

Prof. Johan Bolhuis, Cognitive Neurobiology, Utrecht University

Title: Evolution cannot explain how minds work

Attempts to apply Charles Darwin's theory of evolution to cognition have not fared well, mainly because questions of evolution and of mechanism are fundamentally different. Evolution is concerned with a historical reconstruction of brain and cognition, while the the actual underlying mechanisms are the domain of cognitive neuroscience and psychology. It is often not clear a priori whether a particular cognitive or neural trait is homologous (i.e. the outcome of common descent) or the result of convergent evolution, or indeed beyond the domain of natural selection. A good example is human speech and language, where both neural and genetic homology and evolutionary convergence are involved regarding speech, but human language has a unique combinatorial complexity. Thus, I argue that in the study of animal and human cognition, questions of function and evolution and questions of mechanism should be seen as logically separate. Functional and evolutionary considerations may be used as clues to generate hypotheses regarding the underlying mechanisms. But these hypotheses may be false and should always be tested empirically, using methods from cognitive neuroscience, behavioural biology and experimental psychology.

Barbara Webb, Institute for Perception, Action and Behaviour, University of Edinburgh

Title: The abstract and the concrete in models of animal behaviour

Abstraction in model building can draw both praise and criticism. A model with few variables is more elegant, more constrained, and usually easier to understand as a mechanistic explanation. On the other hand, if the model is of a complex system such as a behaving animal, an abstract model must leave out, radically simplify, or even distort many real causal factors. In this talk I will discuss ways to resolve this tension by recognising that issues of concrete model grounding and validation are largely orthogonal to the dimension of abstraction.

Tom Smulders, Centre for Behaviour and Evolution & Institute of Neuroscience,
Newcastle University

Title: The adaptive function of spatial memory for food-hoarding titmice

Although many species of food-hoarding chickadees and titmice are known to cache food in the autumn and retrieve it throughout winter, the duration of their spatial memory has consistently been shown to be no longer than 4-6 weeks. It is therefore unlikely that their spatial memory has been adapted for long-term retrieval over many months. In a series of experiments, we have explored the functional significance of shorter-term (<4 weeks) spatial memory in food-hoarding titmice. We propose that shorter-term cache memory has two main functions in these species. Firstly, remembering where previous food items have been stored affects the distribution of new caches, hence improving the long-term survival of all caches. Secondly, short-term memory-based retrieval improves energy intake during the day, increasing the birds' chances of surviving the long, cold winter nights.

Thomas Bugnyar, Department of Cognitive Biology, University of Vienna

Title: (When) does smart behaviour-reading become mind-reading?

Dealing with a complex social world requires sophisticated knowledge about others, allowing individuals to predict, and manipulate, the behaviour of potential competitors as well as cooperation partners. However, the ability of judging others' responses may be qualitatively different from a human-like understanding that the others' behaviour is guided by mental states such as perceptions, intentions and beliefs. I here review a series of experiments on socio-cognitive abilities in ravens *Corvus corax* that have been suggested to be linked with mental state attribution in humans (tactical deception, gaze following, perspective taking, knower-guesser differentiation). Our findings indicate that ravens are highly sensitive to the others' perception and support the view that building blocks for a human-like 'Theory of Mind' have evolved multiple times.

Elske van der Vaart, Artificial Intelligence & Behavioral Ecology and Self-Organisation,
University of Groningen

Title: Caching and cognition in scrub jays: Insights from a computational model

Many corvids – members of the crow family – hide food underground, saving it for later. They recover their caches by memory, but also pilfer those of others, if they know where to find them. Cachers employ many different techniques to prevent their caches being stolen, such as re-caching in new locations if they can't help being observed. But which mechanisms underlie these cache protection behaviors? Are they evidence of visual perspective taking, or is a simpler explanation sufficient? In our work, we tackle this question using an approach new to the field: Computational cognitive modeling. We implement a set of assumptions about corvid cognition as a working computer program, and then expose it to virtual versions of real experiments. In this way, we can very precisely test the behavioral consequences of different cognitive assumptions. In this talk, I discuss how this method has generated new insights into scrub jays, first by providing evidence for a new learning mechanism, and then by discovering a new explanation for their re-caching behavior.