Session: From the Data Deluge to Self-Writing Papers
Organizers: Ádám Miklósi and George Kampis

How, If and Under which conditions: Three equally important questions in comparative cognition

Christian Schloegl[1,2], Judith Schmidt[2,3],Sandra Mikolasch[2], Simone Singh-Sondhi[2] and Kurt Kotrschal[2]
[1] *Cognitive Ethology Lab, German Primate Center, Göttingen, Germany*
[2] *Konrad Lorenz Forschungsstelle, Grünau im Almtal & Department of Behavioural Biology, University of Vienna, Austria*
[3] *ARGE Papageienschutz, Vienna, Austria*

An increasing interest in cross-species comparisons added an important analytical tool to Cognitive Sciences. The use of identical procedures in tests with a wide array of species allows the assessment of the frequency and distribution of cognitive abilities, which may ultimately facilitate the application of tools for phylogenetic constructions. With this goal in mind, many studies test if two or more species solve the same tasks to draw conclusions about the cognitive abilities of the species at hand. Such comparisons allow the sampling of data about the performance of a relatively large number of species in a reasonable amount of time. However, recent evidence from several experimental designs used across a variety of species at different labs suggests that focusing on the question if certain species are capable of solving a task may be too narrow. Over the last years, we have been testing five corvid and parrot species in various inferential reasoning tasks, in which the animals had to locate hidden food by relying on various visual or acoustic cues provided by a human experimenter. With our data, we will demonstrate that some of the species differ in their performance in some of the tasks but that simultaneously some species may achieve similar performance levels if the same tasks are presented in different ways. Thus, species may possess similar cognitive abilities, but they may differ in their reliance on these skills in comparable conditions. From this we conclude that single comparisons may fall short of allowing dependable cross-species comparison. Furthermore, we believe that knowledge about the exact conditions under which a species demonstrates its cognitive abilities is as important as knowledge about the species' abilities itself.

Lateralization in insects: Theoretical and experimental approaches

Elisa Frasnelli
Konrad Lorenz Institute for Evolution and Cognition Research, Altenberg, Austria

Lateralization, namely the different functional specialization of left and right side of the brain, has been documented in many vertebrates and recently, in invertebrates too. In many species, left- and right-lateralized individuals coexist but in unequal numbers ('population-level' lateralization). It has been argued that brain lateralization increases individual efficiency (e.g. avoiding unnecessary duplication of neural circuitry and reducing interference between functions), thus counteracting the ecological disadvantages of lateral biases in behaviour (making individual behaviour more predictable to other organisms). However, individual efficiency does not require the alignment of the direction of lateralization in the population. Thus, such arguments do not explain population-level lateralization. Using mathematical theory of games, it has been shown that, in the context of prey–predator interactions, population-level lateralization can arise as an evolutionarily stable strategy when individually asymmetrical organisms must coordinate their behaviour with that of other asymmetrical organisms. Recently, further modelling has showed that populations consisting of left- and right-lateralized individuals in unequal numbers can be evolutionarily stable, based solely on strategic factors arising from the balance between antagonistic (competitive) and synergistic (cooperative) interactions. Empirical evidence supporting the model has been provided by comparative studies in insects of the Hymenoptera Apoidea family showing social and non-social organization, which suggests that stable polymorphism with an uneven distribution of left- and right- forms can be expected to emerge spontaneously in species in which left-right biases have behavioural consequences during everyday interactions between individuals.

Automated home cage ethology: biologically relevant and efficient, but complex

J.E. van der Harst[1], R.C. de Heer[1], B.M. Spruijt[1,2]
[1] Delta Phenomics B.V., Utrecht, The Netherlands
[2] Behavioural Biology Group, Department of Biology, Faculty of Science, Utrecht University, The Netherlands

Behaviour is the ultimate and most complex output of the brain and is used more and more as a readout parameter in neuroscience. However, intensive labour related to complicated tests and human observations, together with variability concerning ethograms and inherent poor reproducibility, prevented a general implementation of ethological methods.The complexity and pitfalls in behavioural neuroscience receives increasing attention, not in the least due to the need of reliable and high-throughput behavioural assessments for the elucidation of the functional role of genes in behaviour. It seems difficult to accept that behavioural expressions need a mathematical approach to unravel its organisation and meaning, but developments in artificial intelligence and data mining are essential to accelerate the necessary evolution in behavioural sciences. But the mere automation alone of already existing tests is not the optimal answer to generate efficient tests providing qualitative and quantitative information on behaviour. An important source of confounding variables and waste of potential information is formed by neglecting basal behaviour in the standard housing cage and transporting the animals to a novel test environment and back. Therefore, we apply automated home cage monitoring and integrated test-protocols for anxiety, learning and cognition, thereby minimizing human intervention, animal

handling, and transportation and maximizing data-generation on both spontaneous and evoked behaviour. Automated home cage monitoring can be utilized for behavioural phenotyping, compound-screening, but also for assessment of general wellbeing of animals. Automation, and especially 24 hour continuous monitoring, results in enormous sets of data which requires complex analysis, generating excessive amounts of parameters. Some examples will be presented.

Does 'sexy' cognition help behavioural biology?

Adam Miklósi
Department of Ethology, Eötvös University, Budapest, Hungary

The history of research on the mind has been characterised by alternating periods of generous and strict/rigorous thinking on the nature of mental processes which control behaviour. Currently, both approaches are present in different fields of research ranging from neurophysiology to cognitive science. This duality is best represented by re-occurring debates between cognitively 'sexy' discoveries ("X is able to count") and alternative, 'killjoy' hypotheses (X is simply showing a preference for larger amount). In the presentation I would like to raise the issue to what degree 'sexy cognition' helps biologists who are interested in animal problem solving. Taking a functional approach, problem solving (in nature) is the behavioural equivalent of cognitive (mental) skills. Although cognitive terms (intention, imitation etc.) have the advantage to provide a general "code" for conceptualizing animal and human minds, they may be biased because they reflect the (linguistic) thinking of one species, humans. The many different definitions of some cognitive terms may also show the effort of researchers to accommodate a human-based concept to the species under investigation. At the dawn of modern comparative cognition we may investigate animal problem solving from a behavioural point of view, and change our concept-driven approach (e.g. Does species X have a theory of mind?) to a skill-driven approach (Under what conditions is species X able to solve this problem to Y degree?). This notion has a long tradition in ethology, and it may be useful to re-visit it again, given our much better chance to do comparative cognitive research with new technical tools. This line of thinking also includes problems of what one could consider as evidence that certain behavioural skill or mental mechanism exists in animals or humans.

No escape from conceptualizing animal behaviour? The role of theory in comparative cognition

Zsófia Virányi
Konrad Lorenz Institute for Evolution & Cognition Research, Altenberg, Austria

Comparative cognition set out to reconstruct cognitive phylogenies, which in practice mostly means searching for the counterparts of human cognitive skills in other animal species. Determining, however, whether the same cognitive ability is being manifested in various species cannot be done on a purely formal basis, since distinct species can look and behave very differently. To mention just one simple example: different animals may search for objects walking, flying, crawling or swimming. As such, functional categorization of the behaviours observed will always be unavoidable when attempting species comparisons. Obviously, forming and defining these categories constitute the Great Challenge of comparative cognition. In this talk I will argue that random data collection, even if large scale is not sufficient for this process; on the contrary, cognitive theory has an immense role in the development of clear concepts. On a case study of comparative research on imitation and action understanding I will show that ultimately the reconstructed phylogenetic tree may depend on the way we categorize the behaviour of the species compared.

A domain analysis of social cognition: structure and dynamics

Sándor Soós[1,3] and George Kampis[2,3]
[1]*Institute of Research Organization, Hungarian Academy of Sciences*
[2]*History and Philosophy of Science, Lorand Eötvös University, Budapest, Hungary*
[3]*Collegium Budapest, The Institute of Advanced Study*
E-mail: ssoos@colbud.hu

The study of social cognition along with its comparative and evolutionary dimensions has been distributed across a wide range of research fields and directions, characterized by various theoretical and conceptual frameworks. To facilitate meaningful communication between those communities involved, and to establish a common ground to integrate succesfully different approaches, an empirically informed overview on the underlying domain and its development is inevitable. In our study we provide such an analysis via the application of state-of-the art science mapping and visualization techniques. Following Ord et al, who undertook the bibliometric analysis of animal behavior research for the period 1968–2002 (c.f. Ord, T.J. and Martins, E.P. and Thakur, S. and Mane, K.K. and Börner, K. (2005). Trends in animal behaviour research (1968-2002): Ethoinformatics and the mining of library databases. *Animal behaviour*, 69(6), 1399–1413.), we focus on the leading scholarly journals related to social cognition, but with an emphasis on the recent decade, up to 2010. Databases of the Web of Science are harvested to retrieve the bibliographic record of the most domain-relevant journals, covering the period under study. This dataset is then subjected to bibliometric and content analytic mining. Our primary goal is to uncover, among other trends, the development of conceptual patterns in the field, especially the connections or interfaces between different research directions. The models we utilize involve dynamic network structures implemented in so-called bipartite graphs that enable us to capture the macro-level relations between