Workshop: A Multilevel Approach to Distributed Cognition

Organizers: Gün R. Semin & Rui F. Oliveira

Arrival: October 10 – *Departure*: October 13, 2013

Location:
Cascais, Portugal @ Hotel Farol Design http://www.farol.com.pt/en

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Workshop: A Multilevel Approach to Distributed Cognition

The aim of the proposed symposium is to approach the grounding of social behavior from a multilevel perspective. In this perspective, an adequate explanation of social behavior requires an understanding of the interplay between behavior, bodily structure, social context, and environmental resources rather than a focus on the isolated study of individual cognitive functions such as attention, memory, or learning. The perspective adopted by the approach characterizing the proposed symposium contrasts with a view of human cognition that became prominent with the cognitive revolution. This view brought the 'mind' and 'cognitive processes' to the fore as the object proper of scientific inquiry but simultaneously narrowed the focus across the cognitive sciences to the processing and representation of information by an isolated individual.

The current perspective invites changing the individual centered question of 'what is cognition?' to 'what is cognition *for*?' This minor change modifies the subject from a study of detached thought to a biologically grounded one about the production of adaptive action and raising the level of analysis form the individual to the social.

The shift in direction adopted by the participants to this symposium focuses on understanding cognitive activities as extended to the social and physical environment, which constitute integral parts of cognitive activity in their own right. Moreover, social species by definition create emergent systems that supersede the individual. These emergent systems have evolved jointly at multiple levels. Social psychologists who have a long history of investigating social processes have done so largely by examining them independently from their biological origins and mechanisms. However, it is becoming increasingly evident that biological perspectives can inform social approaches towards understanding social behavior as an emergent phenomenon. Social systems are undoubtedly one of the most complex systems and a consequence of this complexity is that there are also emergent properties that may not be directly derivable from the biological features. Thus, the interface between social and biological processes becomes a critical one to advance our understanding of social processes.

The Participants

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PRELIMINARY PROGRAM

Oct 10/Thursday:

Morning/early afternoon: -Arrival

Late afternoon/evening:
- Get together
- Presentation of Workshop goals

Oct 11/Friday:

9:00-9:15 – Opening remarks
9:15-12:30, Theme 1 – What is social and what is cognition in *social cognition*?
9:15-10:15 - Barrett: "The way we make up our minds is not the way our minds are made up"
10:15-11:15 - Chittka: "Large societies and small brains: insects as minimal models of social cognition"
11:15-11:45 - Coffee Break
11:45-12:30 - Group discussion
LUNCH (12:30-14:00)
14:00-18:15, Theme 2 – Evolution of communication in social networks
14:00-15:00 - McGregor: "Communication networks and cognition"
15:00 – 16:00 - Semin: "Mysterious Communication: The Secret Language of Chemosignals"
16:00-16:30 - Coffee Break
16:30 – 17:30 - Moita: "You are not alone: Fear in the context of social interactions"
17:30-18:15 - Group discussion

Oct 12/Saturday:

9:00-12:15, Theme 3 – Behavioural Ecology of social cognition
9:00-10:00 - Reader: "Questioning the independence of social learning"
10:00-11:00 - Oliveira: "Social competence as an ecological performance trait: proximate mechanisms and ultimate consequences"
11:00-11:30 – Coffee Break
11:30-12:15 - Group Discussion
LUNCH (12:15-14:00)
14:00-18:15, Theme 4 – Studying interacting brains in social networks

14:00 – 15:00 - Mainen: “What can experimental systems neuroscience teach us about studying social systems?”
15:00-16:00 - de Polavieja: “Decision-making in groups”
16:00 – 16:30 - Coffee break
16:30-17:30 - Kiverstein: “Proof of the pudding: predictive brains in social interaction”
17:30 – 18:15 - Group discussion

Oct 13/Sunday:

9:00 – 13:15, Theme 5 - Collective cognition in social networks
9:00 – 10:00 - Garcia-Marques: “Can the social groups act like cognitive extensions of the individual brain?”
10:00 - 11:00 - Hollingshead Transactive Memory Errors
11:00-11:30 – Coffee break
11:30-12:30 – Kish: “Emergent Coordination”
12:30 - 13:15 - Group discussion
13:15- 13:30 – Closing remarks (Semin, Oliveira)

- FAREWELL BRUNCH

Afternoon: departure

Abstracts

The way we make up our minds is not the way our minds are made up

Louise Barrett
University of Lethbridge

The cognitive revolution has a lot to answer for. Both comparative psychology and a particular school of thought in evolutionary psychology continue to promote a heavily representational, and hence ultimately Cartesian, view of mind, legitimized by the notion of cogniton as computation. In this view, cognition is solely a brain-based process, and we experience our environment only indirectly, acting on the basis of our internal representations and not the world itself. The idea that cognition is this kind of purely 'heady' affair lies at the root of the confusion and circularity that (to me at least) characterises the Social Brain or Social Intelligence hypothesis: primate groups are argued to be complex because the animals that live in them are complex and have big brains, but the reason that primates have evolved into big-brained complex animals is because they live in complex groups. This argument is not only circular, but, on closer inspection, it also becomes apparent that it contains no precise definition of what complexity actually is; indeed, it simply begs the question. This poorly defined, anthropocentric notion of social complexity is then applied to other taxa in ways that become self-reinforcing: whatever form of social structure is identified as a correlate of large brain size must, by definition, be cognitively demanding because the animals' enlarged brains demonstrate this is the case. Any morphological or enviromental difference between species are therefore considered irrelevant with respect to exploring cognitive differences: brains are all that matter. Here, I want to suggest that, if we follow William James and James Gibson in assuming that there is only one world that organisms experience directly, and combine this with Roger Barkers' idea of "behavioural settings", along with Daniel Hutto and Erik Myin's argument that cognition is 'extensive' and not merely 'extended', we can begin to escape circularity and get a better grasp of how and why social life is complex. As a corollary, we will also appreciate more fully the similarities and differences between human and non-human social complexity. Once we've done this, the real puzzle to solve will be why we ever thought cognition was anything other than a multi-level distributed phenomenon.

Large societies and small brains: insects as minimal models of social cognition

Lars Chittka

Queen Mary, University of London

The social brain hypothesis holds that the cognitive demands that come with living in societies have shaped brain evolution, and that social group size might in turn be linked to brain size. This hypothesis is controversial even within the primate world, but more complications arise when one inspects the social insects. Ants, bees and wasps build cohesive societies with small brains and 10s of thousands to millions of individuals. Just like in humans, these societies are not (only) held together by individual recognition, but by learnt cues that indicate the location of society, and the place of the individual within it. However, it would be incorrect to view social insects as anonymous societies, since individual recognition determines dominance hierarchies in several species. The facial recognition of some social wasp species is one example, and indeed some insects can assemble configural representations of facial cues, and identify faces even when rotated. There are also various forms of social learning in the insects, with the consensus building process in honeybee swarms as one example that is unique in the animal kingdom. Since insects' nervous systems are comparatively small, this raises the question of what the minimal neural circuitry is that is required to achieve these feats. Neural network analyses show that many 'advanced' cognitive feats are possible with very limited neuron numbers (i.e. 100s or 1000s, rather than the billions in some vertebrate brains).

Communication networks and cognition

Peter K. McGregor

Centre for Applied Zoology, Cornwall College, Newquay, Cornwall, UK

Communication and cognition have often been linked, partly because communication can be a tool to assess cognitive abilities – from Clever Hans to lexigram use by non-human primates. But more recently because it is becoming more widely recognized that communication is a key component of the context / social environment in which cognitive abilities have evolved. The natural and virtually ubiquitous context for communication is a social network of several individuals. This is because most signals can be received over an area that encompasses many individuals. Communication networks offer several types of information transfer opportunity to signallers and receivers. For such opportunities to be exploited, individuals in networks require cognitive abilities – such the ability to identify other individuals in the network and a form of transitive inference to assign them relative social ranks. This talk will briefly outline the key features of communication networks, then deal in more detail with social eavesdropping (extracting information from signalling interactions between others) and what such behaviour implies for cognition. The examples are drawn from non-human animals – predominantly fish and birds – but should be widely applicable.

Mysterious Communication: The Secret Language of Chemosignals

Gün R. Semin

Utrecht University and Koç University

In this presentation, I shall give an overview of the results of a series of studies that investigate the communicative potential of an underexplored modality for the transmission and distribution of emotional states: human odors and olfactory communication. Generally, communication research relies on the usual suspects for carrying a message: auditory (e.g., speech, prosody), symbolic, visual (e.g., gestures, reading) modalities. Human olfaction has never been considered as a medium of communication, however, as it turns out, olfaction is a powerful transmitter of emotional information. The presentation will cover studies that involve the olfactory transmission of disgust, fear, and happiness, as well as the relative contribution of olfactory versus audiovisual modalities. I shall conclude with a study investigating the relative strength of male versus female odors in transmission of emotions (fear) as well as the sensitivity of male and female recipients. The implications of a communicative medium that escapes conscious access as well as defying linguistic representation will be discussed.

You are not alone: Fear in the context of social interactions

Marta Moita

Champalimaud Neuroscience Program

Animals regulate their defense responses using cues from the social environment. They can signal danger to other individuals either actively (e.g. alarm calls) or passively (e.g. display of defense responses). Social interactions have, on the other hand, also been shown to be anxiolytic, a phenomenon known as social buffering, suggesting that animals can also provide safety cues.

In our lab we are studying both danger signaling and social buffering by studying the effects of social interactions between a fear-conditioned rat and its cage-mate. We trained one rat to fear a tone cue and the next day tested its fear of the cue in the presence of its cage-mate. We found that the cage-mate froze upon the display of freezing by the conditioned rat, provided it had prior experience with shock. This suggests that learning from self-experience with an aversive event is important for rats to respond to freezing displayed by others. In addition, using the recorded sound of a rat exploring a box we found rats perceive the cessation of movement-evoked sound (caused by freezing of the conditioned rat) as a signal of danger and its resumption as a signal of safety. Conversely, we found that the presence of a naive cage-mate during exposure to the tone down regulates freezing by the conditioned rat in a long lasting manner. In a complementary set of experiments, we found that conditioned rat dams freeze when tested alone, but switch to active defensive behaviors in the presence of their pups.

Questioning the independence of social learning

Simon M. Reader

Department of Biology, McGill University, Canada and Department of Biology, Utrecht University, The Netherlands.

It is commonly assumed that social learning involves derived cognitive processes that evolve and develop independently. In this talk, I question the independence of social learning and discuss the evidence for social learning as an adaptive specialisation. I will review experimental work with fish, rodents and humans that demonstrates that current, recent and early life experience all predict the reliance on social information, and thus can potentially explain variation in social learning as a result of experiential effects rather than evolved differences. Comparative work with primates supports the idea that social learning evolves together with other cognitive processes, while work on primate parasite transmission suggests that social learning may also have specific costs. I will conclude with discussion of possible approaches to the investigation of social learning as an adaptive specialisation, including discussion of recent work on nonapeptide systems in tropical fish.

Social competence as an ecological performance trait: proximate mechanisms and ultimate consequences

Rui F. Oliveira

ISPA – Instituto Universitário and Instituto Gulbenkian de Ciência/ Champalimaud Neuroscience Program, Portugal

Social animals need to fine-tune the expression of their social behavior to the social environment in order to optimize benefits and reduce costs of group-living. Therefore, social competence, defined as the ability of an animal to optimize the expression of its social behavior as a function of the available social information, should be considered as a performance trait that impacts on the Darwinian fitness of the animal. Here I will present cognitive appraisal and social learning as key mechanisms of social information acquisition that underlie social competence. Their proximate mechanisms at the molecular and neural level and their functional value will be discussed. Finally, the role of hormones on the modulation of rapid socially driven changes in behavior will be Described and discussed in the scope of an embodied response of social decision-making networks to social challenges.

What can experimental systems neuroscience teach us about studying social systems?

Zachary F. Mainen
Champalimaud Neuroscience Program

Complex social systems, such as human societies, are distinguished by patterns of coherent behaviour across many individual members. A parallel can be drawn between the emergence of such collective social phenomena and the emergence of directed individual behaviour (e.g. decision-making) from the interactions of the individual neurons comprising a nervous system. In this presentation my goal is to consider the neural and social domains and their relationship. But I wish to focus not on the conceptual similarities of the problems but on the potential similarities in how they might be approached from an experimental and methodological standpoint. Thus, after outlining key parallels and divergences between the two domains, I will describe the experimental tools and paradigms that are currently believed to be critical to understand, in principle, how neural systems give rise to organismic behaviour. I will then consider what these criteria would entail if they were to be translated into experimental approaches for studying collective social behaviour. Despite the limitations of the analogy, and granting that our experimental approaches to the brain are themselves surely open to much technical and conceptual improvement, I hope this analysis may help to highlight both challenges and new opportunities for the experimental analysis of social systems.

Decision-making in groups

Gonzalo de Polavieja
Instituto Cajal, Madrid

I will describe a theory of decision-making in animal groups in which subjects try to choose a good option. I will then use the theory to (a) compare against experimental data, (b) show that, in contrast to the case of choosing the best option, it implies a higher probability that all subjects choose the same option when all options are equally negative and (c) to obtain a method to improve wisdom of the crowds after social interactions.

Proof of the pudding: predictive brains in social interaction.

Julian Kiverstein
University of Amsterdam

Herbert Clark (1996) argued for a view of conversation as a type of joint action in which coordination depends on common ground. This idea of conversation as joint action has been taken up more recently in the work of Garrod and Pickering (see e.g. their 2013 BBS article). Joint action more generally in which agents act together with the aim of bringing about a shared intention or goal also depends on common ground – the parties in the interaction must know for instance what goal each is pursuing and adjust their behaviour accordingly. A common assumption in work on joint action has thus been that the type of coordination we find in joint actions depends on common ground or mutual knowledge. In this talk I will pursue the possibility that this gets things back to front and in fact coordination is what produces common ground. A similar argument has been made by proponents of interactionism in the recent literature on social cognition where an argument is made that the exchanges of information that take place in online social interaction serve as the basis for social cognition. Thomas Fuchs and Hanne De Jaeger (2009) for instance argue that coordination is what produces understanding of others. I will make an analogous claim for common ground required for communication and joint action. In the second part of my talk I will relate this perspective on the role of coordination in creating common ground to recent work on the Bayesian brain and predictive coding theories of brain function (for a review see Clark 2013). I will argue that common ground can be understood as framing the contexts in which individuals act together. Standard predictive coding theories focus on the mismatch between expected or predicted inputs and actual inputs within an individual. I will argue that what matters for common ground is a match in expectation across interacting individuals. Coordination provides a means of testing whether interacting individuals have matching expectations. The proof of the pudding is thus in the coordinated social interaction.

Can the social groups act like cognitive extensions of the individual brain?

Leonel Garcia-Marques
Faculdade de Psicologia da Universidade de Lisboa

Although it is relatively common to think of human cognition as exclusively residing in the human brain, nothing is more intrinsically human than the use of cognitive extensions of the brain (e.g., maps, abacus, logarithmic paper). In my talk, I will ask a very simple question: Can a social group act as an extension of the individual brain? The answer to this easy is however not as easy. In fact, the social group has a very bad cognitive repute (e.g., crowd psychology, groupthink, conformism). As a case in point, I will discuss a more recently found effect that apparently portrays once more the social group as a cognitive burden – the collaborative inhibition effect in memory. In this talk I will describe the effect, present some of my own research about it and offer some speculations and also new data that suggest collaborative inhibition is part of a process of creative destruction that represents a first step for effective distributed memory.

Transactive Memory Errors

Andrea B. Hollingshead
University of Southern California

The theory of transactive memory developed by social psychologists explains the development of distributed cognition among humans in collectives, and has generated interest among researchers across a wide array of disciplines. A transactive memory system is a group-level memory system that often develops in close relationships and work teams. It involves the division of responsibility among group members with respect to the encoding, storage, retrieval and communication of information from different knowledge areas, and a shared awareness among group members about each member's knowledge responsibilities (or "who knows what"). Originally proposed to explain memory distribution among intimate couples, evidence of transactive memory has been discovered in a variety of other relationships and groups, including families, friends, coworkers, project teams and organizations. Most transactive memory research has focused on the benefits to collective processes and outcomes that a distributed memory structure can provide. However, groups with an efficient transactive memory also make errors and mistakes. My talk will focus on the difficulties and dark side inherent in the creation and maintenance of transactive memory systems. At the end of the talk, I will explore how biological perspectives might help identify mechanisms and other outcomes of this form of distributed cognition.

Emergent Coordination

David Kish
UCSD

What sort of external structures do people create to coordinate group performance? When do they need to? Stigmergy enables efficient group activity without a group doing anything extra – such as talk, create a task list, define a route, draw architectural plans, etc. World state contains enough information to determine good outcomes for the beings involved. Most human contexts require extra artifacts explicitly for coordinating activity because effective joint activity is underdetermined externally. I explore this problem using concrete examples drawn from our studies of dance creation, musical performance, map following, espresso making, cooking and others.