WORKSHOP

Evolution, Development and Intentional Control of Imitation

5-7 March 2008
University of Vienna

Sponsored by the EU
Sixth Framework Programme – NEST Pathfinder
‘What does it mean to be human?’ initiative
Aims

Imitation has both a long history and vibrant contemporary life. For at least a century it has been cast as a milestone in cognitive evolution, an engine of cognitive and social development, and a channel of cultural inheritance. In the last decade — building on the discovery of ‘mirror neurons’ and new ways of examining imitation in adulthood — it has also become a focus of intensive interest in experimental psychology and social cognitive neuroscience. The time is ripe for those interested in the evolution, development and neuro-cognitive control of imitation to come together to access recent progress and to integrate emerging answers to the most fundamental questions about imitation. These include: What are the evolutionary and developmental sources of the capacity to imitate? What are the psychological and neurological processes that mediate imitative potential and imitative performance? How, and in what ways, does imitation contribute to cognitive and social development, enculturation, cooperation and evolutionary change?

As partners in the EDICI project, we have been working on imitation together since 2005, funded by the European Commission under its Framework 6 ‘What does it mean to be human?’ initiative. Now, as our project draws to a close, we are inviting an exciting, international and multidisciplinary group of researchers to join us for the presentation of cutting-edge research and integrative discussion.

Organizers

**Ludwig Huber** (Department of Neurobiology and Cognition Research, University of Vienna, Vienna, Austria)

**Cecilia M. Heyes** (Department of Psychology, University College London, London, UK)

**Gyorgy Gergely** (Institute for Psychological Research, Hungarian Academy of Sciences, Budapest, Hungary)

**Marcel Brass** (Department of Experimental Psychology, Ghent University, Ghent, Belgium)
Wednesday, 5 March 2008

EVOLUTION

09:00–09:30 Opening ceremony

Welcome address: Vice-Rector Heinz Engl
EDICI consortium: Short presentation of the EDICI project

09:30–12:50 Session 1 (Chair: Heyes)

09:30–10:15 Huber et al. The evolution of imitation: Old wine in new bottles?
10:15–11:00 Miklósi & Topál The big imitation game: The case of dogs and their “masters”
11:00–11:20 Coffee break
11:20–12:05 Tennie & Call Why study action copying?
12:05–12:50 McGuigan et al. Dissecting imitation and emulation in children and chimpanzees

12:50–13:35 Lunch

13:35–14:20 Guided tour through the main building of the University

14:20–17:40 Session 2 (Chair: Huber)

14:20–15:05 Ferrari An evolutionary perspective on the role of mirror neurons
15:05–15:50 Wood Reading beneath the surface appearance of events
15:50–16:10 Coffee break
16:10–16:55 Shea Imitation as an inheritance system
16:55–17:40 Galef What it means to be not human: Social learning without imitation

17:40–18:40 Poster session
Thursday, 6 March 2008

DEVELOPMENT

09:00–12:50 Session 3 (Chair: Gergely)

09:00–09:45 Heyes & Ray  Imitation and the wealth of the stimulus
09:45–10:30 Longo  Automatic and intentional imitation in infancy
10:30–10:50 Coffee break
10:50–11:35 Jones  Learning to imitate in infancy
11:35–12:50 Meltzoff & Williamson  Children’s flexible imitation

12:20–13:20 Lunch

13:20–17:45 Session 4 (Chair: Brass)

13:20–14:05 Gergely  Beyond imitative learning
14:05–14:50 Morin & Sperber  Demonstrations: guidance of imitation by the model
14:50–15:10 Coffee break
15:10–15:55 Carpenter  Social and collaborative aspects of imitation
15:55–16:40 Kopp  Imitation in modeling embodied communication
16:40–17:00 Break
17:00–17:45 Massen et al.  Covert imitation in tool use

20:00 Social Dinner at the Heurigen "Mayer am Pfarrplatz" (Beethoven House)
Friday, 7 March 2008

CONTROL & CONSEQUENCES

08:45–12:05 Session 5 (Chair: Prinz)

08:45–09:30 Brass et al. Shared representations and self/other distinction

09:30–10:15 Calvo-Merino Using expertise to understand cognitive and neural mechanisms of action observation

10:15–10:35 Coffee break

10:35–11:20 Rumiati Beyond imitation: The role of emotions in guiding actions

11:20–12:05 Sebanz Task sharing: Does imitation presuppose joint action abilities?

12:05–13:05 Lunch

13:05–16:35 Session 6 (Chair: Galef)

13:05–13:50 Grèzes Understanding other people’s intentions and emotions from their behaviours

13:50 –14:35 Keysers & Gazzola Mirror systems and social cognition

14:35–14:55 Coffee break

14:55–15:40 Bach & Tipper The role of covert imitation in social perception

15:40 –16:25 Van Baaren et al. Monkey see, Monkey doesn't

16:25–16:35 Final Discussion
The evolution of imitation: Old wine in new bottles?

LUDWIG HUBER¹, FRIEDERIKE RANGE¹, ZSÓFIA VIRÁNYI² & BERNHARD VOELKL¹

¹ Department of Neurobiology and Cognition Research, University of Vienna, Austria
² Konrad Lorenz Institute for Evolution and Cognition Research, Altenberg, Austria

Two sets of fundamental issues have been addressed in the EDICI project: 1) What are the evolutionary and developmental sources of human imitative potential? 2) How is imitative potential brought under intentional control? Research in Vienna has shown that marmosets can precisely copy the movement patterns of a novel action demonstrated by the model. The high matching degree suggests that these monkeys possess the neuronal mechanism to code the actions of others and to map them onto their own motor repertoire, rather than priming existing motor-templates. ‘Selective imitation’ experiments have shown that dogs – like human infants – do not simply copy an action they observe, but adjust the extent to which they imitate to the circumstances of the action. Together these new results show that the potential to imitate and to bring it under intentional control is widespread in the animal kingdom and furthermore suggest that the development of the human potential for imitation depends on task- and species-general cognitive processes.
The big imitation game: The case of dogs and their “masters”

ÁDÁM MIKLÓSI¹ & JÓZSEF TOPÁL²

¹Department of Ethology, Eötvös University, Budapest, Hungary
²Institute of Psychology, Hungarian Academy of Sciences, Hungary

The popular dog literature has often attributed the capacity of imitation to dogs without caring too much about scientific evidence. The renewed interest in dog-human relationship and its cognitive underpinnings facilitated that the issue of social learning (including imitation) in dogs has now looked at by researchers. Recently, two studies have been published both claiming to show some form of imitation in dogs. By reviewing these studies and some other recent observations we will look for ways how the concept of imitation can be used fruitfully in comparative social cognition, especially in the case of dogs. At present it seems that after seeing an action done by a demonstrator observer dogs are inclined to display corresponding behaviour. In a training situation observer dogs seem to be similarly effective both with conspecific and heterospecific demonstrators even if very often the behavioural scheme of the demonstrated actions is different depending on the species (human or dog). The comparison of effectiveness of conspecific and heterospecific demonstrators actually, offers an interesting method to look into the issue how the observation of an action will put to use by the observer. We think that the study of social learning in dogs could offer some interesting insight into the hierarchy of cognitive processing of the other’s action (and the parts of environment associated with the action), and also whether social learning contributes to or facilitates the emergence of own body schema through executing actions by seeing them done.
Why study action copying?

Claudio Tennie & Josep Call

Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

Recently, the existence of socially mediated traditions in primates (especially in chimpanzees) has been proven in many lab situations of problem solving. However, subjects in these studies, instead of having copied the very behaviour of demonstrators (action copying), might instead have learned about general environmental outcomes (roughly: emulation), specific outcomes (object movement re-enactment), may have become more focused towards certain locations or stimuli (local or stimulus enhancement) Action copying is likely to play an important role in the accumulation of culture, and a difference in action copying abilities (or motivations) might set apart traditions of primates from human forms of culture. However, I will argue that under certain conditions this separation might become less clear cut. I will present a series of experiments designed to isolate action copying from various forms of environmental learning. I focus on studying non-enculturated subjects of different species, for which I try to vary levels of task-difficulty. I compare resulting performances with those of human children.
From emulation to ‘over-imitation’: Increases in the tendency to imitate irrelevant actions from 2 years to adulthood

Nicola McGuigan¹ & Andrew Whiten²

¹School of Life Sciences, Heriot Watt University, Edinburgh, UK
²School of Psychology, University of St. Andrews, St. Andrews, UK

In the first study we describe here, we explored whether the tendency to imitate or emulate is influenced by the availability of causal information, or the amount of information available in a display. Three and 5-year-old children observed either a live or video model use a tool to retrieve a reward from either a clear or an opaque puzzle box. Some of the tool actions were irrelevant to reward retrieval, whereas others were causally necessary. The causal relevance of the tool actions were highly visible in the clear box condition, allowing the participants to potentially discriminate which actions were necessary. In contrast the causal efficacy of the tool was hidden in the opaque box condition. The results indicated that both 3- and 5-year-old children imitated the irrelevant actions regardless of the availability of causal information following a live demonstration. In contrast, the 3-year-olds employed a more emulative approach with both boxes when the information available in the display was degraded via a video display containing the hands and actions of the model only. The 5-year-olds were unaffected by the degraded information and continued to employ a “blanket” imitative approach.

Studies 2 and 3 explored whether the trend towards greater imitativeness with age found in study 1 would extend backwards to a 2-year-old group, and forwards to an adult group. The results of study 2 show that 2-year-olds were most commonly emulative, performing only the causally necessary actions with both boxes. This strategy contrasted with the blanket imitation of both causally irrelevant and causally relevant actions witnessed at 3 and 5 years. Study 3 revealed an adult group to be surprisingly imitative, copying with a greater level of fidelity than the children. These findings suggest, rather counter-intuitively, that the human species becomes more rather than less imitative with age, in some ways ‘mindlessly’ so!
An evolutionary perspective on the role of mirror neurons in nonhuman primates’ imitative processes

PIER FRANCESCO FERRARI

Dipartimento di Neuroscienze, Università di Parma, Parma, Italy

In this paper I will review the evidence of mirror neurons involvement in action recognition in monkeys and humans. In humans, imitation learning is supported by the mirror neuron system in addition to other neural structures. We still do not know how the mirror neuron system became suitable for imitation since monkeys are not capable of imitating. However, the automatic tendency of nonhuman primates to reproduce an observed movement has been described in several contexts and probably reflects a resonance mechanism of the motor system mediated by a mirror neuron mechanism. Thus, it seems that more complex forms of imitation such as those involving learning, recruit additional cognitive and neural resources to add to a basic matching mechanism. From this perspective non-human primates may offer an interesting model to study these phenomena and their evolutionary origins. New data from macaque development will provide new insights on the cognitive and neural processes underlying imitative behaviors in nonhuman primates.
Reading beneath the surface appearance of events: primate inferences about goals and intentions

JUSTIN WOOD

Department of Psychology, Harvard University, Cambridge, USA

I will present a series of experiments on three nonhuman primate species (cotton-top tamarins, rhesus macaques, and chimpanzees), representing the three major groups (New World monkeys, Old World monkeys, and apes), that examined how individuals make inferences about others' goals and intentions. Results suggest that the psychological mechanisms that support the capacity to make inferences about others' goals are independent from the motor systems that support action on the world. These results have important implications for the nature and origins of action perception.
Imitation as an inheritance system

NICHOLAS SHEA

University of Oxford, Somerville College, Faculty of Philosophy, Oxford, UK

What properties does an imitation mechanism need to have in order to be evolutionarily significant? This paper focuses on just one such property, suggested by previous work in philosophy on the nature of genetic inheritance. That property is being an inheritance system. To be an inheritance system an imitation mechanism must not only give rise to heritable phenotypes which themselves have evolutionary functions, it must also have the function of doing so --- the meta-function of producing heritable phenotypes. This paper examines whether the imitation mechanisms studied experimentally meet the conditions to be an inheritance system, and spells out the consequences if they do.
What it means to be not human: Social learning without imitation

Bennett G. Galef

Department of Psychology, Neuroscience & Behaviour, McMaster University, Hamilton, Ontario, Canada

It has been known for more than a century that, relative to humans, other mammals are poor imitators. However, despite a lack of imitative ability, non-human mammals choosing amongst behavioural alternatives still manage to exploit the behaviour of others of their species to reduce the potential costs of individual, trial-and-error learning. Like humans, other mammals frequently use information acquired from observing the behaviour of conspecifics (or residuals of such behaviour) to guide the development of their own behavioural repertoires. I shall use social learning about foods by rodents as an empirical model system: (1) to explore non-imitative social learning processes and their consequences, and (2) to show that, although rodents give no sign of being able to imitate, they still garner many of the advantages that accrue to those that can.
Imitation and the wealth of the stimulus

Cecilia Heyes & Elizabeth Ray

Department of Psychology, University College London, London, UK

How do neurocognitive systems get the information necessary to match observed with executed actions? The associative sequence learning (ASL) model suggests that this correspondence problem is solved by sensorimotor learning in the course of ontogenetic development. The solution depends, not on innate knowledge and special-purpose computations, but on phylogenetically ancient mechanisms of learning engaging with a rich sociocultural environment. In support of this 'wealth of the stimulus' argument, we will present behavioural and neurophysiological experiments examining the online control of intentional and automatic imitation in adult humans. We will also report training studies, showing that automatic imitation can be enhanced and abolished by different regimes of sensorimotor learning, and discuss the types of social interaction that could generate imitative competence. If the wealth of the stimulus argument is correct, imitation is not an adaptation, but it may still have important evolutionary and developmental consequences.
Automatic and intentional imitation in infancy

MATTHEW LONGO

Institute of Cognitive Neuroscience, University College London, London, UK

We are able to imitate others deliberately; but there is also a tendency for people to imitate observed actions of others, independent of conscious will. Such intentional and automatic imitation represent the two great poles of imitative behavior in humans. By their nature, however, these two phenomenons are difficult to compare using comparable paradigms. In this talk, I will discuss data revealing similarity and differences between intentional and automatic imitation in adults, and their respective developmental trajectories. It will be argued that while automatic imitation exists from birth, the ability to intentionally imitate does not develop until the latter part of the first year of life. Changes in imitation during infancy will be discussed in the context of the two great “revolutions” in infant sociality, at approximately 2- and 9-months of age.
Learning to imitate in infancy

SUSAN JONES

Department of Psychological and Brain Sciences, Indiana University, Bloomington, USA

It is widely accepted that newborn infants can imitate a range of modeled behaviors, and evidence of imitative abilities at birth is often taken to indicate that the ability to imitate is innate. The belief that imitative abilities are innate is now part of the foundation of a wide range of theories within and beyond psychology and neuroscience. In this talk, I present data from several studies indicating that 1) the primary evidence for newborn imitation is not sufficient to support this extraordinary claim; and that 2) the ability to imitate is actually the product of a prolonged history of learning that extends through the first 2 years. While it will never be possible to show that newborn infants cannot imitate, these studies urge caution in the use of the proposal that imitative abilities of any kind are innate as a basis for theory construction.
Children’s flexible imitation: Prior experience and perceived causal efficacy influence imitation in 36-month-old humans

ANDREW N. MELTZOFF & REBECCA A. WILLIAMSON

Institute for Learning and Brain Sciences, University of Washington, Seattle, USA

Human children are remarkably adept at imitating, but what regulates when and what they choose to imitate? Not only do human children copy the overall goal or outcome of a demonstration, they also imitate the precise means a demonstrator uses to attain that goal. Here we show that 36-month-old children combine their own prior experiences and the perceived causal efficacy of the model to determine whether and what to imitate. In one new experiment, 36-month-old children were randomly assigned to have either a difficult or easy experience achieving a goal using their own technique. They then saw an adult use a novel technique to achieve the goal. Children with a difficult prior self-experience were more likely to imitate the adult’s means; it is as if they were more ‘open’ to imitating what they saw, based on their own prior difficulty with the task. Children in a second study showed further selectivity—they preferentially imitated causally-efficacious versus non-efficacious acts, with all other aspects of the demonstration controlled. In a final study we found that even after an easy prior experience led children to think their own means would be effective (and that they could ignore the adult’s technique), children still encoded the novel means performed by the model. After the model’s demonstration, we surreptitiously and invisibly altered the stimuli so that it was now impossible for the children to reach the goal using their own previously effective means. The children at first tried their own technique but then switched actions and imitated the model’s novel technique through deferred imitation. Taken together, these 3 studies show that young human children are not confined to rote and automatic imitation. In regulating their imitation young children combine information from two sources: prior experience of the self and the observed causal efficacy of the acts of others. This research will be discussed within a more general model of factors that influence the intentional control of when, what, and whom children choose to imitate.
Beyond imitative learning: The case for natural pedagogy
evoluto-nary mechanisms of cultural knowledge transmission in humans

GYORGY Gergely

Institute for Psychological Research, Hungarian Academy of Sciences, Budapest, Hungary

Infants fast-learn many cultural skills even when they cannot fully grasp their relevant causal, functional, intentional, or adaptive properties. How can such cognitively ‘opaque’ cultural forms be successfully transmitted across generations? The dominant view holds that imitative learning serves the evolutionary function of human cultural transmission. However, current theories of imitation are ‘relevance-blind’ lacking selection mechanisms to differentiate relevant (to-be-learned) from non-relevant (to-be-disregarded) aspects of observed behaviors.

We argue that the emergence of cognitively opaque cultural skills during hominin evolution created evolutionary pressure leading to the selection of a new type of ‘relevance-guided’ social-communicative learning mechanism: ‘Natural Pedagogy’. On the “teacher’s” side, NP involves an instinctual inclination to communicate by ostensive manifestation relevant cultural information to be fast-learned. On the “learner’s” side, NP involves evolved sensitivity to ostensive-referential cues that signal others’ communicative intention to manifest new and relevant cultural knowledge and trigger a receptive fast-learning attitude. We’ll present evidence showing differential cultural learning effects in preverbal infants who observed intentional actions either in ostensive-communicative or incidental observation contexts. It’ll be argued that many early emerging social-cognitive phenomena (e.g., imitative learning, social referencing, A-not-B error) are better accounted for by the epistemic functional perspective of NP than by hypothesized human-specific social motives to identify with, imitate, and ‘share’ mental states with conspecifics, or by related motor simulation theories (e.g., the mirror-neuron hypothesis).
Demonstrations: The guidance of imitation by the model

OLIVIER MORIN & DAN SPERBER

Institut Jean Nicod (CNRS/EHESS/ENS), Paris, France

Much imitation in humans takes place in the context of pedagogical interaction where the teacher guides the learner by producing the behaviour to be imitated in an ostensive manner: inviting the learner to pay attention, highlighting crucial features, and so on. We analyse this form of interaction, illustrate it with examples, and discuss it in relationship with Sperber & Wilson’s relevance theory and Csibra & Gergely’s theory of pedagogy. We speculate on the place of guided imitation in evolution, development, and culture.
Social and collaborative aspects of imitation

MALINDA CARPENTER

Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

There are many ways in which human social learning is even more social than previously thought. I will present recent research from our lab highlighting the social, collaborative, normative, and communicative aspects of imitation – and the effects of being imitated – already beginning in infancy. Whenever possible I will also present comparative results with apes, all of which support the view that human imitation, already in infants and very young children, is social and collaborative in a way that ape imitation is not.
“Resonant computers” - the role of imitation in modeling embodied communication with virtual humans

STEFAN KOPP

Artificial Intelligence Group, University of Bielefeld, Germany

Imitation requires an ability to map the perceptions of other’s actions onto corresponding motor representations of one’s own. Different representations and mechanisms can mediate in-between, depending on the immediacy of imitation or the significances of the actions observed. Neuroscience has demonstrated an active involvement of (parts of) the motor system in the observation of actions of others and this may underpin higher levels of action understanding. Yet, most research has studied those mechanisms for imitation of transitive (i.e. object-directed) actions. I will take this view to communication, in which we frequently come to observe expressive intransitive behaviors of our interlocutors. There is growing evidence that the same mechanisms are also at work when we engage in social interaction, in which we do not only try to decode what a single behavior conveys but also respond in many “resonating” ways (e.g., by alignment or mimicry). I will present work that aims to explore those mechanisms for communicative hand gestures in computer simulations with virtual humans. I will show how modeling increasing abilities for imitating gestures brings our virtual agent “Max” further towards human-like qualities of embodied communication. In particular, the following aspects will be addressed: (1) the realization of perception-action couplings in virtual humans; (2) the acquisition of these couplings through imitation learning and the incorporation of this capability in double-route models of imitation; (3) the taking of these couplings to levels of compositionality, symbolic encoding, and gesture meaning.
Covert imitation in tool use

CRISTINA MASSEN, MIRIAM LEPPER, ARVID HERWIG & WOLFGANG PRINZ

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Recently, a strong evolutionary connection has been suggested between the establishment of a culture of tool-use behaviour in humans and their ability for true imitation. According to Iriki (2006), the learning and execution of refined tool-use actions contributes to the emergence of a sense of the subjective self, because it raises the question of whether tools (and in a similar way, also the parts of one’s own body) have to be regarded as belonging to oneself, or to the outer world. In this sense, tool users learn to see their body parts and also themselves from a third-person perspective, and develop the ability to imitate the form of an observed action, independently from its current goal or environmental triggers. We are currently investigating processes of automatic action activation through the observation of others’ tool-use actions. In the experiments reported, priming effects for observing the target, the movement or the target-to-movement-mapping (or action rule) of a tool-use action were experimentally dissociated. The results of a series of experiments show that the observation of others’ tool-use actions in humans leads to an activation of the action rule, rather than an activation of the goal of the action. They may thus be taken as evidence for a mirroring system in humans that is specialized for coding the form or “how” of an action, independent from the concrete goal that may be pursued by the actor.
Social dinner

at the Heurigen "Mayer am Pfarrplatz" (Beethoven House)

As old as the history of Vienna itself is the history of its wine. In the Third Century A.D., the Roman Emperor Probus promoted grape growing in the Roman provinces, and here in Vienna the grapes thrived. Ever since then wine has been drunk here. Light, fresh and tasty the “noble nectar” trickles down the throat and makes one merry and warm.

A special attraction is the romantic old house of the Mayer family, which is completely unchanged since Ludwig van Beethoven lived there in 1817. The Mayer family has lived in Grinzing and Heiligenstadt since 1683. All the wine they serve originates completely from their family-owned and self managed vineyards, and is of select quality. About half of the vintage is served at “Heurigen”, the rest is sold in bottles. Their wines can be found on the wine lists of many first class hotels and restaurants all over the world.

Ludwig van Beethoven lived in this house on Pfarrplatz in the summer of 1817. At that time there was a spa in Heiligenstadt, which Beethoven visited, hoping to find relief from his constantly worsening deafness. During an earlier stay in Heiligenstadt, Beethoven composed his 6th Symphony (Pastoral), and while staying in this house, he worked on his greatest opus, the 9th Symphony (Choral).
Converging evidence from different fields of cognitive neuroscience suggests that the observation of an action leads to a direct activation of an internal motor representation in the observer. It has been argued that these shared representations form the basis for imitation, action understanding and mentalizing. However, if there is a shared representational system of perception and action, the question arises how we are able to distinguish between intentionally formed motor representations and externally triggered motor plans. First, I will present recent behavioural experiments investigating the role of intentions in shared representations. Then, I will outline brain imaging work that points to the crucial role of self/other distinction when dealing with shared representations. Furthermore, I will present recent findings showing that the mechanisms involved in the control of shared representations share neural resources with social cognitive abilities such as action understanding, mentalizing and joint action.
Using expertise to understand cognitive and neural mechanisms of action observation

Beatriz Calvo-Merino

Institute of Cognitive Neuroscience and Department of Psychology, University College London, London, UK

In my talk, I will focus on our recent studies using expertise as a tool for understanding the neural and cognitive mechanisms by which we observe others’ actions. In our paradigm, we compare participants with different motor skills (e.g., dancers), while they observe different types of movements (e.g., dance moves). These movements are either familiar to participants, or novel. This approach enables us to dissociate the contributions of motor experience (familiar vs. unfamiliar moves) and motor skills (ability to perform these moves) for action observation and understanding. In particular, I will discuss (1) the neural substrates of action observation, and its interaction with motor experience and motor skill; (2) the cognitive mechanism (local vs. global processing) involved in the observation of whole body human static figures and human movement through biological motion; (3) and finally, I will present preliminary data on how expertise interacts with task instructions, that is, the aim of the observation. These effects are also observed at the behavioural level when performance between subjects is compared in visual discrimination tasks. Taken together, these studies show evidence for different systems for seeing actions at a neuronal and a cognitive level.
Beyond imitation: The role of emotions in guiding actions

RAFFAELLA RUMIATI

Programme in Neuroscience, Scuola Internazionale Superiore di Studi Avanzati, Trieste, Italy

I will present two studies that address the role of emotions in shaping imitative responses. The key results of the first study are the following. Imitation performance is enhanced when a seen lifting or tapping finger movement, compatible with a pre-instructed motor response, is preceded by a negative rather than by a neutral photograph. In the emotional condition, anxious participants’ responses were slower than those of the non anxious. The facilitation effect is disrupted when participants perform the same task after seeing a white circle moving instead of a finger, and is specific to aversive stimuli. In a second study, in which the same paradigm was used and ERP were recorded, we found negative shifts in the timing of two motor event-related potentials (the Readiness potential and the Motor potential) following the aversive stimulation. Aversive stimuli engage a putative defensive system which, in turn, promptly selects adaptive motor responses. Why would imitation improve the fitness of individuals? One possibility is that, for non anxious individuals, imitation constitutes a response model that is available, whose risks are readily assessed.
Task sharing: Does imitation presuppose joint action abilities?

NATALIE SEBANZ

Psychology Department, Rutgers University, Newark, USA

This talk will address the question of how the ability to engage in joint action with others and the ability to imitate others’ actions are related. I will argue that close links between perception and action provide a necessary but not a sufficient basis for joint action and imitation. The selective, intentional imitation of others’ goal-directed actions involves the ability to perceive others as intentional agents and the ability to distinguish between self and other. These abilities may have their roots in task sharing, where individuals acting in the same context form shared representations of each other’s actions and tasks, leading to changes in perception, action planning, and memory.
Understanding other people’s intentions and emotions from their behaviours

JULIE GRÈZES

Laboratoire de Physiologie de la Perception et de l’Action, Collège de France – CNRS, Paris, France

The ability to make judgments about mental states is critical to social interactions. To do so, the information that is directly available consists mostly in the movements of the agent in space and time in the physical or social environment. By observing other people’s non-verbal behaviour, humans are not only able to recognize the performed actions; they can also predict and infer underlying causes, emotions, intentions and beliefs from the behavior of others. We will present neuroimaging studies that explored the neural basis of everyday human competence to make judgments about beliefs, deceit and emotions through the observation of the non-verbal behavior of other people. These studies also aimed to clarify to what extent this ability rely on simulation, to determine the influence of inter-individual differences on the efficiency of this process, and to identify the degree of coupling between the representations of other people’s actions, intentions and affective states.
Mirror systems and social cognition

CHRISTIAN KEYSERS & VALERIA GAZZOLA

NeuroImaging Center, University of Groningen, The Netherlands

We often effortlessly understand what goes on in other people despite the fact that their goals and feelings are hidden from sight, inside of their brains. How do we do that? We will review evidence that suggests that while we view the actions of other people, we activate our premotor, parietal and somatosensory cortex as if we were executing similar actions. While we view the tactile sensations of other individuals, our somatosensory areas are activated as if we felt similar sensations. While viewing the emotions of other individuals finally, we activate our premotor and parietal areas as if executing similar facial expressions and our insula as if experiencing similar emotions. Overall, the stronger these mirror activations, the more empathic individuals appear on self report questionnaires of empathy. Together, this suggests that we may in part understand other individuals by simulating their actions, sensations and emotions.
The role of covert imitation in social perception

PATRIC BACH & STEVEN P. TIPPER

School of Psychology, Bangor University, Gwynedd, UK

Humans represent the actions of others as if they were their own. It has been proposed that this process of covert imitation would provide an observer with empathic insights into the internal states of the acting persons, but evidence for such a role remains scarce. I will report data from multiple paradigms that demonstrate a direct involvement of the action system in social perception. We show that properties of the observer’s own actions can become misattributed to the actions of others and influence how these persons are perceived. Moreover, when seeing others, observers re-activate knowledge about the bodily states associated with these persons, even when these states are not currently exhibited. Both processes are highly automatic, occurring even if person judgments are task irrelevant, but are nevertheless directly related to the subjective judgments of the observed persons. Thus, not only are our initial assessments of others based on processes in our own action system, but these processes may also form a part of our stored representation of these persons.
Monkey see, monkey doesn't

RICK VAN BAAREN, BARBARA MULLER, RON DOTSCH & AP DIJKSTERHUIS

Radboud University, Nijmegen, The Netherlands

People automatically imitate others. Research from neurological, social, cognitive, and developmental sciences leaves the impression that humans are “wired” to imitate. We argue that the current view on imitation is incomplete and that it partially lacks ecological validity, because it overestimates the contribution of imitation in human social interaction. In interpersonal situations, people can react with others but also to others. That is, when behavior relates to control and dominance, work from human ethology and primatology suggests that individuals not only imitate, but that they also behave opposite to the other (e.g., actor expanding the body, observer constricting it). This type of behavior, where perception of a specific behavior leads to performance of its opposite is often termed “complementarity”. Whereas many studies investigated the automaticity and neural correlates of imitation, little work has been done on the automaticity and underpinnings of complementarity. We present two studies, which suggest that in addition to resonance, complementarity is also an automatic reaction in social interaction.
POSTER ABSTRACTS

Theta burst stimulation of inferior frontal gyrus disrupts automatic imitation of finger movements

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In order to imitate an action, the imitator must solve the “correspondence problem” to establish which set of motor commands to their own muscles will produce an outcome that visually matches the imitated action. Both behavioural and neurophysiological evidence suggest that solving the correspondence problem is a process which occurs without intentional control, and thus that observed movements are imitated automatically. It has been hypothesized that automatic imitation involves “mirror neurons” located in the inferior frontal gyrus, but it has not yet been shown that this brain area is necessary for automatic imitation (i.e. imitation not under intentional control). We used theta burst transcranial magnetic stimulation to disrupt processing in the inferior frontal gyrus during a behavioural automatic imitation task. In baseline and control site conditions, participants showed automatic imitation of task-irrelevant finger movements: reaction times to perform finger movements (little and index finger abduction) in response to an imperative stimulus were faster when the accompanying image of a finger movement was response-compatible than when it was response-incompatible. Following theta burst stimulation to inferior frontal gyrus, this automatic imitation effect was abolished. This suggests that the inferior frontal gyrus is required for automatic imitation of movements.

Imitation does not readily lead to stable culture

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In a recent series of experiments, Whiten and coll. studied the spread and persistence of arbitrary behaviors between groups of chimpanzees and claim to have shown that chimpanzees can learn from each other with sufficient fidelity for local traditions to be maintained (Whiten 2005; Whiten, Horner et al. 2005; Horner, Whiten et al. 2006; Whiten, Spiteri et al. 2007). We, however, review other similar transmission chain studies and use a theoretical model of social learning to show that the level of fidelity they report is not sufficient to support the long-term persistence of animal culture. Imitation is obviously essential to cultural transmission, but the levels of fidelity observed in animal imitation are not sufficient by themselves to explain how “nonhuman species can sustain unique local cultures.” (italics added, Whiten, Spiteri et al. 2007). Other factors, which may be ecological or psychological, must contribute in an important way to explaining the fact that chimpanzee, and more generally animal cultures exhibit diversity and stability notwithstanding the relatively low level of fidelity in transmission.
Actions speak louder than words: Comparing automatic imitation and verbal command

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Automatic imitation – copying observed actions without intention – is known to occur, not only in neurological patients and those with developmental disorders, but also in healthy, typically-developing adults and children. Previous research has shown that a variety of actions are automatically imitated, and that automatic imitation promotes social affiliation and rapport. We assessed the power of automatic imitation by comparing it with the strength of the tendency to obey verbal commands. In a Stroop interference paradigm, the stimuli were compatible, incompatible and neutral compounds of hand postures and verbal commands. When imitative responses were required, the impact of irrelevant action images on responding to words was greater than the effect of irrelevant words on responding to actions. Control group performance showed that this asymmetry was not due to modality effects or differential salience of action and word stimuli. These results indicate that automatic imitation was more powerful than verbal command.

Body part priming in action imitation and the mirror neuron system depends on correlated sensorimotor experience

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The “mirror neuron system” in inferior frontal and inferior parietal cortices responds during both execution and observation of actions and hence is thought to play a key role in imitation. We used a combination of behavioural and neuroimaging methods to investigate the role of sensorimotor learning in the development of imitation and the mirror neuron system. First we showed that hand and foot movements were selectively primed by observation of a corresponding, task-irrelevant effector in motion. We then showed that incompatible training, in which observation of hand movements was paired with execution of foot movements and vice versa, led to a greater reduction in body part priming than compatible training, in which subjects experienced typical contingencies between observation and execution of hand and foot movements. Using functional magnetic resonance imaging, we found that incompatible training altered the relative action observation properties of the mirror system, such that areas showing greater
responses to observation of hand movements in the compatible training group responded more strongly to foot movements in the incompatible training group. These findings are consistent with the hypothesis that the development of imitation and the mirror neuron system are driven by sensorimotor learning.

The maintenance of traditions in free-living marmosets: Individual habit or social conformity?

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A frequency-dependent behavioural bias, also termed ‘social conformity’, is considered to be a hallmark of human culture because it accelerates the spread of behaviour within a group (Richerson & Boyd 2005). There is an increasing body of literature on the formation and transmission of behavioural patterns in non-human animals (Fragaszy & Perry 2003; Whiten et al. 1999), yet few empirical studies have investigated the mechanisms involved in stabilisation and maintenance of these so-called traditions over time (Whiten et al. 2005; Leca et al. 2007). It has been assumed that individuals in a social group monitor the behaviour of other group members and adapt their behaviour to the group norm, thus showing social conformity (Whiten et al. 2005). Challenging this current view, our field experiments suggest that the role of individual preferences and formed habits is more important than the social input from group members. Using a two-action apparatus, we established alternative behavioural patterns in nine different family groups of wild common marmosets. We wanted to assess whether individuals that discovered a technique that was different from the group norm would adjust their behaviour to conform to the group. In three groups where members could freely choose their technique, a bias towards one or the other method was observed (e.g. a tradition), but this preference could not be explained by social conformity. A significant number of animals that discovered both techniques preferred the action they were initially successful with, independent of the group preference and the type of action. Animals in the six groups that experienced only one of the two techniques during a training phase reliably remained with that method over an extended period of time, despite discovering the alternative technique when both solutions had become available. These results indicate that the observed behavioural pattern within groups 1) did not adjust to the group norm and 2) could be explained by the first successful manipulation of most individuals. We propose that after an initial spread of a behaviour throughout a group, this behaviour then stabilises because of individually formed habits. This mechanism may in turn lead to a superficially conformist appearance of a group, but is more parsimonious than the socially and cognitively complex mechanism of a conformist bias.
Why domestic dogs (*Canis familiaris*) perform differently in a social learning task

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The aim of this study was to discover the factors which determine the presence or absence of social learning in domestic dogs (*Canis familiaris*). The study further examined whether dogs used alternative behavioral strategies for solving the task, in the absence of social learning. Forty dogs were confronted with a test box that could be manipulated in order to obtain the food inside the box. They were exposed to demonstrations of how to open the box by a human model. The behavior of the dogs during the experiment was analyzed and behavioral patterns were examined using factor analysis. To measure individual differences between dogs, owners were asked to provide socio-demographic data (e.g. age, breed) and describe their relationship with their dogs, as established by the Questionnaire for Anthropomorphic Attitudes (Topál, Miklósi, & Csányi, 1997). Twelve dogs used individual learning to open the box, while only two dogs learned to open the box socially, by applying the demonstrated opening technique. However, some dogs did not try to open the box but used different behavioral strategies. Dogs that had a very close relationship to their owners tried to engage them in the task and requested help from them. Therefore, a predisposition to learn individually as well as a close relationship with owners might prevent dogs from learning socially.

The differential influence of ostensive communicative context on observational learning in human infants and domesticated dogs: A comparative study

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Recent study (Gergely & Csibra 2007) showed that infants have an early sensitivity to ostensive communicative and referential cues (OCRCs), like eye contact, motherese, gaze-shift, pointing. In order to reach the required goal in an ostensive-communicative context infants tend to imitate „cognitively opaque” and less effective actions. Recent experiments have shown corresponding skills in dogs, human behaviour action can actually be used by dogs as a cue for selecting functionally similar behaviour on their part (Topál et al. 2006, Erdőhegyi et al. 2007).

In this study we created a comparative situation between human infants and dogs to examine how the OCRCs and the presence of the demonstrator influence the behaviour of the subjects in a two-way choice task and what can be the reason for the differences or the similarities in their choice behaviour.

14–18-month-old infants and dogs had to choose between two bowls after a demonstration. One of the bowls was empty and transparent the other one was non-transparent and baited with a ball. The bowls were connected with each other through a
special device so when the demonstrator moved the empty bowl this led to the baited one becoming lifted up and the ball rolled out of it. In the study we varied if the demonstrator (D) used OCRCs during the demonstration (Ostensive stance) or not (Incidental stance), and if the D was present or not present during the test phase.

Infants in all conditions chose the empty (the demonstrated) bowl first which shows that they can learn from this situation: for some reason it is much worth to choice the empty bowl, because the demonstrator did it that way. Dog in the Ostensive/D present condition also chose the empty bowl, but not in the other conditions. This can show that dogs are also sensitive to the OCRCs, but they not learn rather they synchronize their behaviour, but they do it only in the presence of the demonstrator.

Automatic imitation across effector systems

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The effector-specificity of automatic imitation was investigated using a stimulus-response compatibility (SRC) procedure in which participants were required to make an open or a close response with either their hand or their mouth. The correct response for each trial was indicated by a pair of letters in Experiments 1 and 2 and a coloured square in Experiment 3. Each of these imperative stimuli was accompanied by task-irrelevant action images depicting a hand or mouth opening or closing. Relative to the response, the irrelevant stimulus was either movement compatible or movement incompatible, and either effector compatible or effector incompatible. A movement compatibility effect was observed for both hand and mouth responses. These movement compatibility effects were present when the irrelevant stimulus was effector compatible and when it was effector incompatible, but they were smaller when the irrelevant stimulus and response effectors were incompatible. These findings, which are consistent with the associative sequence learning model of imitation, indicate that automatic imitation is partially effector-specific, and therefore that the effector-specificity of intentional and instructed imitation reflects, at least in part, the nature of the mechanisms that mediate visuomotor translation for imitation.

Cooperation and automatic imitation

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In naturalistic interpersonal settings automatic imitation generates liking, affiliation, cooperation and other positive social attitudes. The purpose of this study was to find out whether the relationship between cooperation and imitation is bidirectional; can cooperative priming increase automatic imitation? Participants were either primed with cooperative or non-cooperative words in a scrambled sentence task. They were then tested using an automatic imitation stimulus-response compatibility procedure. Participants were required to perform a pre-specified movement (e.g. opening their hand) on presentation of a compatible (open) or incompatible (close) hand movement.
Reaction time data, collected using electromyography, showed that cooperative priming produced a larger automatic imitation effect than non-cooperative priming. This difference, which may be due to modulation of attention to social stimuli, indicates that the relationship between imitation and cooperation is bidirectional.

How do we infer others' goals from their actions?

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A huge body of evidence shows that action observation directly activates an internal motor representation in the observer (direct matching). However, little is known if this mechanism is used to infer other people's action goals in non-stereotypic implausible action situations. I will present recent evidence from functional magnetic resonance imaging that aimed to unravel this question. For goal inference processing in implausible action situations we found a mentalizing network consisting of the superior temporal sulcus, the right inferior parietal cortex, at the junction with the posterior temporal cortex (TPJ) and the angular gyrus of the inferior parietal lobule. In line with previous findings, we found the mirror system involved in direct matching to be more strongly activated for highly plausible actions (Iacoboni et al. 2005) indicating an involvement of the inferior frontal gyrus (IFG) in goal representation for stereotypic actions. Our findings are in line with teleological reasoning accounts (Gergely & Csibra, 2003) in which goal inference in implausible action situations is based on an evaluation of the action as an optimal mean to obtain the goal given the situational context (Gergely & Csibra, 2003).

Juvenile ravens copy the behaviour of a human experimenter in an artificial fruit task

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It has been suggested that staying with parents and/or peers allows young ravens to adopt local habits and traditions. In support for this view, Fritz & Kotrschal (1999) found evidence for social learning in 3-months-olds birds: the foraging behaviour of naive individuals was affected by a model bird's actions. We here built on those experiments to test directly for the ravens’ capacity to copy the behaviour of others. We individually confronted a total of 13 hand-raised young ravens with a kind of artificial fruit apparatus. A human experimenter (which was very familiar to the birds) demonstrated one of two opening techniques (horizontally or vertically pushing sliding lids; n = 7 and 6 subjects/group), both of which were executed at the same position of the apparatus. Birds that received a horizontal-push demonstration were more likely to open the
apparatus with horizontal push-movements than those who could see a vertical-push demonstration. This indicates that naïve young ravens are capable of copying simple behavioural techniques from humans and offers the possibility that imitation may play a vital role in ravens’ early social life.

**Does learning to imitate depend on contingency?**

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Several recent studies have found that the development of imitation and the mirror system depend on sensorimotor learning. Here we asked whether this kind of learning is driven by the predictive relationship between (contingency), in addition to the co-occurrence of (contiguity), observed and executed actions. During training in Experiment 1, participants executed opening and closing hand actions while (1) observing an incompatible action in every trial (contingent group), or (2) observing an incompatible action in one half of the trials, and no action in the other half of the trials (non-contingent group). In a subsequent test session, participants were required to execute a pre-specified hand action (e.g. opening) while observing a human hand performing a compatible (opening) or incompatible (closing) action. On test, the contingent group showed a smaller automatic imitation effect than the non-contingent group, suggesting that the non-contingent group had learned less during training. Experiment 2 replicated this finding, and through the addition of a ‘signalled group’, found evidence that response-only trials diminish the effects of training by reducing learning rather than by promoting extinction. These findings suggest that, like associative learning in nonhuman animals, the learning that contributes to the development of imitation depends on stimulus-response contingency.

**Imitation recognition in capuchin monkeys (Cebus apella)**

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Imitation recognition is based on the ability to conceive of a match between one’s own motor output and the visual input from another individual’s actions. Human infants appear to perceive being imitated as a form of social communication as indicated by preferential looking, smiling and contingency testing behaviors directed at an imitator. It is still an open question if and how other primates recognize when they are being imitated. Here we present data on imitation recognition in tufted capuchin monkeys (Cebus apella). In Experiment 1, capuchins interacted with an object while being faced by two experimenters. The imitator performed the same object-directed actions as the capuchins while the non-imitator performed non-matching actions, both acting in synchrony with the monkeys. In Experiment 2, while capuchins manipulated an object,
both experimenters performed synchronous actions matching those of capuchins; however, one experimenter looked directly at the monkeys while the other looked away from the monkeys. Results indicate that capuchins looked significantly longer at the imitator than the non-imitator, but that gaze directions of experimenters did not significantly affect visual preferences of the monkeys. No social responses or contingency testing behaviors were observed. It appears that capuchins are equipped with a basic action-matching mechanism but that they do not attend to others’ attentional states, which suggests that being imitated is not understood as a communicative interaction.

The effect of ostensive cues on dogs’ performance in a manipulative social learning task

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Attracting the attention of a subject while demonstrating how to solve a problem is usually thought to improve the social learning abilities of dogs and also human children. Here, we investigated learning from a dog and a human demonstrator in a manipulate task, where the models demonstrated which part of a box to manipulate in order to open the box and get the food reward. We varied the communicative context both for the dog and the human demonstrator in a comparable way: a second experimenter was directing the attention of the subjects to the model or she remained silent. In a fifth condition the human demonstrator herself was calling the attention of the dogs towards her demonstration. In line with former studies, we found that the human and dog demonstrator were equally effective. However, the effectiveness of the demonstrations was significantly hampered if communicative cues were given. This was especially the case with the result that showed the talking human demonstrator to be less efficient than the silent model. This was somewhat surprising in light of a detour study (Pongracz et al., 2004) that found attention getting the most important component of a human demonstration. The reason for the negative effect of communicative cues during the demonstration on the social learning of dogs seemed to be a combination of reduced attention focused on details of the problem, as well as a higher level of excitement.

The touch-screen method as an implement for dog experiments

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In the last few years the cognitive abilities of canines have aroused a great deal of interest. Adequate methods for conducting experiments concerning, for example., their ability to classify and categorize visually, were missing and thus nothing was known about these
abilities in dogs. By using a touch-screen to test dogs, it is now possible to study them without human cueing, under circumstances that are suitable for dogs. Several studies implementing the computer automated technique have been or are being conducted at the moment, including a visual categorization task, learning by exclusion, as well as comparing their discrimination abilities on the touch-screen with object discrimination under conditions in reality.

The categorization study examined dogs’ ability to discriminate between a set of dog pictures and a set of landscape pictures. The dogs learned to discriminate between the two sets and could transfer their knowledge to novel pictures. Furthermore, their performance on new dog pictures mounted on already known (and thus negative) landscape pictures remained significant, this indicates the use of classification with a category-based response rule. The learning by exclusion study demonstrated that dogs could extend their knowledge about S+ and S- stimuli to new items according to the exclusion rule on the touch-screen. The object discrimination study will show dogs’ ability to understand the connection between pictures of objects presented on the touch-screen and the real objects themselves within a two-choice discrimination task. We argue that the touch-screen method is a relevant investigation tool for testing cognition in dogs and for comparing their abilities with other species.

Controlling automatic imitation recruits key processes involved in social cognition

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Recent work, based on the discovery of ‘mirror neurons’, has suggested that action observation leads to an automatic activation of corresponding internal motor representations. However, in healthy adults the potential to imitate is not always automatically translated into overt performance, raising the question by which cognitive and neural mechanisms imitative behaviour is brought under intentional control. Previous neuroimaging studies showed that the inhibition of imitation draws on regions (anterior fronto-median cortex (aFMC) and the temporo-parietal junction (TPJ)), implicated in higher-level social cognitive processing. This suggests that the inhibition of imitation requires cortical regions and computational mechanisms needed in social cognition, such as separating the perspectives or representations of self and other (relying on the TPJ), or such as the building and maintaining of intentions and intentionality (related to the aFMC).

To address this issue, we aimed to investigate overlapping functions of the intentional control of imitation and social cognitive abilities in a within-session, within-subject fMRI study. Previous work was primarily based on between-experiment and between-subject comparisons of activated regions. We hypothesized that if common computational mechanisms exist, similar neural regions should be activated across tasks in one study, supporting these elementary processes. In the present study, eighteen participants completed four tasks tapping these functions. Imitative control required participants to
lift their index or middle finger in response to a number, while viewing videos of incongruent or congruent finger movements. Social cognitive abilities were tested by a mentalizing task, a paradigm requiring self-referential judgments and a task on agency processing. Activations in the individual tasks were tested for common overlap by means of a conjunction analysis. As predicted, commonly activated regions occurred in the aFMC and TPJ. Furthermore, the individual ability for controlling imitation was functionally related to behavioural and neural correlates of mentalizing functions. These findings further support the idea that controlling imitative behaviour recruits key processes involved in social cognition, implemented in similar cortical regions. This might include a meta-cognitive ability for representing one’s own or others’ intentions and mental states, and a rudimentary capacity to differentiate between self- and other-related actions, thoughts or perspectives.

**Do common marmosets (Callithrix jacchus) copy a conspecific model’s action or its effect?**

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In the study of social learning there is a crucial question as to whether observers copy a demonstrator’s actions or learn about the effects these actions made on the environment and try to reproduce them with their own method. Interestingly, human children seem to show a higher general tendency to copy demonstrated actions (imitation), whereas chimpanzees focus primarily on the environmental changes (emulation) in problem-solving tasks (Call et al. 2005). In this study, we wanted to investigate whether common marmosets – a primate species characterized by high tolerance and synchronized and cooperative behaviour – learn more successfully from a conspecific model’s action and/or its environmental effect (movement of the apparatus and getting access to the reward). 25 common marmosets were tested in a manipulation task, to examine whether they could pull an opaque cylinder out of a ring to get access to food. Animals were tested in five different conditions, (1) seeing the model’s action only (failed attempt), (2) viewing the effect of the action, but no demonstration (ghost control), (3) observing both the action and the effect (full demonstration) or (4) one of these (social control). In a fifth condition, the end state of the demonstration (apparatus pulled out and the model eating from it) was shown without the movement of the apparatus. A comparison of these groups revealed that marmosets can learn from both the demonstrator’s action and the movement of the apparatus, however, the end state itself does not provide sufficient information to perform that task.
What dogs imitate in a “Do as I do” paradigm

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The present study was designed to investigate whether a dog (Canis familiaris) is able to show imitative behaviour, in the sense of being able to use the behaviour of a human or dog demonstrator as the basis for performing matching actions. The study is based on the work of Topal and his team with Philip, a dog trained to assist handicapped people (Topal et al, 2006). Philip is able to use different human actions as samples against which to match his own behaviour. Using the same method - “Do as I do” - this study investigated whether the ability of dogs to copy certain actions is limited to a human demonstrator, or if dogs are also able to imitate a dog demonstrator. The essence of the “Do as I do” paradigm is to internalise the rule that in a given situation the most diverse actions of the demonstrator have to be imitated as precisely as possible. The dog has no other clue for solving the problem than what it has seen just a few moments ago. The subject of the present work was Joy, a two-year-old Weimaraner. Joy was initially trained to repeat eight human-demonstrated actions on command (“Do it!”). When her performance was above chance in response to a demonstration by her owner, she was tested with another human demonstrator and with a demonstrator dog, performing the same eight actions. After several weeks of training with known actions, Joy was tested with novel actions that had never been used in this situation before. The novel actions were performed by the owner and by the demonstrator dog. Joy showed transfer to both a new demonstrator person or dog, as well as to novel actions to be matched; this proves the presence of some imitative abilities. In a second experiment, Joy was presented with novel actions, which weren’t part of the dog’s repertoire, and with a sequence of human actions, again using the “Do as I do” paradigm. Although the results point out significant limitations in Joy’s imitative abilities, she did, however, show a tendency for trying to understand and imitate these new actions as well.

Personality in dogs and its influence on social learning behaviour

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The study of individual differences in animal behaviour has become a topic of increased interest in recent decades. Individual behavioural variation has been found in many aspects of behaviour in a wide range of species. A number of studies demonstrated the heritability of these individual differences, and suggest that they may be adaptive and a product of natural selection. In practical work with dogs, behavioural tests, in particular with puppies, are a common method to determine the aptitude for various areas of use. Nevertheless, a scientific approach still raises a lot of unanswered questions. While more and more studies try to apply the concept of personality to animals, there is still a lack of knowledge concerning the connection between personality and performance in both
general and in particular situations. In the Vienna Clever Dog Lab, a number of different learning tests have been carried out with a large sample size of dogs of different breeds. In the present study, a personality test consisting of 14 different tasks was conducted on dogs that had participated in learning studies. A planned factor analysis will reveal a number of traits that can be used to describe dogs’ personality characteristics. The resulting personality profiles may provide a basis for the examination of the correlation between behavioural characteristics and performance in several different social and individual learning situations. Social learning takes place in the framework of an individual’s social interactions, which, in turn are likely to be affected by the individual’s personality. Assuming that personality influences the way an individual copes with social and non-social problems, we can expect to find significant differences in learning performance and behaviour in learning tasks that correlate with different personality profiles.

The influence of ostensive demonstration on selective imitation in dogs

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Recently, we showed that dogs could imitate selectively (Range et al. 2007), much like 14-month-old infants. In Gergely et al.’s (2002) study, the infants “rationalized” the inefficient head action of the model and themselves used their hands to turn on a light if the model’s hands were occupied – a constraint which the children did not share with the model. On the contrary, if the model’s hand were free when the demonstrator turned on the light with her head the infants adopted her method and used their heads as well. Similarly, our study dogs opted to use their mouth to pull a rod in order to gain a food reward if they had seen the model dog carrying a ball in her mouth, even though the model dog manipulated the rod with her paw. If, however, the model had used her paw while her mouth had been empty, the dogs also used their paw instead of the preferred mouth action. The occurrence of the selective copying behaviour of the infants proved to be dependent on the ostensive-communicative context of the demonstration (Gergely & Csibra 2005). If the children observed the demonstration incidentally they preferred the more efficient method in both conditions (e.g. their hands). It seems that ostensive cues are needed to communicate the relevance of the head action and to encourage the infants to learn it. Our new results also show that dogs stop imitating selectively if the communicative cues are removed from the situation during the demonstration. The behavioural similarities between dogs and children invite further experiments and the development of relevant theories.
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