitor and feeding schedule on object manipulation behaviour in Asian short-clawed otters (Aonyx cinereus)

Iwan Evans, Andrew Cooke, Jonathan Cooper, Beth Ventura

University of Lincoln, UK

Asian short-clawed otters engage in intricate activities using their paws as means of food extraction, exploration, and tactile communication within their social group. Our study aims to explore the association of visitor density and feeding time on object manipulation such as “stone juggling”. Four motion-activated trap cameras were positioned around the otter exhibit at Lincolnshire Wildlife Park, Lincolnshire, UK [n=6 otters, 4 male, 2 females], which when activated captured behaviour for 20 seconds. Admittance data from the zoo was used as a proxy for guest density per day. Data collection and analysis are ongoing, but preliminary findings suggest that otters tend to rock juggle out of sight of guests. Understanding how feeding and visitor pressure affect expression of object manipulation in otters may shed light on the causes and function of these behaviours, which may be useful in informing management to promote otter welfare.

4. Individual variation of neophilia in kea parrots

Cornelia Habl¹, Melissa Krismer¹, Tiziana Srdoc², Remco Folkertsma¹, Megan Lambert¹

University of Veterinary Medicine Vienna, Austria¹; University of Vienna, Austria²

The kea (*Nestor notabilis*) is a protected parrot species endemic to New Zealand renowned for its strong affinity for novelty, a phenomenon known as neophilia. While their novelty seeking behaviour has been well documented, its contextual boundaries remain unexplored. Our study addresses this gap by aiming to profile the costs and limitations of neophilia on an individual level. We are recording keas’ novelty responses on three separate two-choice tasks: (1) novel object vs. familiar object, (2) novel object vs. familiar food, and (3) novel food vs. familiar food. To simulate different availabilities of resources, in the ephemeral condition, subjects are only allowed to interact with their first choice, while in the stable condition, both items remain available throughout the trial. The results of this study will advance our understanding of keas’ unique behaviour, and a profile of neophilia for each individual will provide a reference point for future research.

5. Sweet temptation: the effects of ego-depletion and glucose administration on rats

Jake Hargrave, Jacoby Cefalu, Kalyn Otzelberger, Julia Meyers-Manor

Ripon College, USA

The strength model of self-control asserts that as glucose is depleted, self-control declines, indicating that consuming glucose could improve self-control (Gailliot & Baumeister, 2007). Previous research in our lab found that rats showed depletion of self-control and reversal following glucose. The current study aimed to replicate our prior experiment while reducing the delay for reward from a 10-second delay to a 5-second delay. Ten rats were tested between a larger, later reward or a sooner, smaller reward via two levers. The subjects' base percentages of responding to the larger, later reward were compared following a stressor to reduce self-control and then orally administered glucose, saccharin, or flavoured water in counterbalanced order. The results of the experiment showed no significant difference between responding in any of the conditions. The results may indicate that glucose does not have a substantial effect on self-control or that smaller delays cause a ceiling effect.

6. The nine faces of the wolf: Wolves (*Canis lupus*) can convey emotional responses via facial expressions, which gives insights into their sentience

Elana R. Hobkirk^{1,2}, Sean D. Twiss¹

Durham University¹, UK; Durham Falconry Ltd., UK²

Wolves (*Canis lupus*) are frequently used as a model for describing the social behaviour of group-living animals. Communication within wolf packs reduces aggression and maintains pack cohesion and stability. Wolves are considered to produce facial expressions which they use to convey 'emotional' states. However, to date, there is no quantitative research linking specific facial expressions to specific emotional states in wolves. Using the Dog Facial Action Coding System (DogFACS) and Linear Discriminant Analyses (LDA), for the first time, this research quantifies and classifies nine emotional facial expressions of wolves: anger, anxiety, curiosity, fear, friendliness, happiness, joy, interest, and surprise. This research demonstrates that wolves are more communicatively complex than previously considered and gives insights into how sentient wolves are. In addition, the methods used in this research have the potential to provide a non-invasive tool to assess emotional states across mammalian species, which could prove beneficial for animal welfare purposes.

7. Honeybees can resist everything but yellow – visuo-motor lateralization in Apis mellifera: flight speed differences in foraging choices

Daide Liga¹, Gionata Stancher², Elisa Frasnelli¹

University of Trento, Italy¹; Rovereto Civic Museum Foundation, Italy²

This study investigates visuo-motor biases in free-flying honeybees by analysing foraging choice preferences in a Y-maze. Bees were trained to associate a visual stimulus (blue or yellow target) to a reward/punishment. We assessed for each bee the directional choice for one of the two identical targets placed in the arms of the maze and the flight times to reach the chosen target. The results revealed a significant directional preference only at the individual level and discovered the influence of both direction and colour on flight times. Overall, bees took less time to choose the stimulus in the left arm. Furthermore, the yellow target, when punished, was reached on average faster than the blue target, with a higher number of no-choices for punished blue targets than for punished yellow targets. This opens new perspectives not only on the study of lateralization in honeybees but also on their chromatic preferences.

8. Relationships between empathy measures in dogs

Kalyn Otzelberger¹, Jacoby Cefalu¹, Jake Hargrave¹, Teresa Romero², Julia Manor¹

Ripon College, USA¹; University of Portsmouth, UK²

Understanding how human emotions affect dogs is important for understanding the impact we make on our companion animals. The present study examined the relationship between multiple measures, including: an empathy survey, response to emotion, contagious yawning, physiological measures, and a cognitive bias task (CBT). We found that owner's report of the dog's empathy was predictive of person-oriented behaviour during crying. We found that dogs responded to people most during crying and second highest in laughing. Neither contagious yawning nor the CBT were related to empathy responses. Our results suggest that dogs are aware of the emotional states of others and will respond when someone is in distress. Our findings also suggest that although dogs may respond to emotions, the exposure to emotions does not impact their own emotional state or that transitory emotional states are not well-measured by the CBT.

9. A bird's eye view of weight: do kea rely on visual cues to infer weight?

Tessa Parker¹, Sarah Jelbert², Megan L. Lambert³

University of Vienna, Austria¹; University of Bristol, UK²; University of Veterinary Medicine, Vienna, Austria³

In this study, we aim to test whether kea (*Nestor notabilis*) can use the visual cues of size, material, apparent density, and quantity to determine the weight of an object prior to directly interacting with it. The kea were trained to drop either a light or heavy object into a box. In this study, the kea are presented with pairs of objects – one light and one heavy – from the four different categories and were rewarded for dropping the object of their target weight into the box. We measured i) which object the birds first contacted, ii) whether they switched after contact with incorrect objects, and iii) which object the birds dropped into the box. The results from this study will provide insight into whether kea can use visual cues to infer weight and, if so, which visual cues they rely on.

10. Why work when not motivated? The role of motivation in cognitive test performance

Inés Sánchez García¹, Piero Seddaiu², Irene Camerlink²

University of Edinburgh, UK¹; Polish Academy of Sciences, Poland²

In cognitive tests, individuals insufficiently engaged with the task might show poor performance despite their actual cognitive abilities. This may result in drop-outs and hence underpowered studies. Therefore, we aimed to investigate the role of motivation on test performance in pigs (*Sus scrofa domesticus*), an important species in cognitive and biomedical research. Male and female pigs (n=25), housed in either barren or enriched conditions, were assessed for their motivation to voluntarily leave their siblings' group to go to the test arena, where they could complete a spatial memory task (holeboard test). The results showed that highly motivated pigs had better short-term memory (p=0.003) and a shorter trial duration (p=0.001). Enriched-housed pigs were more motivated to participate in the test (p=0.024). Holeboard test performance improved across trials (p<0.001) but was unaffected by the housing conditions (p>0.05). This suggests that motivation played a role in pigs' cognitive test performance.

11. Evolutionary Roots of Decision-Making Under Risk: Risk Preference in Squirrel Monkeys (*Saimiri sciureus*)

Olivia E. Varley, Miya Kannampurackal

Newcastle University, UK

We examined risk preference in squirrel monkeys (*Saimiri sciureus*) at Living Links Research Centre at Edinburgh Zoo. The study aimed to explore whether risk-proneness in squirrel monkeys aligns with the ecological rationality hypothesis, which posits that species' decision-making patterns map onto their wild foraging ecology. Species exploiting uncertain food sources prefer risk, while those relying on constant food sources avoid it. Squirrel monkeys have an opportunistic diet in the wild, feeding mainly on insects and fruits which are unpredictable. Therefore, we expected them to be risk-prone. Utilizing a novel choice task adapted from previous research, seven squirrel monkeys were presented with choices between a 'safe' and a 'risky' option using containers of differing valued food rewards. Like chimpanzees and capuchins who have similar feeding ecologies, squirrel monkeys exhibited a significant preference for risky options, suggesting that risk-proneness is an adaptive response to the challenges of foraging for valuable food resources.

Evening Poster Session

1. Beware of my face: the role of configuration in predator recognition

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Holistic object perception simultaneously evaluates the presence and configuration of individual object properties. This type of perception has been repeatedly demonstrated in human face recognition. Holistic perception has also been demonstrated in a number of other animals but has not yet been adequately tested in birds. Moreover, it has not been tested at all in predator-prey relationships. In experiments in aviaries, untrained wild great tits were presented with modified European sparrowhawk dummies. We observed the behaviour of the tits before and during the presentation of the tested dummies. We also provided control dummies, such as a harmless domestic pigeon and an unmodified dummy of a sparrowhawk. We recorded the reactions of 420 tits. We can conclude that the tits perceived not only the presence of the key features but also their configuration. In this presentation, I will focus on the first half of our results concerning face modifications.

2. Consequences of Komodo dragon habituation to humans in Komodo National Park

Ardiantiono1,2, Tim S. Jessop2,3, Deni Purwandana2, Claudio Ciofi2,4, M. Jeri Imansyah2, Maria Rosdalima Panggur5, Achmad Ariefiandy2

University of Kent, UK1; Komodo Survival Program, Indonesia2; Deakin University, Australia3; University of Florence, Italy4; Komodo National Park, Indonesia5

Increasing tourism in Komodo National Park has inevitably exposed the endemic Komodo dragons to humans. We evaluate how human activities affected Komodo dragons' behaviour and wider consequential effects on the Komodo dragon population and human-Komodo interaction. We compared Komodo behavioural, phenotypic (body size and condition), and demographic (age, sex ratio, survival) responses across 10 sites with varying levels of human activities. Komodo dragons exposed to tourism exhibited habituated responses to humans. In these areas, supplementary feeds were used to attract Komodo dragons to viewing sites. The feeding caused alterations in Komodo behaviour (e.g., less wariness and increased intra-species competition) that resulted in adult-biased population structure which could be detrimental to long-term Komodo populations. Moreover, Komodo habituation can contribute to increased human-Komodo conflict incidences. Deeper consideration is needed on how benefits of tourism can be optimized within a sustainable framework to promote human-Komodo coexistence and support long-term populations of these iconic dragons.

3. Are Tonkean macaques able to make intuitive statistical inferences?

Alice Beaud¹, Alyzé Detourbet^{1,2}, Sébastien Ballesta¹, H el ene Meunier¹

University of Strasbourg, France¹; Sorbonne Paris North University, France²

Making predictions about uncertain events has ecological relevance for many species. Recent research showed that infants, great apes, and capuchins were able to predict the nature of samples randomly drawn from two populations by reasoning about proportions. But it is still unclear whether Afro-Eurasian monkeys possess this ability. To better understand the evolutionary origins of this skill, we assessed the ability of Tonkean macaques (*Macaca tonkeana*) to consider proportions when making an inference from two options differing in their relative distribution of a preferred and nonpreferred food item. Results suggested that Tonkean macaques' decisions both relied on absolute and relative quantities of the preferred food item. More detailed analyses revealed a substantial inter-individual variability in decision-making strategies. Our results support an evolutionary ancient origin of intuitive statistical reasoning. However, the high cognitive demands of such capacity might explain the motivation of some animals to use simpler heuristics in daily decisions.

4. Cognitive control in distracted dinosaurs

Thibault Boehly, Mathias Osvath, Stephan A. Reber

Lund University, Sweden

Cognitive control is a skill used to control one's own behaviour to reach a goal. We compared this skill across archosaurs by using the distraction task on American alligators, emus, chickens, and common ravens. We investigated whether the animals would still find a food reward hidden behind one of two identical opaque barriers after picking up a food distraction. Results show that all species can find the hidden food reward despite being distracted, but the presence of a distraction impaired the performance of all species except the common raven. All species being from the clade Archosauria, it suggests that cognitive control is a conserved ability which underwent little changes since their last common ancestor, allowing us to draw some inferences about extinct related taxa (e.g., non-avian dinosaurs). Moreover, the raven's unflinching performance could be explained by the sharp increase in telencephalic neuron numbers which occurred in the clade *Telluraves*.

5. On the opportunities offered by recording ultrasonic vocalisations (USV) to investigate the behaviour of laboratory rats

Vincent Bombail¹, Sarah M. Brown², Tayla J. Hammond^{1,2}, Gaëlle Champeil-Potokar³, Olivier Rampin³, Isabelle Denis³, Nicolas Darcel³, Birte L. Nielsen⁴, Alistair B. Lawrence^{1,2}

Scotland's Rural College, UK¹; University of Edinburgh, UK²; University Paris-Saclay, France³; Universities Federation for Animal Welfare, UK⁴

Rats produce USV in response to several stimuli, we propose their recording and analysis is a simple way to gain information on cognitive processes. Broadly speaking, USV calls of frequencies around 22kHz and 50kHz are associated with negative or positive stimuli, respectively. Individual variability in USV production patterns might also inform on the characterisation of endophenotypes in experimental animals. More recently, we and others have reported that analysing 50kHz USV, and their acoustic properties, might reveal insights into laboratory rat behaviour. We present data on the usefulness of USV measures in olfactory conditioning of heterospecific play, the study of positive welfare interventions, and we show that rats chirp with their mouth full. Further work on USV significance should be informed by studying behavioural correlates of vocalisation production. Recording rat USV is a promising, non-invasive tool to investigate emotional states and individual variability in response to stimuli.

6. Social knowledge in an open social network: how do female dolphins assess male quality?

Alice Bouchard¹, Simon J. Allen^{1,2,3}, Richard C. Connor⁴, Michael Krützen³, Stephanie L. King^{1,2}

University of Bristol, UK¹; University of Western Australia, Australia²; University of Zurich, Switzerland³; University of Massachusetts, USA⁴

Despite broad interest in studying the evolution of social intelligence, few studies have investigated how animals acquire and use social knowledge. In Shark Bay's bottlenose dolphin population, reproduction presents different challenges for males and females; cooperation between males is crucial for their reproductive success while females need to balance costs of sexual coercion with the necessity to reproduce. While there is evidence of associative concept learning in males who form multi-level alliances to coerce females, little is known of how females apprehend their relationships with males and if and how they assess male quality. As a step to addressing this, we analysed long-term data to assess drivers of mixed-sex social relationships in this population. We found that, although female male associations are mostly driven by home range overlap and long-term familiarity, females also associate more with males whom they might perceive as "better quality", indicating some form of social knowledge accrual.

7. Sensory processing during mate choice in swordtail fish

Kathryn Bullough, Bram Kuijper, Laura Kelley

University of Exeter, UK

Mating preferences among conspecifics are often influenced by the magnitude of sexual signals, indicative of signaller quality. While it is often assumed that these signals are perceived linearly by the receiver, increasing evidence suggests that stimuli perception may be subject to nonlinear discrimination and cognitive constraints. An example of this is through proportional processing (Weber's Law), where discrimination between signals is based upon their proportional difference rather than their absolute difference. I aim to use green swordtail fish (*Xiphophorus helleri*) to illustrate this type of cognitive processing of visual signals (tail length, colour intensity, etc.) during mate choice, demonstrating the first comprehensive cognitive analysis of psychophysical laws in a visually-based receiver. I shall also explore the evolutionary outcomes of integrating proportional processing into many generations of sexual selection. This would determine whether Weber's Law drives signal limitation, exaggeration, or elaboration, a topic which has been debated for over a decade.

8. From monkeying around to tooling around? The role of object play in the acquisition and expression of tool use in long-tailed macaques

**Camilla Cenni^{1,2}, Christina Nord^{1,3}, Jessica B. A. Christie⁴, I Nengah Wandia⁵,
Jean-Baptiste Leca^{1,6}**

University of Lethbridge, Canada¹; University of Mannheim, Germany²; University of California Davis, USA³; University of Edinburgh, UK⁴; Udayana University, Indonesia⁵; National Institute of Advanced Studies, India⁶

Object play is believed to facilitate tool use in its development and evolution, but empirical support for this claim is limited. We assessed whether a cultural form of object play called "stone handling" promotes the acquisition and expression of stone-tool use in a free-ranging group of Balinese long-tailed macaques. Using field experiments, we tested whether individuals "stone handling" profiles predicted their ability to solve foraging tasks using stones as tools. Frequentist network-based diffusion analysis, Bayesian multilevel regression modelling, and description of individuals learning trajectories suggest that stone-tool-assisted foraging depended on various social and asocial learning strategies. Certain stone handling profiles, as well as other trait- and state-dependent variables, contributed to explaining variation in stone-tool use. This is the first study to experimentally evaluate the role of stone-directed play in the expression of stone-tool use. It has implications for understanding the ecology and evolution of lithic technology in early humans.

9. Artificial light at night impairs fish cognition

**Gaia De Russi¹, Tyrone Lucon-Xiccato¹, Cristiano Bertolucci², Stefano Cannicci³,
Elena Maggi¹**

University of Ferrara, Italy¹; University of Florence, Italy²; University of Pisa, Italy³

Artificial light at night (ALAN) is one of the most pervasive sources of pollution and is often observed in aquatic habitats. As light profoundly alters the nervous system's physiology, ALAN can potentially affect animals' cognition, an impact that has not yet been investigated in aquatic species. We exposed zebrafish (*Danio rerio*) to either control or ALAN conditions to compare their cognitive abilities. ALAN exposure affected cognitive flexibility, but not learning, in a colour discrimination and a spatial task in adult fish. The cognitive alterations emerged even at the larval stage following a short exposure to ALAN during eggs' development. Moreover, we found that ALAN disrupted covariations between cognitive and personality traits, suggesting an effect on individual differences. Overall, our study indicates that ALAN has significant effects on fish cognitive abilities that can be problematic for wild populations exposed to this form of pollution.

10. How do birds stop? An investigation into the core cognitive mechanisms of response inhibition

Anneleen Dewulf¹, Joah R. Madden², Luc Lens¹, Frederick Verbruggen¹

Ghent University, Belgium¹; University of Exeter, UK²

Response inhibition (RI), or the stopping of actions, is considered a key component of flexible and adaptive behaviour. Across disciplines, RI is often treated as a unitary cognitive mechanism. However, we propose that RI consists of a chain of cognitive processes, including the detection of a stop signal and the implementation of the selected action (which is, in the case of stopping, the suppression of motor output). Here, we present preliminary data from two studies on juvenile herring gulls. In our first study, we partially replicated previous work on how stopping performance in the detour task improves when the perceptual features of the barrier match the ecological niche of the species, highlighting the importance of signal detection for RI. Next, data from a continuous RI task indicate that the implementation component of RI should be further decomposed into a salience-related pause followed by a stop-specific cancellation process.

11. Chickens produce different vocalisations on their first day of life by combining multiple acoustic features

Michael G. Emmerson, Laura Freeland, Shuge Wang, Elisabetta Versace

Queen Mary University of London, UK

Young animals often undergo long periods of development to attain adult vocal communication patterns, but other species exhibit more mature vocal capabilities early in life. Young chickens produce several call types at hatch, like pleasure calls during social interaction and contact calls during social separation. What acoustic features drive the difference is unclear, and addressing such a question could reveal the uses and maturity of a chick's vocal communication. Here, we recorded and quantified acoustic features of pleasure and contact calls of Ross 308 chicks one day post-hatch. All features differed on average between categories, but with overlap that was reduced after factor reduction to reduce features to a single representative variable. Chicks therefore don't have categorically distinct call features at hatch but combine features to make different calls. Such call maturity reflects a chick being able to exchange multiple information signals and engage in complex social interactions during early-life.

12. The effects of cognitive biases on heterospecific alarm call recognition in meerkats and yellow mongooses

Nikola Falk, Stuart K. Watson, Vanessa Rüegg, Marta Manser

University of Zurich, Switzerland

Alarm signals are highly diverse in their acoustic structure, even across phylogenetically close species. Nevertheless, it is often reported that animals respond to heterospecific alarm calls. In this study, we investigated cognitive biases involved in alarm call recognition in wild (N=20) and captive (N=8) meerkats (*Suricata suricatta*), and wild yellow mongooses (*Cynictis penicillata*, N=10). We studied this question by playing back alarm calls of conspecifics, different mongoose species, and a sympatric avian species. Unexpectedly, subjects did not react more strongly to closely related mongoose species, but they were more likely to flee in response to any call with higher fundamental frequency and tonal structure. Only wild meerkats and yellow mongooses were more likely to flee in response to sympatric avian alarm calls, suggesting it is a learned response. These results suggest an innate bias towards processing of specific acoustic features, and the capacity to flexibly associate novel signal-forms with an eliciting cause.

13. Long-term memory of a visual discrimination task in gopher tortoises (Gopherus polyphemus) revisited

Kelsey Felder¹, Elisa Frasnelli², Tom Pike¹, Anna Wilkinson¹

University of Lincoln¹, UK; University of Trento, Italy²

Like other Chelonia, Gopher tortoises (*Gopherus polyphemus*), have long life spans. Long-term memory is therefore critical for these animals as they interact with their environment and conspecifics, and travel between multiple burrows and foraging sites. Six gopher tortoises were trained on, and able to learn, a visual discrimination task involving 2 sets of compound stimuli. After 6 months they underwent their 1st memory test. All animals retained the information, preferentially choosing the positive stimuli, with retraining times significantly shorter than in initial training. Twelve months later, a 2nd memory test and subsequent retraining have been conducted (in progress). The initial training revealed that visual cues are likely to be important to this species when making decisions. Our 1st memory test showed this information can be retained for at least 6 months' time, and our 2nd will tell us if it can be retained for a year.

14. Impact of turbidity on visibility in goldfish

Anna Garcia, Cait Newport, Theresa Burt de Perera

University of Oxford, UK

Turbidity is likely to impact the visual information that underpins behaviours that are fundamental to the survival and success of aquatic species. However, we do not know how this visual information is influenced, despite the fact that anthropogenic activity and climate change are rapidly increasing the severity and frequency of high turbidity events globally. This study aims to address this knowledge gap by behaviourally assessing the impact of turbidity on visibility. Goldfish were trained to locate a target stimulus under clear conditions, then stimulus detection distance was investigated under different turbidities, and differences in movement behaviour were subsequently explored. The results of this study will shed light on the visual system's robustness to sensory pollution, enhancing our understanding of population resilience in the face of environmental stress.

15. Behaviour profiles of baby Barbary macaques

Matt Gardiner¹, Elizabeth Campbell², Nicola Koyama¹, Emily Bethell¹, Imad Cherkaoui³, Patrick Tkaczynski¹

Liverpool John Moores University, UK¹; Wildlife Conservation Research Unit, Department of Zoology, University of Oxford, UK²; Ibn Tofail University, Morocco³

Sociality, cognition, and behavioural profiles are a well-studied field in primatology, yet animals under six months old remain little studied. Despite this period encompassing pivotal physical, cognitive, and social developmental milestones, and influencing lifelong phenotypical changes (e.g., sociality, personality) in the individual and contributing to individual fitness. The socio-behavioural profile of adult Barbary macaques is well documented; making them an ideal study species to elucidate baby behavioural profiles. To assess this key developmental phase, behavioural observations were performed across seven groups of wild Moroccan Barbary macaques (*Macaca sylvanus*), spanning individuals aged one day to six months. Unique behavioural nodes are presented. Results detail a complex suite of social behaviours is also documented including gestural and vocal communication, learning through imitation and exploration, social play, affiliative and agonistic interactions, and infant-mother specific social behaviours. Differences in behavioural profiles and developmental milestones in relation to levels of human presence/disturbance are discussed.

16. Enriched environment induces developmental plasticity of cognition in zebrafish larvae

Elia Gatto¹, Tyrone Lucon-Xiccato¹, Maria Santacà², Camilla Maria Fontana², Matteo Bruzzone², Marco Dal Maschio², Marco Dadda², Angelo Bisazza², Salvatore D'Aniello³, Cristiano Bertolucci^{1,3}

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Phenotypic plasticity, the capacity of a genotype to produce different phenotypes under different environments, has been extensively studied for morphological and behavioural traits, but less is known about its effects on cognition. Exploiting an Environmental Enrichment (EE) treatment based on presence/absence of abiotic elements, we studied cognitive plasticity during early ontogeny in fish. Newly-hatched larvae exposed to EE for only a few days developed a phenotype with greater cognitive performance: for instance, they showed greater discrimination of visual stimuli and faster habituation learning to vibrational stimuli. To investigate the mechanisms of cognitive plasticity, we exploited a recently-generated CRISPR/Cas9 null mutant lacking of the gene expressing BDNF, a neurotrophin involved in neuronal plasticity. The mutants did not show the plastic cognitive phenotype observed in the wild-type zebrafish. Overall, the study highlighted that

fish cognitive phenotype is extremely plastic during early ontogeny and this plasticity is likely regulated by neurotrophins.

17. Alligators respond to their names irrespective of caller: speaker normalization in a crocodylian

Simon Grendeus, Mathias Osvath, Stephan A. Reber

Lund University, Sweden

Speaker normalization is the ability to recognize phonetic information regardless of speaker identity and crucial for human speech perception. While initially considered unique to humans, it was later also observed in songbirds, budgerigars, cats and dogs. These results have been explained by the sophisticated vocal communication of these bird species, and by artificial selection for sensitivity to human language cues. Here, we studied the response of name-trained American alligators when called by unfamiliar voices, and found that addressed alligators responded more strongly than non-addressed conspecifics. In a follow-up experiment, individual alligators heard their names spoken in conversational tone or called as if in training; they showed no discrimination. Hence, alligators generalized their names across speakers and prosody. This is the first evidence of speaker normalization outside of mammals and birds. These findings suggest that speaker normalization might be part of a basic categorical perception skill potentially shared across amniotes.

18. Shearwaters make efficient navigational decisions, even at very fine scales

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Shearwaters are extremely efficient wide-ranging navigators, commuting long distances over open ocean with pinpoint accuracy. Little is known, however, about their navigational abilities over short distances where the payoff to making efficient navigational decisions is very small. Over larger distances, the refinement of navigational routes could be facilitated by learning associatively which navigational decisions resulted in efficient homing, since making poor decisions may result in large homing inefficiencies. However, this refinement is less clear over short distances since the absolute difference between potential routes will be negligible. By displacing Manx shearwaters to proximal sites along the coast of their home island and GPS-tracking their return routes around the island, we show that shearwaters choose the shortest homing trajectories even when the disparity in distance is negligible. These findings suggest that shearwaters understand the geography of their home island, allowing them to make efficient navigational decisions in their local area.

19. Kea neophilia: costs, limitations and individual differences

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Neotic responses, such as neophilia (an attraction to novelty), play a key role in behaviour and evolution; however, we know relatively little about the immediate conditions under which neophilia is likely to reveal itself. In this study, we examine the costs, limitations, and consistency of neophilia in highly curious kea parrots. Subjects received three tests, offering a) novel object vs. a familiar object, b) novel object vs. familiar food, and c) novel food vs. familiar food, in two conditions: ephemeral (subjects only get to interact with the item they first chose) and stable (both items remain available throughout the trial). Preliminary results show that kea's responses to novelty vary across food and object tests and depending on the cost (i.e., condition). We further report demographic differences in neophilia and individual differences to highlight the range of neophilic expressions within the species.

20. Firehawks and bin chickens: Northern Australian birds forage at savanna bushfires

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Lund University, Sweden¹; Eötvös Loránd University, Hungary²

Wildfires are known to threaten many species but can also bring unexpected benefits. We examined the abundance and behaviour of thirty bird species before, during, and after bushfires in the Mimal Indigenous Protected Area in Northern Australia over 23 days. We found most species were indeed more abundant during bushfires, with raptors, crows, and various generalists/insectivores gathering in great numbers to hunt insects and small vertebrates escaping the fire. Some foraged calmly within a meter of the fire, suggesting it was a routine behaviour. Others, including parrots and ibises, foraged mainly on burned patches. Our study highlights the importance of wildfires for local birdlife and offers a general methodology for initial studies of wild avian pyrocognition, namely how birds respond to and learn about fire. This is particularly relevant to areas where changing wildfire regimes are threatening the survival and conservation of wildlife.

21. Cognitive abilities are linked to ecology and fitness in wild mouse lemurs

Peter M. Kappeler, Johanna Henke-von der Malsburg, Claudia Fichtel

University of Göttingen, Germany

Ecological generalists tend to have enhanced cognitive abilities, but it remains poorly known through which evolutionary mechanisms such interspecific variation evolves. We therefore investigated whether cognitive abilities or personality traits in wild grey mouse lemurs (*Microcebus murinus*, N=198) are linked to survival. This study revealed that survival was predicted by individual variation in cognitive performance as well as body mass and exploration. Because cognitive performance covaried negatively with exploration, individuals gathering more accurate information enjoyed better cognitive performance and lived longer, but so did heavier and more explorative individuals. These effects may reflect a speed-accuracy trade-off, with alternative strategies yielding similar overall fitness. The observed intraspecific variation in selective benefits of cognitive performance, if heritable, can provide the basis for the evolution of cognitive abilities in members of our and other lineages.

22. Impulsive and persistent birds: How neurotoxins alter response inhibition and its behavioural consequences

Sophia Knoch, Luc Lens, An Martel, Frederick Verbruggen

Ghent University, Belgium

Heavy metals pose detrimental risks to animals and are therefore a focus of EU policy. Heavy metals exert neurotoxic effects, causing behavioural problems. However, previous work on heavy metals often ignores the intermediate cognitive level that links brain to behaviour. The cognitive system may be vulnerable to even low levels of exposure, especially if absorbed prenatally. An important cognitive function that may be affected by heavy-metal exposure is response inhibition (RI). RI allows animals to inhibit inappropriate actions in order to adapt to constantly changing environments, so impairments in RI can have serious fitness consequences. In this presentation, I will outline a new research program. I will use two coupled 'heavy-metal-animal' models to test how prenatal exposure to heavy metals (methylmercury and lead) affects RI, and then to quantify how heavy-metal-induced individual differences in RI are related to real-world behaviour (foraging-flexibility and mortality) in free-ranging individuals fitted with GPS loggers.

23. Comparing the performance of cockatoos and capuchin monkeys on a weight-based discrimination learning task

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We want to find out how the acquisition rates of Goffin's cockatoos, *Cacatua goffiana*, and brown capuchins, *Sapajus apella*, compare when they are required to learn to correctly choose between a heavier and lighter object. This dual study is the first to present a comparable methodology for a weight-based discrimination learning task to an avian and primate model for technical problem-solving. We are asking whether methodological differences among previous studies might largely explain the vast difference in arbitrary weight discrimination learning abilities found so far between large-brained birds and monkeys and apes, or whether there might exist a distinct difference in sensitivity and learning abilities related to weight information in these two evolutionary groups.

24. The sun compass in the wild: how do shearwaters integrate information about the sun's arc?

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Animals use the sun as a compass cue, relating their egocentric heading to a global frame of reference. However, experiments investigating use of the sun compass have almost always taken place in captive animals or over very small scales of time and space. Animals moving in the wild face complex challenges when trying to use the sun to gain directional information. Here, we have tracked free-ranging Manx shearwaters (*Puffinus puffinus*) with GPS-loggers to investigate what animals know about changes in the sun's arc through space and time and how shearwaters integrate information from multiple compass systems to navigate effectively. We show that shearwaters travelling longitudinally induce error in their sun-compass use through jetlag, whilst shearwaters may rely on a magnetic compass to keep track of changes in the sun's azimuth at dawn and dusk during latitudinal movement.

25. Differentiating forms of episodic memory in monkeys

Madeline LoRusso, Julie Neiworth

Carleton College, USA

Episodic memories decline early in Alzheimer's Disease (AD). Specifically, familiarity and recollection memory uniquely fail in AD but not with aging. Differentiating specific memory failures in animal models is critical for translational research. Four cotton top tamarins participated in an object recognition test. They were exposed to two unique objects placed in a consistent context for 5 daily sessions. Next, a delay of 1 day or 1 week was imposed. Subjects' memory of the objects was tested by replacing one of the familiarized objects with a novel one. The tamarins looked longer at the novel object after both delays, an indication of remembering the familiar object. In other tests, the test pair was relocated to a new location or presented at a different time of day. It seems that context changes disrupted their recollection of recent events, but the monkeys showed accurate familiarity memory with longer delays.

26. Chimpanzees (*Pan troglodytes troglodytes*) apply insects onto the wounds of conspecifics: A case of prosocial behaviour?

Alessandra Mascaró, Lara M. Southern, Tobias Deschner, Simone Pika

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Prosocial behaviours, defined as behaviours alleviating the need or improving the welfare of another individual, have been linked with empathy and have long been seen as uniquely human. However, observations of non-human primates as well as other mammalian species showing behaviours such as comforting, sharing, and helping resulted in a lively debate. Here, we present observations collected during a 14-month period (November 2019 – February 2021) of chimpanzees (*Pan troglodytes troglodytes*) living in the Loango National Park, Gabon, applying insects to their open wounds (N=19) but also to those of others (N=3). We discuss this behaviour with regard to other prosocial behaviours in animals and propose a methodological design to test whether insect applications qualify as prosocial behaviours. We thereby provide powerful insights for novel considerations on prosocial behaviours and the evolution of medical cognition.

27. The impact of bedding practices on quantity of sleep and its relationship to cognitive bias in the horse

Amber Matthews, Ellie Taylor, Linda Greening

Hartpury University, UK

Sleep disruption can cause mood and performance disturbances in human athletes but little is known about the effects of disrupted sleep in performance or utility animals. Six riding school horses were randomly split into two groups (Control: bedding 5cm deep, Treatment: bedding 15cm deep) in a cross over design (five consecutive nights on each bedding condition, separated by a wash out period). Sleep behaviours (duration of lateral and sternal recumbency and standing states) were measured throughout and the horses' cognitive/emotional state was tested at the end of each treatment period using the spatial cognitive bias paradigm (positive, negative and ambiguous spatial cues). Although there were significantly greater lateral/sternal recumbency durations for horses on the Treatment bedding conditions, latency to approach the ambiguous location during the spatial cognitive bias paradigm did not significantly differ between treatments. Species-specific effects of sleep disturbance on cognitive performance are discussed in this context.

28. Performance inconsistency in the ovine delayed-match-to-sample task

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Aberystwyth University, UK

Sheep can perform a wide range of cognitive tasks (intra-dimensional extra-dimensional set shifting task, stop-signal task, facial recognition task) indicative of high level learning and memory attributes. The delayed-match-to-sample (DMS) task involves the presentation and removal of a reference image, a delay followed by the presentation of two or more sample images. The task requires memory of the sample image to be matched to the reference image with the task becoming more cognitively demanding the greater the delay. Fourteen female sheep, previously trained on an automated operant system were used for this study. The DMS task used two sample images (S+, S-) and the delay between the reference and the sample images was set at 3 seconds. All sheep reached the success criteria (eight out of ten trials/ six consecutive trials) but none could sustain this performance level for more than 2 sessions. The reasons for performance inconsistency are discussed.

29. ManyBirds study 1: neophobia in birds

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Investigating the evolution of cognition ideally requires large and diverse samples of individuals and species; however, these can be difficult to obtain by single labs or institutions, leading to potential reproducibility and generalisation issues. To help mitigate these issues, in February 2021, we established the ManyBirds Project – a Big-Team Open Science approach, following the lead of exemplary Big-Team science projects (e.g., ManyBabies, ManyPrimates). ManyBirds aims to provide new insights into the evolution of avian cognition and behaviour through large-scale, multi-site collaborative studies, with far-reaching implications for both theoretical development and applied animal welfare and conservation. Here, we provide a) an overview of the ManyBirds Project; b) update on ManyBirds Study 1 on neophobia (responses to novelty) in birds (162 species across 25 orders; 60+ institutions across 22 countries worldwide) and c) potential future study plans. We hope to attract potential future collaborators in new ManyBirds studies (more info at: <http://www.themanybirds.com>).

30. Raising the bar for working memory tasks: reducing location bias in the matching-to-sample task in capuchin monkeys

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School of Psychology and Neuroscience, University of St Andrews, UK

Elucidating the evolutionary origins of cognition in primates requires large-scale phylogenetic comparison (ManyPrimates 2019, 2022), which rely on short and meaningful cognitive assays. We adapted the matching-to-sample task of working memory to try to reduce the need for extensive training regimes, in brown capuchins. Resembling a food-finding task, a ‘raisin’ was hidden inside a sample ‘object’ on a touchscreen monitor. After a delay, subjects should select the sample among three distractors. Eleven capuchins were divided into two conditions: regular - where incorrect choices started the next trial; and correction - where after incorrect choices the trial was presented again, with the incorrect choice removed and only the remaining objects available. The correction condition resulted in fewer position biases, but capuchins did not show above average performance within the c.120 trials received. While matching-to-sample benefits from high construct validity, more work is needed to make it amenable to large-scale studies.

31. Almost there: learning to navigate approximately with a grid map

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The idea that animals navigate using a grid map of intersecting environmental gradients has been invoked to account for various impressive navigational abilities. Mechanisms by which animals might extrapolate gradient structures and combine information from multiple gradients have been modelled, but the ontogeny of these mechanisms has been little considered: might animals employ fixed mechanisms or do these develop through learning? We trained neural networks to navigate using simulated gradients and assessed fit to navigational models. We found neural networks initially adopted the approximate bicoordinate model, which involves combining independently determined displacements in each gradient field to navigate; this generates predictable errors in non-orthogonal grids. This might suggest that this is a relatively simple mechanism that animals might adopt in complex environments. Conversely, neural networks extrapolated gradients differently depending on the environment. These results allow us to make nuanced predictions of how animals might develop grid map navigation through learning.

32. Urban foxes are bolder but not more innovative than their rural conspecifics

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Bold and innovative behaviours are proposed to help urban animals exploit novel anthropogenic resources. Red foxes are one of the most widespread carnivores on the planet. Despite frequent stories, images, and videos portraying them as "urban pests" due to their exploitation of food-related objects (e.g., random litter), it is unknown whether they are bolder and more innovative in terms of their likelihood of exploiting these resources compared to rural populations. We gave novel food-related objects to foxes from 104 locations across a large urban-rural gradient. To access food, foxes had to use behaviours necessary for exploiting many food-related objects in the real world (e.g., biting or pushing human-made materials). Urbanization positively predicted the likelihood of foxes touching, not exploiting, objects. Thus, urban foxes may be bolder but not more innovative within this context, which is inconsistent with the notion that foxes are more likely to exploit food-related objects in cities.

33. The role of GABAergic neurotransmission in the modulation of nocifensive behaviours in Bombus terrestris

Elisa Pasquini, Elisa Frasnelli

University of Trento, Italy

Pain is a mental state that sentient beings can experience and is relevant for moral consideration. In insects, the distinction between pain and nociception remains controversial; it is unclear whether they experience subjective pain alongside nociception. The presence of endogenous neurotransmitters in the invertebrate nervous system may imply pain-reducing mechanisms similar to those present in vertebrates, that go beyond mere nociception. With this in mind, we combined behavioural observations and pharmacological manipulations to investigate the modulation of nociceptive responses to a noxious stimulus, i.e. a heated tunnel, in *Bombus terrestris* by targeting GABA as a potential neurotransmitter. We found that noxious stimulation induced painful state-related behaviours that changed in the group of animals treated with a GABAergic analgesic. These preliminary results indicate that bumblebees can modulate their behaviour following a noxious stimulus through neuroactive compounds, suggesting they may perceive more than nociception.

34. The use of a context-dependent strategy in number discrimination by archerfish

Davide Potrich, Marco Gigliozzi, Mirko Zanon, Giorgio Vallortigara

University of Trento, Italy

Non-symbolic numerical estimation is an essential ability that allows an individual to interact successfully in the environment. Numerical representation is precise with small numbers (up to 3-4 elements), becoming more approximate as the numerosities increase. However, humans overcome this limitation using conventional symbols (e.g., Arabic numerals). Using a symbolic context-dependent task, we investigated the ability to create associations between non-numerical information (i.e., colours) and numbers in archerfish (*Toxotes jaculatrix*). Fish were trained to select one of three simultaneously visible groups of black dots (i.e., 2, 3, or 4 elements) on a coloured background (red, green, or purple) to obtain a food reward. In every trial, the colour background predicted which of the three numbers was rewarded. Results indicated that archerfish can use a context-dependent strategy, limited, however, only to two colour-number associations. When a third colour-number association was introduced, fish fail, probably revealing a too-demanding memory task.

35. Social learning by mate-choice copying increases dispersal and the speed of range expansion

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Mate-choice copying (MCC) is a type of social learning where individuals copy the mate choice of others. Using individual-based models, we examined how MCC can affect populations within a patch, between patches, and between habitats. We tested whether copying could reduce dispersal costs and, thereby, be relevant at large ecological scales. Within a patch, MCC can evolve through indirect selection and increase population fitness, but only in some conditions. In a heterogeneous multi-patch environment, MCC showed to be adaptive to migrating females because it informs them of locally adapted males, promoting dispersal but weakening local adaptation. Finally, when animals disperse between habitats, MCC can still be adaptive, but depends on the type of mate preference rules and copying behaviours used. These studies show that MCC may affect species ecology and shine a light on future research avenues on the correlated evolution of copying behaviour and dispersal.

36. Species-specific differences in ultrasound communication. The role of familiarity and social systems

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Rodents emit ultrasounds during social interaction, yet precise function of those sounds remains unknown. This study aimed to elucidate the role of ultrasounds in communication of two vole species: highly territorial bank voles (*Myodes glareolus*) and common voles (*Microtus arvalis*), which live in social groups. Two testing scenarios were designed. The first preference test included a choice between ultrasounds emitted by conspecifics and different species, while the second configuration allowed choosing between ultrasounds of familiar and unfamiliar individuals. In female common voles, results have shown a strong preference not only for ultrasounds from the same species but also for familiar individuals. Male common voles exhibited no such preference. Bank voles lacked similar trends. These differences align with species-specific social systems: female common voles live in groups where communication can be more essential, whilst bank voles' territoriality may potentially reduce this need. This work emphasizes social structure's role in rodent's communication.

37. Multialternative social decision making in zebrafish

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Normative principles of economic rationality assume that a rational individual makes consistent choices that maximize utility. The principle of independence of irrelevant alternatives (IIA) proposes the invariance of preference order between two options, regardless of the inclusion of other alternatives, or decoys, in the choice set. Organisms ranging from slime molds to human beings are reported to have violated IIA in various tasks, mostly with respect to combinations of two or more choice attributes. Here we investigate the entire social decoy space of zebrafish using a combination of binary and ternary social choices involving single and groups of zebrafish freely moving in a circular arena. We show sex-based differences in exhibiting the decoy effect, inter-individual differences, and group rationality by the zebrafish shoals in the social decision-making task.

38. Susceptibility and physio-behavioral reactions to cognitive illusions in kea (Nestor notabilis) and Goffin's cockatoos (Cacatua goffiniana)

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Cognitive illusions offer a valuable lens into animal cognition. Kea (*Nestor notabilis*) and Goffin's cockatoos (*Cacatua goffiniana*) are optimal animal models to examine susceptibility to cognitive illusions due to their physical cognition skills and exploratory tendencies. This study involved a bait-and-switch cognitive illusion of food items varying in desirability followed by an information-seeking phase to examine not only illusion susceptibility, but also surprise behaviours expressed overtly (e.g., crest-raising; feather-fluffing) and/or covertly (e.g., surface temperature change produced by arousal). We predicted both species would exhibit: 1) prolonged investigation of where the magically swapped food items appeared; 2) prolonged investigation of the magical stimulus in the information-seeking phase; and 3) covert surface temperature changes in response to the trick. Implications for this research include novel perspectives into species differences in overt versus covert behaviours in response to violated expectations, as well as expressions of information-seeking in non-human species.

39. Sorry to dine and dash: a comparative study of choosiness during foraging in humans and squirrels

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Decision-making while foraging can be difficult, especially under risk. Despite a vast wealth of foraging models that focus on animals, it is unclear whether these predictions also apply to humans. To begin to address this gap, we observed the number of different food items eaten by grey squirrels and humans across varying conditions of perceived risk (squirrels: open vs. sheltered microhabitats, humans: no vs. some time pressure). We found a negative relationship between pickiness in squirrels and distance from the tree canopy and that squirrels were pickier when they greatly preferred one food item over another. We further observed that humans consumed a larger mass of less preferred items : preferred items when under pressure. Our work provides evidence that both species adjust their foraging decisions under risk and that food preferences influence the ease of decision-making.

40. You scratch me, I scratch you: turn-taking in grooming interactions of chimpanzees in the wild

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Special attention has recently been addressed to the highly cooperative interactional infrastructure underlying language - the turn-taking system. First introduced by Sacks and colleagues (1974), it is characterized as a reciprocal exchange of alternating, short, and flexible turns between two or more interactants. Given its universality across language and culture, it is of great interest to trace its presence and potential origin within our evolutionary lineage. Chimpanzees, one of our closest living relatives and with a broad repertoire of cooperative social behaviours, suggest that they possess a suite of advanced cognitive abilities. In this study, we investigated firstly whether cooperative turn-taking could be found in the communicative exchanges of nonhuman primates using 78 hours of video footage of social grooming among male chimpanzees (*Pan troglodytes troglodytes*, N=10) at the Ozouga Chimpanzee Project, Gabon. Furthermore, we examined the effect of association strength and dominance rank on turn-taking styles within these dyadic interactions.

41. Olfactory conditioning for mitigating stress in horses

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Maria Vilain Rørvang¹**

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Olfactory detection is linked to the neurobiological processing of emotions. Research in human psychology shows that odours associated with positive experiences can induce positive emotions and may be used to, e.g., relieve stress and improve cognitive performance. The same may be true for other animals with well-developed olfactory systems. In this study, we will investigate if horses can form an association between an odour (lavender) and a positive affective state induced by tactile stimulation. Forty-two Swedish Warmblood horses will be divided into three treatment groups to control for the effects of the olfactory conditioning and any potential effect of lavender odour as an unconditioned stimulus. In a series of behavioural and cognitive tests, we aim to answer whether the conditioned odour can i) induce a positive affective state and ii) be used to mitigate fear in stressful situations. If so, olfactory conditioning may be useful in promoting horse welfare.

42. The development and transmission of stone-handling behaviour in captive Japanese macaques at the Highland Wildlife Park, Scotland

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Japanese macaques have been fundamental to studying cultural behaviour in non-human animals, with long-term observations documenting the spread of traditions such as stone-handling, a non-instrumental object manipulation behaviour. Despite stone-handling being well documented across multiple groups, there is limited data on the ontogeny and transmission of the specific behavioural patterns. We conducted research with a troop of 34 Japanese macaques at the RZSS Highland Wildlife Park who had not been reported to stone-handle. By introducing stones to the enclosure, we observed the development of stone-handling within individuals and the transmission through the group. We will present preliminary results on the role of social learning in the spread of stone-handling patterns. In addition, we will discuss the commonalities of stone-handling with a potentially new behaviour observed in this troop, stick collection, and how interaction between the two behaviours could have implications for our current understanding of the underlying motivation of stone-handling.

43. The effect of social stability on inhibitory control and learning in chickens

Kathryn Willcox, Alizée Vernouillet, Luc Lens, Frederick Verbruggen

Ghent University, Belgium

Complex social environments require animals to inhibit inappropriate responses and rapidly learn to change their behaviour, to avoid conflicts and maintain group cohesion. Individual variation in such cognition could be attributable to developmental plasticity in response to environmental differences. Here, we investigate the effect of early-life social stability on inhibitory control (IC), learning, and social behaviour. Chickens (n=72) are raised in either stable or unstable social groups, and their interactions are recorded. At five-weeks-old, the chicks' IC and learning abilities are assessed. We predict chicks raised in unstable groups will more rapidly learn to inhibit their actions than those from stable groups, as such learning is expected to be beneficial in a fluctuating social environment. Finally, mature birds in combined groups are tracked whilst spatial resource predictability is manipulated, to assess how early-life experiences affect social networks in a changing environment, potentially mediated by individual variation in IC and learning.

44. Asymmetrical shape fitting and alignment in Goffin's cockatoos (*Cacatua goffiniana*)

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Shape alignment is an important aspect for efficient tool use in animals. However, the complexity and asymmetry of objects can make alignment more cognitively demanding. Shape fitting paradigms have been used to investigate these alignment skills in different tool-using primates but are rare in other taxa. Tool-using Goffin's cockatoos (*Cacatua goffiniana*) spontaneously insert toys during play into substrates and correctly select objects matching shaped holes in an apparatus, but their specific alignment capabilities remain unknown. In this study, we focussed on the Goffins' alignment abilities in a shape fitting paradigm. We presented them with 18 objects with increasing levels of asymmetry. Using a deep learning model, we tracked the object rotations by the birds. Preliminary results show a strong effect of asymmetry on successful alignment and high performances compared to primates. These alignment abilities may help to explain their complex forms of tool use in captivity and the wild.