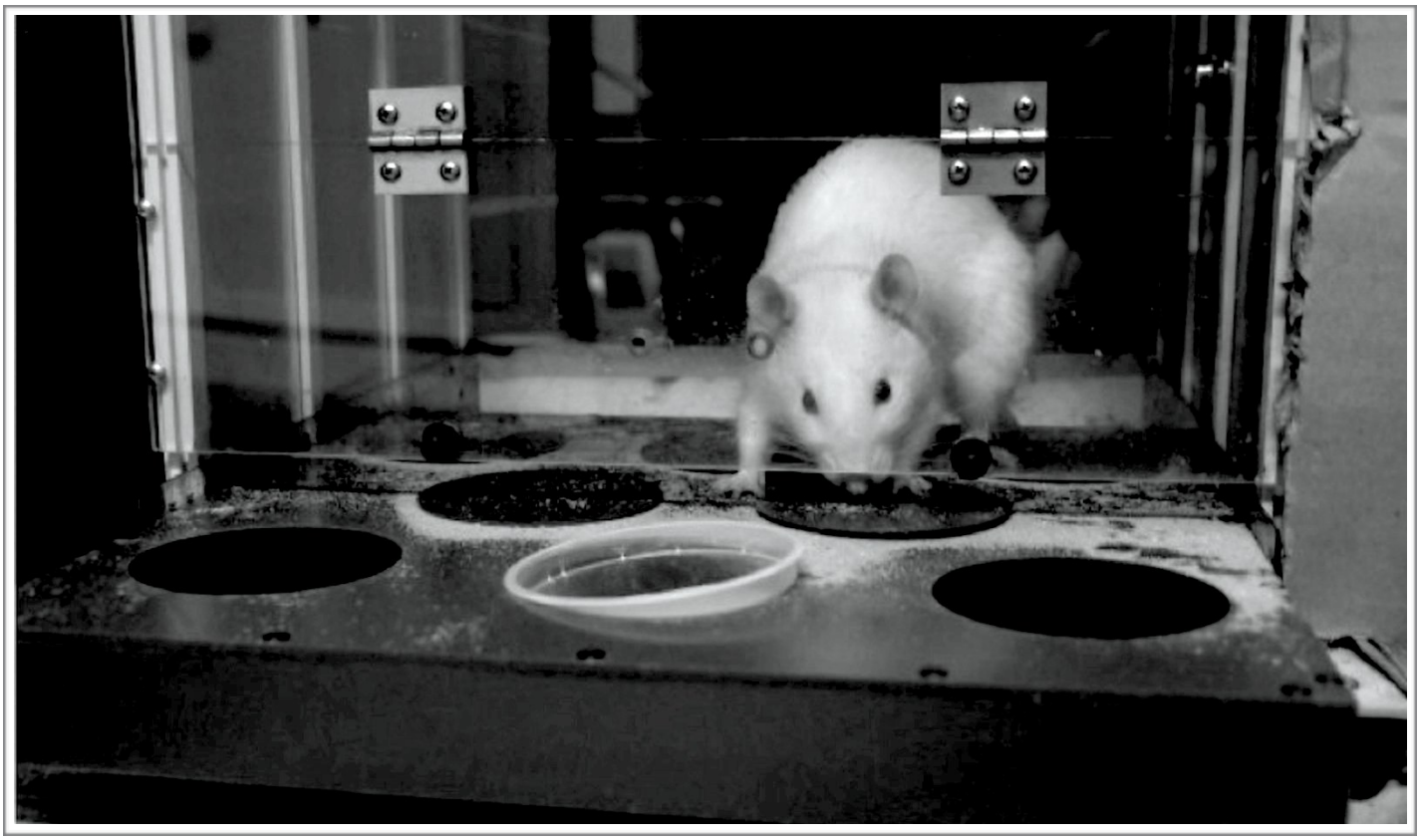

Expert Meeting on

Animal Cognition

Het Pand, Gent **Dec 19-20, 2013**

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Organizers:

Tom Beckers (KU Leuven)
Jan De Houwer (Ghent University)
Elisa Maes (KU Leuven)
Sarah Beurms (KU Leuven)

SCIENTIFIC PROGRAM

Thursday December 19

Registration from 9:00 onward

9:30 Tom Beckers (Leuven) - Introduction

Session 1: Associative and non-associative processes in animal learning

9:40 Gonzalo Urcelay (Cambridge) - Simulations of a correlation theory of instrumental behaviour

10:00 Charlotte Bonardi (Nottingham) - Occasion setting: Configural and hierarchical explanations

10:30 Mark Haselgrove (Nottingham) - Overcoming associative learning

11:10 Coffee break

Session 2: Association versus proposition in animal learning

11:40 Sean Hughes (Ghent/Maynooth) - Associative learning, stimulus equivalence and RFT

12:10 Jan De Houwer (Ghent) - On the relation between propositional theories of associative learning and Relational Frame Theory: Friends in humans, foes in animals?

12:40 Anthony Dickinson (Cambridge) - Reconciling propositional and associative accounts of learning about associations

13:10 Lunch

14:00 Daniel Hanus (Leipzig) - Causal reasoning verses associative learning in animals: A useful or a strawman dichotomy?

Session 3: Social and non-social animal cognition

14:30 Ed Wasserman (Iowa) - Problem solving in a virtual world: The virtual string task

15:10 Alex Kacelnik (Oxford) - When Mum and Dad don't teach the kids how to behave: The extensive knowhow of parasitic birds

15:50 Coffee break

16:20 Cecilia Heyes (Oxford) - Animal mindreading: What's the problem?

17:00 Keith Jensen (Manchester) - Feeling into others and the origins of human sociality

18:00 Drinks

19:00 Dinner

Friday December 20

Session 4: Categorization and generalization

9:30 Hans Op de Beeck (Leuven) - Generalization, categorization, and visual similarity in rodents

10:00 Elisa Maes (Leuven) - Similarity- versus rule-based generalization in rats

10:20 Andy Wills (Plymouth) - Comparative studies of categorization: Pigeons, humans and squirrels

11:00 Coffee break

Session 5: Animals' representation of cues absent

11:30 Michael Waldmann (Göttingen) - A rat study on the representation of hidden objects

11:50 Dominic Dwyer (Cardiff) - An associative re-analysis of the effects of cue ambiguity on rat behaviour

12:20 Magda Osman (London) - Future-minded: Contingency learning is the bedrock of human and animal prospective cognition

12:50 Lunch

Session 6: Choice and abstraction in animals

13:40 Thomas Zentall (Kentucky) - When less is more in humans and other animals

14:20 Sarah Beurms (Leuven) - Symmetry in rat choice behaviour

14:40 Marco Vasconcelos (Oxford) - Food versus knowledge: Paradoxical preferences for low probability of reward

15:00 End

ABSTRACTS

Simulations of a correlation theory of instrumental behaviour

Gonzalo Urcelay & Omar D. Perez
Department of Psychology & Behavioural and Clinical Neuroscience Institute, University of Cambridge.

According to associative theories of learning, the probability of reinforcement is a strong determinant of associative strength. However, in instrumental learning, response rates are usually higher under random ratio (RR) relative to random interval (RI) schedules of reinforcement, even when the latter result in a higher probability of reinforcement per response. This difference has been thought to suggest that animals represent the experienced correlation between rates of response and reinforcement. I will present simulations of a correlational theory of instrumental behaviour (Baum, 1973) that accounts for the RR-RI difference under diverse parameters. I will discuss these results and the implications for instrumental behaviour in human and non-human animals.

Occasion setting: Configural and hierarchical explanations

Charlotte Bonardi
The University of Nottingham

Both animals and humans can learn conditional discriminations, in which a CS x may, for example, be paired with a US only when is signalled by another cue, A (e.g. A: x-->+, x-->-). More conditioned responding is shown to x when it is signalled by A than when it is presented alone. Solution of such discriminations can occur independent of the associative strength of the constituent stimuli, and in these cases A is termed an occasion setter. One explanation is in terms of configural theories, which are characterised by the assumption that the compound of two stimuli is more than the sum of its parts (e.g. Brandon, 2000; Pearce, 1987; 1994). These theories can argue that a configural cue, produced by co-presentation of A and x, predicts the US. An alternative is the hierarchical explanation (e.g. Holman & Mackintosh, 1981; Holland, 1989; Bonardi, 1991), according to which A exerts hierarchical control over the x-->US association, facilitating the ability of x to excite the US representation and elicit a CR. In terms of propositional logic these two classes of explanation capture the distinction between 'if (A and x) then US' and 'if A then (if x then US)' and are indistinguishable. However, in terms of associative theory they differ insofar as the first assumes that A and x play qualitatively identical roles in generating behaviour (x and A both activate the US representation), whereas the second does not (x activates the US representation whereas A facilitates this process). Some experiments will be described that attempt to discriminate between these possibilities.

Overcoming associative learning

Mark Haselgrove
The University of Nottingham

On the basis of research conducted in recent years, it seems that non-human animals are metacognitive, empathic and rational decision makers that are capable of feats of higher-order cognition including (but not limited to) co-operation, reasoning about hidden causal agents and understanding gestures made by other species. This is astonishing for two reasons. First, because many humans that I know would be incapable of demonstrating to me such a breadth of intelligence; and second, because until relatively recently, most animal behaviour was explained in terms of simple associative connections. What methodological advances have recently been made that have allowed us to overcome the analysis of behaviour that appeals to associative learning? I shall argue that in a number of relatively high profile cases, this position is unjustified. I shall review the structure and content of associative learning and attempt to piece together the sorts of variables that should be ruled out in order to overcome explanations of animal behaviour that appeal to associative learning.

Associative learning, stimulus equivalence, and Relational Frame Theory: Working out the similarities and differences between human and non-human behavior

Sean Hughes, Dermot Barnes-Holmes
Ghent University, National University of Ireland Maynooth

The question of what makes humans unique has attracted considerable attention within the behavioral sciences. Throughout much of the past century it was assumed that those learning principles identified in non-humans could stretch to, and account for, much of complex human behavior. However, when researchers turned their attention to those hallmarks of human psychology (language and cognition) a number of important findings started to emerge, findings that hinted at learning processes that may be unique to, or largely elaborated in, some species relative to others. In the current talk we introduce one such process - known as arbitrarily applicable relational responding (AARR) - and argue that it is the basic functional 'unit' from which complex human behavior springs forth. We examine recent findings from the associative learning and acquired equivalence literatures and argue that a number of important questions still need to be addressed before we can conclude that non-humans can respond in functionally similar ways to that observed in our own species. Nevertheless, we believe that AARR represents a golden opportunity to develop much needed dialogue between animal and human learning researchers on issues that are central to both traditions. Importantly, this dialogue is not a one-way street: the lessons learned in human research may stimulate developments in the animal literature and vice-versa. We believe that increased collaboration between these two traditions may help shed new light on the commonalities that bind, and the differences that separate, humans from other species in the animal kingdom.

On the relation between propositional theories of associative learning and Relational Frame Theory: Friends in humans, foes in animals?

Jan De Houwer
Ghent University

At the core of propositional theories of associative learning lies the idea that learning is mediated by propositional representations that encode information about how events in the world are related (e.g., A is a cause of B, A is an effect of B, A is opposite to B). Inferential reasoning is possible only when representations are propositional but propositional representations can be utilized also by non-inferential processes (e.g., similarity-based retrieval). At the functional level, this cognitive propositional theory implies that associative learning always involves a change in relational responding: Learned behavior is controlled not by a single event but by the relation between this event and another event (e.g., smaller or bigger than, similar or opposite, cause or effect). At the functional level, Relational Frame Theory was built on the distinction between two types of relational responding: non-arbitrary relational responding (NARR) and arbitrary applicable relational responding (AARR). Importantly, RFT postulates that all instances of (associative) learning in verbally able humans are changes in AARR. Hence, propositional theories of associative learning imply RFT as applied to verbally able humans. On the other hand, the theories seem to diverge when applied to non-human animals: Whereas proponents of propositional theories have argued that inferential reasoning (which necessitates propositional representations) can also occur in non-human animals, proponents of RFT have argued that only humans show evidence of AARR. I discuss three ways to realign these views: (1) NARR in non-humans is mediated by propositional representations that cannot be utilized by inferential processes; (2) Some instances of NARR that occur in non-humans are mediated by inferential reasoning; (3) Some instances of AARR also occur in non-humans and are mediated by inferential reasoning.

Reconciling propositional and associative accounts of learning about associations

Anthony Dickinson
University of Cambridge

De Houwer, Mitchell and Lovibond have argued that learning about event associations involves the acquisition of propositional knowledge rather than associative connections. To address this issue, in this talk I shall reprise an argument outlined in Dickinson (2012). I argue that embodying associative connections within specific processing architectures provides mechanisms that can mediate psychological rationality and illustrate such embodiment by discussing the relationship between practical reasoning and the associative-cybernetic model of goal-directed action.

Dickinson, A. (2012). Associative learning and animal cognition. *Philosophical Transactions of the Royal Society B, 367*, 2733-2742.

Causal reasoning versus associative learning in animals: A useful or a strawman dichotomy?

Daniel Hanus
Max Planck Institute for Evolutionary Anthropology

Humans differentiate between events that follow a purely spatio-temporal contingency and those that additionally hold a causal relationship. Even though several studies suggest that we are not the only species capable of doing so, it is under debate whether or not the same cognitive mechanisms are at work in animals and humans.
I will present two experimental studies with chimpanzees that were explicitly designed to differentiate between (classical) associative and more cognitive interpretations of the demonstrated performances. Both studies follow the logic that, if subjects are capable of "true" causal inferences, they should appreciate a problem-solving context with an inherent cause-effect structure compared to one that only allows for a trial-and-error strategy. In the latter case, subjects' behavior should be determined only by the observed statistical regularity of the given cue-outcome relation, not by the causal nature of those cues.
Our data suggest that chimpanzees are indeed sensitive to the logico-causal relations between external objects, which supports the view that non-human cognition potentially goes beyond mere perceptual information processing.
It remains to be discussed, whether the traditional "conditioning vs. cognition" or "perceptual vs. conceptual" – battle is still useful or whether more integrative accounts are needed or already available to explain non-human as well as human behavior.

Problem solving in a virtual world: The virtual string task

Edward A. Wasserman
University of Iowa

For many decades, developmental and comparative psychologists have used a variety of string tasks to assess the perceptual and cognitive capabilities of human children of different ages and different species of nonhuman animals. The most important and widely used of these problems are patterned-string tasks, in which the organism is shown two or more strings, only one of which is attached to a reward. The organism must determine which string is connected to the reward and pull it. We report a new way to implement patterned-string tasks via a computerized touchscreen apparatus. Pigeons successfully learned such virtual patterned-string tasks and exhibited the same general performance profile as animals given conventional patterned-string tasks. In addition, variations in the length, separation, alignment, and attachment of the strings reliably affected the pigeons' virtual string-pulling behavior. These results not only testify to the power and versatility of our computerized string task, but they also demonstrate that pigeons can concurrently contend with a broad range of demanding patterned-string problems, thereby eliminating many alternative interpretations of their behavior. The virtual patterned-string task may thus permit expanded exploration of other species and variables which would be unlikely to be undertaken either because of inadequacies of conventional methodology or sensory-motor limitations of the studied organisms.

When Mum and Dad don't teach the kids how to behave: the extensive knowhow of parasitic birds

Alex Kacelnik, Ros Gloag & Juan Carlos Reboreda
University of Oxford

Reproductive parasites avoid rearing effort by laying their eggs in the nests of other species. As a consequence, juveniles are raised in the absence of direct contact with conspecific adults, thus providing an interesting model for the limits of behavioural complexity that develops in natural isolation from social influences.
I will describe behavioural adaptations of South American avian brood parasites, with emphasis on their biological rationality and the conflict with hosts.

Animal mindreading: What's the problem?

Cecilia Heyes
All Souls College & Department of Experimental Psychology, University of Oxford

Research on mindreading in nonhuman animals seems to be in trouble. It was once an active research programme, pursued by many research groups, using a variety of field and laboratory methods, asking whether animals have 'full-blown' theory of mind; for example, the capacity to represent false beliefs and therefore to engage in intentional deception. Now, several of the major contributors have become sceptics, the field is dominated by one research group, their ambition is more limited – e.g. to find evidence that animals 'understanding seeing' – and even evidence for this capacity is widely contested. So, what's the core problem? Philosophers have suggested it is 'logical', 'semantic' and/or 'methodological'. In this talk I'll propose that there are also ideological and socioeconomic components; argue that the core problem is 'theoretical', it relates to the formulation of testable focal and alternative hypotheses; and suggest ways in which this problem could be tackled.

Feeling into others and the origins of human sociality

Keith Jensen
University of Manchester

Decision-making does not always take place in a vacuum. The consequences of social decisions are shaped by the decisions of others, and a single act can have multiple consequences, both for the actor and the other individual. The ability to "feel into" others, to take their emotional perspective, can serve as a social thermostat that measures whether the consequences for others were achieved and allows us to adjust our actions accordingly. "Other-regarding concerns" can reflect our motivation to help others. To understand how these concerns might have evolved in humans, my colleagues and I have tested our closest living relatives in tests of prosociality. It appears that unlike human children, chimpanzees do not take the needs of others into account when sharing and helping, nor do they seem to be motivated out of even a primitive sense of fairness. Yet, chimpanzees are able to function very well socially. It may be that an awareness of the well-being of others and a motivation to help – and, at times, hinder – others may underlie uniquely human sociality.

Generalization, categorization, and visual similarity in rodents

Hans Op de Beeck
KU Leuven

Perceptual similarity is a core concept in theories of categorization and generalization. Many findings can be explained through similarity. Furthermore, similarity is the first confound which needs to be ruled out before arguing in favor of other factors such as the use of rules. Here I will describe several recent findings from our laboratory on how rats solve categorization and generalization tasks with visual stimuli of varying complexity (gratings, shapes, and natural movies). Rats are able to learn a variety of recognition and categorization tasks, including position-invariant shape recognition (Vermaercke & Op de Beeck, 2012, Curr. Biol.), so-called rule-based and information-integration categorization tasks, and even the 'semantic' categorization of movies according to the presence/absence of a rat. A detailed analyses of their behavior suggests that rats use non-trivial adaptive strategies based upon visual similarity in terms of moderately complex visual properties. In contrast to humans and other primates, they do not show a bias to use unidimensional rules, and they do not show evidence for the use of nonvisual semantic distinctions. In conclusion, perceptual similarity is a powerful concept to explain categorization and generalization in rodents, even more so than in humans.

Similarity- versus rule-based generalization in rats

Elisa Maes, Jan De Houwer[#], Rudi D'Hooge & Tom Beckers
KU Leuven, [#]Ghent University

Humans and non-human animals are capable of learning complex discriminations that seemingly reflect general rules. However, this does not necessitate that they actually understand the underlying rules; their behavior may be mediated by simple associations. One way to investigate the underlying cognitive mechanisms is to investigate behavior of human and non-human animals in similar yet novel situations. Abstraction of a rule and subsequent application of that rule to a novel set of cues seems to be beyond the scope of association formation models.
In 1998, Shanks and Darby provided evidence for rule-based generalization of negative and positive patterning in humans. To investigate the contributions of similarity- versus rule-based processes to generalization in rats, we trained 24 animals on a negative and a positive pattern simultaneously. Despite the fact that the rats were capable of learning the patterning problems, generalization was based on similarities rather than rules. We will discuss the implications of our findings for the processes that underlie patterning performance in rats.

Comparative studies of categorization: Pigeons, humans and squirrels

Andy Wills
Plymouth University

Where a set of stimuli can be correctly classified by a rule, or by overall similarity, classification by similarity is often considered to be a "fall back" mode for adult humans - an approach to classification adopted when cognitive capacity are limited by, for example, concurrent load. This belief leads to the hypothesis that classification by similarity rather than rules will dominate in species whose cognitive capacity is more limited than adult humans. Over three different procedures, and two different non-human species, I present some investigations of this hypothesis.

Rats Distinguish between Absence of Events and Lack of Evidence in Contingency Learning

Michael R. Waldmann, M. Schmid, J. Wong & A. P. Blaisdell
University of Göttingen

The goal of three experiments was to study whether rats are aware of the difference between absence of events and lack of evidence. We used a Pavlovian extinction paradigm in which lights consistently signalling sucrose were suddenly paired with the absence of sucrose. The crucial manipulation involved the absent outcomes in the extinction phase. Whereas in the Cover conditions access to the drinking receptacle was covered by a metal plate, in the No Cover conditions the drinking receptacle was accessible. The Test phase showed that in the Cover conditions the measured expectancies of sucrose were clearly at a higher level than in the No Cover conditions. We compare two competing theories potentially explaining the findings. A cognitive theory interprets the observed effect as evidence that the rats were able to understand that the cover blocked informational access to the outcome information, and therefore the changed learning input did not necessarily signify a change of the underlying contingency in the world. An alternative associationist account, renewal theory, might instead explain the relative sparing of extinction in the cover condition as a consequence of context change. I will discuss the merits of both theories as accounts of our data, and conclude that the cognitive explanation is in this case preferred.

An associative re-analysis of the effects of cue ambiguity on rat behaviour.

Dominic Dwyer
Cardiff University

There is evidence from both sensory preconditioning (Blaisdell, Leising, Stahlman, & Waldmann, 2009) and patterning procedures (Fast & Blaisdell, 2011) that rats respond differently to the non-presentation of a cue than they do if they are prevented from accessing the physical source of that cue (for example, they respond differently if a light is not turned on as compared to when the lightbulb is covered or removed from the experimental chamber). Blaisdell and his colleagues suggested that, without access to a cue's source, the status of the cue as "on" or "off" would be considered to be ambiguous and that this ambiguity would influence the rats' expectancies regarding the occurrence of other events that had previously been presented along with the now-absent cue. However, simulations of a number of standard associative accounts reflect the observed patterns of behaviour when the predictive value of both "cue on" and "cue off" representations is considered (Dwyer & Burgess, 2011). Therefore, there is no need to suppose that rats are sensitive to ambiguity on the basis of these experiments. In addition, the importance of "cue off" representations to both rational and associative analyses makes it clear that questions regarding what is represented should be not be neglected when attempting to examine how representations might be being processed.

Blaisdell, A. P., Leising, K. J., Stahlman, W., & Waldmann, M. R. (2009). Rats distinguish between absence of events and lack of information in sensory preconditioning. *International Journal of Comparative Psychology, 22*(1), 1-18.

Dwyer, D. M., & Burgess, K. V. (2011). Rational Accounts of Animal Behaviour? Lessons from C. Lloyd Morgan's Canon. *International Journal of Comparative Psychology, 24,* 349-364.

Fast, C. D., & Blaisdell, A. P. (2011). Rats are sensitive to ambiguity. *Psychonomic Bulletin & Review, 18*(6), 1230-1237. doi: 10.3758/s13423-011-0171-0

Future-minded: Contingency learning is the bedrock of human and animal prospective cognition

Magda Osman
University College London

Placing the future centre stage as a way of understanding the function of various cognitive processes is an idea that is gaining in interest in psychology, and has its origins in work on foresight conducted in the 1960s and 70s. The general modern label for this is "prospection", and is now referred to as the process of representing and thinking about possible future states of the world. Episodic memory, hypothetical thinking (mental simulation) and conditional reasoning are thought to be necessary cognitive abilities that enable prospective thinking. While there are several differences between the various theoretical perspectives that are currently focusing on understanding the mechanisms behind prospection, many share the view that because the cognitive abilities needed for prospection are not found in non-humans, prospection is unique to humans. The presentation discusses the methodologies used to study prospection, along with the evidence from human studies, and considers what this implies for comparative research.

When less is more: An affect heuristic in humans and other animals

Thomas Zentall
University of Kentucky

When humans are asked to judge the value of a set of objects of excellent quality they often give it higher value than those same objects with the addition of some of lesser quality. This suboptimal choice is an example of the affect heuristic referred to as the less is more effect. Monkeys too have shown this suboptimal effect and we have found a similar effect in dogs. However, inconsistent with this effect, we have found that normally hungry pigeons (85% free feed weight) choose optimally when offered a preferred food plus a less preferred food over a more preferred food alone. On the other hand, when pigeons are placed on a less restricted diet (95% free feed weight), consistent with other species they too show the suboptimal less is more effect. The less is more effect appears to be an evolutionarily functional rule of thumb or shortcut that allows for rapid decisions by humans and other animals (even when rapid decisions are not necessary) and such decisions sometimes result in suboptimal choices, especially when motivation is not high.

Symmetry in rat choice behaviour

Sarah Beurms, Jan De Houwer[#] & Tom Beckers
KU Leuven, [#]Ghent University

Stimulus equivalence is the ability to form classes of stimuli that are functionally interchangeable on the basis of earlier experiences. According to the procedural definition of Sidman et al. (1982), stimulus equivalence is defined by three capacities, namely reflexivity (the capacity to relate a stimulus to itself), symmetry (the capacity to relate stimuli in a bidirectional manner) and transitivity (the capacity to establish relations over relations). This repertoire of responses is highly related to language and reasoning (Hayes, Barnes-Holmes, & Roche, 2001).
In past research, it has proven extremely difficult in animals to obtain convincing evidence in particular for symmetry (Lionello-DeNolf, 2009). We want to investigate the conditions that might constrain the observation of symmetry in rats.
One method to test for symmetry involves the matching-to-sample procedure. Using this method, we replicated the findings of Peña, Pits and Galizio (2006) that rats are capable of generalized identity matching. Evidence suggests that animals encode the location of stimuli together with their identity in the matching-to-sample-task (e.g., Lionello-DeNolf & Urcuioli, 2000). We investigated whether using multiple locations would enhance generalization to new stimuli. Concurrently, we are developing an alternative method to study symmetry using a variant on the Pavlovian-to-Instrumental Transfer (PIT) procedure.

Food versus knowledge: Paradoxical preferences for low probability of reward

Marco Vasconcelos, Tiago Monteiro & Alex Kacelnik
University of Oxford

Everything else being equal, animals prefer high to low probabilities of reward, early to late rewards, and larger to smaller rewards, but when everything else is not exactly equal, these expectations are often violated, and animals display apparently paradoxical preferences. We argue that such cases are important in revealing the mechanisms controlling preferences and choices, and discuss an experimental protocol in which starlings and other species prefer an option with lower reward probability but earlier availability of outcome information, thus systematically losing the majority of available rewards but spending less time uncertain. We consider three mechanistic interpretations (uncertainty aversion, local contrast and Pavlovian conditioning), discuss their merits and relate the findings to the tension between sequential decisions in the wild and simultaneous decisions in the laboratory.

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