

ESF SCH-SCSS Exploratory workshop

**Person perception during infancy: Integrating current knowledge from developmental and comparative psychology, cognitive neuroscience, psychology of language and communication.**

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## **Scientific Report**

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## 1. EXECUTIVE SUMMARY

### Aims and Academic Context of the ESF Workshop

The fundamental aim of the ESF Exploratory Workshop was to explore from an interdisciplinary position, the recent advances of various aspects of person perception. The variety of viewpoints, novelty of recently employed research methodologies and research backgrounds of the participants ensured a truly interdisciplinary stance was made on all topics. We then proceeded to apply this new information to our understanding of person perception during infancy; seeking to overcome seemingly insurmountable fundamental problems and theoretical issues found in infancy research. This workshop was vital to facilitate our understanding of person perception, primarily due to the different aspects of these highly complex and many-faceted issues that are currently hotly debated by scientists of an impressively wide range of different fields of study. The main issue is that the particular theoretical approach, and methodologies employed to the same issues are either unknown or, often misunderstood by the other disciplines. These different disciplines that were unified at our ESF Workshop include philosophy of mind, history of psychology, cognitive neuroscience, developmental cognitive neuroscience, psychology of language and communication, evolutionary psychology, the comparative study of social cognition, and research on the pathologies of intentional action and theory of mind (such as those found in autism) Therefore, the primary goal of the ESF Workshop was to bring together the *leading experts* of these new research directions from a wide range of European centers of research of excellence and to facilitate informal dialogue between them with the intention to help to integrate the many-faceted newly emerging novel approaches to these focal questions of scientific investigation.

The second aim of this exploratory workshop was to provide a possibility for highly promising young scientists at the beginning of their career, who are working in a variety of European countries and in different scientific disciplines, to present their work to and interact in-depth with the leading experts of these neighboring fields in an informal but intensive setting. Our idea was that such a meeting will also provide a useful forum for building bridges and planning joint, multi-site (and possibly multi-discipline) research projects that will usefully integrate the research efforts and resources of the different European research centers represented.

### Background and Organisation

The Workshop was convened by Dr. Tricia Striano and Dr. Vincent Reid from the Max Planck Institute for Evolutionary Anthropology (EVA) and the Center for Advanced Studies at the University of Leipzig. It was organized with the generous help of the Max Planck Institute for Human Cognitive and Brain Sciences (CBS). The workshop was held in the Wilhelm Wundt room on the 4<sup>th</sup> floor of the Max Planck Institute for Human Cognitive and Brain Sciences. This provided ample space, and excellent technical resources not far from the hotel in which participants stayed.

The organizational, administrative, and technical staff of both EVA and CBS provided excellent support throughout the meeting, including the broadcast of the workshop to a room at EVA (some 2 kilometres distant from CBS) where approximately 30-50 people viewed the activities of the workshop on videoscreen. This included the live projection of the Powerpoint presentations of the Workshop and their verbal discussions. This creative arrangement made it possible to keep the intense and informal small group setting of the ESF Exploratory Workshop intact, while making the proceedings available to the many interested academics who traveled throughout Europe and beyond in order to view the events of the workshop.

There were several well planned and executed events, such as a workshop visit to the Wilhelm Wundt room at the University of Leipzig and a workshop visit to the Wolfgang Kohler Primate Research Center at the Leipzig Zoo. Thus, with the generous support of the ESF and the additional financial, institutional, and organizational support provided by the CBS and EVA, the Workshop turned out to be a memorable scientific event with excellent technical and social organization.

Due to the timeliness of and great current interest in the interdisciplinary scientific topic of the proposed Workshop, with the help of the extensive European scientific contacts of the convenors, the large majority (95%) of the senior experts and young scientists originally invited from a wide range of European centers of research accepted the invitation to attend and participated actively throughout the Workshop. In total, 18 participants (10 senior and 8 young scientists) from 8 different countries (England, France, Germany, Holland, Hungary, Italy, Sweden and the USA) took part during the three days of the highly successful meeting.

## **2. 2. SCIENTIFIC CONTENT OF THE EVENT**

### **2.1. Structure and Format**

The structure of the three-day meeting reflected the interdisciplinary character of the workshop. It consisted of 7 sessions, organized around 7 topics that fitted with differing fields and methodological approaches. Each session contributed to the overall major theme of the Workshop of *person perception during infancy*, even though many presenters do not conduct research with infants. Each session consisted of two or three 30-minute presentations, followed by a 5-minute discussion period. Each session ended with a 45-minute general discussion, where all speakers and the discussant sat as a panel for questions from the other participants. There were two additional scientific events included in the workshop:

1. An introductory talk by Tricia Striano on the aims and goals of the workshop. During the talk, as a result of the impossibility for the ESF to provide a representative for the workshop, Tricia Striano also outlined the organizational structure, research objectives and opportunities available within the ESF.
2. The final afternoon session of the workshop was divided into two halves: (A) A general discussion of the workshop and its outcomes, and (B) a planning session, designed to facilitate collaborative research projects forthcoming as a result of the workshop. One other topic of discussion was the production of an edited volume by the workshop participants, covering the topics of the workshop. This volume would be based on their presentations and the resulting discussions.

### **2. 2. Scientific content of the contributions**

The seven sessions that were covered by the Workshop were in the following areas of research:

1. Perspectives on person perception
2. Person perception and the adult brain: Challenges for the developmental sciences from adult research
3. Person perception in infancy: Action processes
4. The role of language and action sequences in person perception
5. Person perception: The challenge of autism
6. The development of motor function and its relationship with person perception
7. Onwards

The workshop was opened by **Tricia Striano** (MPI for Evolutionary Anthropology, Leipzig, Germany), the co-convenor of the workshop. Her introduction was a brief welcome to the participants that included a summary sketch of the major aims of the meeting and its particular organizational structure. This was followed by outlining the role and function of the ESF, including the aims and organizational structure of the ESF, and how those aims can be realized via the programs and activities sponsored by the ESF.

The first session entitled '*Perspectives on Person Perception*' was chaired by **György Gergely** (Institute for Psychological Research, Budapest, Hungary) and included three excellent talks and a lively and provoking general discussion. First, **Vincent Reid** (Center for Advanced Studies, University of Leipzig, Germany) the co-convenor of the Workshop, presented a theoretical paper on the limitations of using observed behavior as a measure for our understanding of development. Titled *Perspectives on person perception: Beyond the descriptive*, his thesis argued that research into early social cognition has advanced rapidly over the past ten years. For example, it is now known that by 9 to 12 months of age, infants systematically engage in joint attention activities, discriminate intentional from accidental actions, use others' emotions to guide their action, and even take a rational stance toward observed actions. These various skills point to an early capacity to predict other's goals and future mental states. He argued that our understanding of when infants begin to perform behaviors that are related to social cognition is reasonably well advanced. He then proposed that the tendency to merely outline descriptive changes in infancy fail to uncover fundamental aspects of developmental social cognition. He suggested that in order to account for rapid social cognitive development, we must attend to mechanisms of change and relate these to brain growth and function. By way of example, he demonstrated how an understanding of Event-Related Potentials (ERPs) allow us to refine developmental cognitive theory and provide information that is not seen in infant behavior.

The next presenter was the cognitive neuroscientist, **Marco Iacoboni** (Center for Brain Mapping, University California, Los Angeles, U.S.A). His talk, entitled *Existential empathy: The intimacy of self and other*, investigated the human mirror neuron system and its relations to various forms of 'person perception', from imitation to emotion and intention understanding. What emerged from the empirical studies produced in his lab were as follows: to understand others we simulate their actions, their intentions, their emotions. This simulation process is not specific to people, and it is also used for perceiving other things, for instance objects. He posed a fundamental question: why do we need to simulate? What he proposed is an account that maps on to recurrent themes in existential phenomenology: if 'existence precedes essence', then one's thought - grounded in existence - must be perspectival and limited. Still, being-in-the-world means being involved with others and alongside things. Hence, simulation of others' actions, emotions, and thoughts is necessary to understand those things. He

called his approach *Existential Neuroscience* and the form of empathy that is explained by these mechanisms *Existential Empathy*.

The final talk of the first session was given by the comparative psychologist, **Michael Tomsello** (Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany). His entertaining presentation, entitled *What apes understand about others*, summarized his current research surrounding our understanding of primate cognition. Particular emphasis was placed on the understanding of intentions, goal directed actions, and other aspects of action perception, all of which were demonstrated with the cunningly crafted behavioral experiments for which he is so renowned. In doing so, he highlighted the benefits of comparative psychology to our understanding of cognitive processes.

The panel discussion of the first session highlighted the cross disciplinary nature of the workshop. Many questions were fielded by individual members of the panel, as well as ones for the panel as a whole. Much focus was placed on the implications of primate cognition for our understanding of human cognition, particularly during early development. There were general agreements on the nature of infant understanding of intentional action. However, this session was designed to illustrate the primary issue of importance for the field, namely, that differing disciplines approach the same topic without utilising pertinent information from other disciplines. In this respect, the workshop started in spectacular fashion, with the first session providing a platform for the central themes, issues and topics of the workshop.

The first afternoon session was on the topic of *Person perception and the adult brain: Challenges for the developmental sciences from adult research*, and was chaired by the Swedish developmentalist, **Claes von Hofsten** (Uppsala University, Sweden). The first talk, by the young German cognitive neuroscientist, **Marcel Brass** (MPI for Human Cognitive and Brain Sciences, Leipzig, Germany) was devoted to issues surrounding the inhibition of imitative action. His talk, entitled *Is it me or is it you? Self/other distinction and the inhibition of imitative behaviour* produced much debate in the workshop. First, he provided an overview of imitation research, specifically in humans, that suggest that when we observe another, we tend to simulate the actions of the other, and in doing so, understand the intentions, goals and objectives of the observed individual. Then he posed an intriguing problem for the workshop; namely that if we use neural networks and structures for perceiving action that are the same as those utilized during the production of action, then how do humans manage to create self-other distinctions, particularly during imitative behavior? The focus on imitative behavior was related to research that indicates that observing such behavior produces effects in terms of speed of reaction time when producing actions counter to, or in alignment with, the observed action. The resulting presentation, focusing on the role of the frontal lobe, covered issues as diverse as motor planning and frontal lobe development. Brass gave a lively presentation that also outlined the issues for developmental science in terms of

explaining how the prefrontal lobe may be activated during theory of mind tasks and indeed, prior to the ages classically associated with the accomplishment of theory of mind tasks.

The second, and final speaker for the afternoon session was the young French neuroimaging specialist, **Julie Grezes** (CNRS, Collège de France, Paris, France). Her talk, entitled *Perceiving intentions and emotion in other people's gestures*, provided a series of discussions on the nature of developmental processes and brain development. She explored how viewing the production of an action sequence may induce action simulation in the adult brain. One particularly illuminating study indicated that when we observe someone performing an action, our brains simulate making that action. Arguing that acquired motor skills offer a unique way to test this question, she presented data obtained from experts in classical ballet or capoeira dance, together with controls. She found differences in brain activity between watching an action that one has learned to do and an action that one has not, indicating that brain processes of action observation are modulated by the expertise and motor repertoire of the observer. These results, she suggested, indicate that the 'mirror system' integrates observed actions of others with an individual's personal motor repertoire, and suggest that the human brain understands actions by motor simulation. This led to the issue of infant motor abilities and how this may interact with their aptitude to detect and observe other humans that have highly advanced motor skills when compared with the infant. It was generally agreed by the workshop that more research was needed on the topic and that it is vital to our understanding of infant development. She also addressed the issue of limitations and advantages of new neuroimaging techniques, including how they may be applied to infant populations. It was agreed that fMRI was probably not the best method of investigating the developing human brain, and that near infrared imaging may be a useful tool for developmental scientists, given its spatial and temporal resolution, however, much work on the method was still required.

Many questions were fielded during the general discussion of the afternoon session. A central theme became focussed on how brain imaging data from adult populations can be related to infant brain development and cognition. It was agreed that the relationship is problematic, however it is important to try and create a synthesis of our understanding from the different disciplines, including adult neuroimaging research. This is primarily the case, as Brass pointed out, as neuroimaging data can guide and inform cognitive theory and in doing so, lead to new predictions that can be tested using techniques applicable to special populations, such as infants.

The second day began with a session devoted to research on the topic of *Person perception during infancy: Action processes*, and was chaired by the Hungarian born English based developmental cognitive neuroscientist, **Gergely Csibra** (Birkbeck College, London, England). The first speaker was the young

Hungarian developmental psychologist **Ildikó Király** (Institute for Psychological Research, Budapest, Hungary), focussed on presenting data that provides evidence for infant understanding of rational versus irrational action. Recent research, she argued, has provided convergent evidence about the central organizing role of teleological interpretation in early understanding of goal-directed actions in infancy. For example, studies using a deferred imitation paradigm have shown that in 14-month-olds, imitative learning of novel means is a function of the infant's evaluation of the relative efficacy of the modelled goal-attainment in relation to the constraints of the actor's situation. However, she pointed out that the cues directing such early teleological action interpretations in preverbal infants are still restricted to the relevant perceptible features of the ongoing action and its context. She presented evidence from a series of imitation studies using complex action sequences with 28-month-old children in which the different types of (verbal and action-based perceptual) cues about goals were systematically varied. The studies collectively demonstrate the continued centrality of the teleological stance in encoding action sequences in terms of goals and suggest that goal information is a primary organising factor in the formation of event representations. This was elegantly displayed when performing an observed action sequence, irrelevant components of an action sequence were omitted by the children when completing the action sequence.

The second speaker of the session was the young German developmental psychologist **Petra Hauf**, (MPI for Human Cognitive and Brain Sciences, Munich, Germany). She presented work that investigated the relationship between action perception and action production in infancy. Entitled *Action perception and action production: A milestone for social communication?*, she maintained that particular importance should be placed on whether the perception of others' actions has an impact on the subsequent active performance of these actions and/or vice versa. Drawing on the common-coding account, with the core assumption that perceived and to-be-produced events are represented in a common domain, she highlighted the fact that there is evidence in adults, however, from a developmental perspective evidence is still rare. She presented data that investigated how infants come to understand own actions and actions of other people by means of a sequence variation. In a so-called *self study* the infants first produced an action and subsequently perceived two adults acting on a toy. In the so-called *other study* the order was reversed. The infants first perceived two adults acting on a toy and subsequently acted on toys by themselves. In a so-called other study, infants first watched a video clip on a screen which showed two adults acting on a toy by turns. Following this the infants were seated at a table and two toys were given into reach simultaneously. Thus, the infants had the chance to choose and to act either with the same toy they had seen in the video before, or with a different one. She argued that her results indicate developmental changes in the interplay of action perception and action production. She contended that clearly, action understanding plays an important role in the context of social communication. Long before we know "who is who" we are able to distinguish "who does what". Therefore, it is of special interest to



investigate the developmental processes involved in acquiring knowledge about other's actions as well as about our own actions.

The final speaker for this session, **Andrew Meltzoff** (University of Washington, U.S.A.), presented a talk on *Imitation, gaze following, and other persons "like me"*. Pointing out that imitation in infants illustrates a close coupling between the perception and production of action, Meltzoff argued that the imitation of bodily acts is mediated by a 'supramodal representation' that allows infants to recognize the similarity between self and other, and that this system is in place in newborns (the AIM account). Further, newborn imitation and the psychological and neural mechanisms that underlie it are important, because imitation is an innate social act that sets human infants on a developmental pathway for understanding others as intentional agents 'like me'. However, he stated that infants do more than simply observe and imitate the bodily movements of others. For adults, certain bodily movements have privileged meanings. For example, if an adult turns to look at an object, other people will do the same — 'gaze following.' His talk then focussed on work investigating eye gaze following during infancy. The results showed that infants at all ages turned to the same side as the adult, however, he highlighted a striking developmental change, with 9-month-old infants failing to differentiate between whether the adult turned with open vs. closed eyes, whereas the 10- and 11-month-olds significantly differentiated these conditions, and only turned to look at an object when the adult turned with open eyes. He suggested that the capacity to gaze follow is a developmental achievement, and provides hints about changes in infants' interpretations of the behavior of other persons. He also presented longitudinal data from these children 1-year later—when they were 18 and 24 months old. These results showed that those individual infants who displayed more sophisticated gaze following patterns as preverbal infants were the same individuals who excelled at language almost 1 year later. His paper concluded with a theoretical examination of both body imitation and gaze following, arguing that both depend on infants' understanding that others are 'like me'.

The panel discussion of the morning session focussed primarily on the relationships between understanding agency and the capacity to use other's as tools with which to direct attention in visual space. For example, eye gaze directs attention to specific objects or locations. The links between agency detection, understanding agent properties, such as teleological interpretations of agency, and understanding action sequences was the primary topic of the discussion. Many agreed that Meltzoff's work with gaze following provided evidence for the 'like me' hypothesis and that this was useful given that much evidence thus far has utilised only imitation and that to have a parallel avenue with which to provide support for the theory is very helpful in terms of conceptualising the central issues. It was also pointed out that Meltzoff's recent research provides further empirical support for theories linking language and joint visual attention, providing an excellent link to the topic of the next session.

The afternoon session focussed on the topic of *The role of language and action sequences in person perception*, and was chaired by the developmental psychologist **Andrew Meltzoff** (University of Washington, U.S.A.). The first speaker was the eminent German cognitive neuroscientist **Angela D. Friederici** (MPI for Human Cognitive and Brain Sciences, Leipzig, Germany). Her talk, entitled *Dissociating the function of the left ventral premotor cortex and the Broca's area* focussed entirely on adult subjects. The implications for development were well presented and covered in the resulting discussion. Her talk opened with the statement that there is a long-standing debate of which areas in the human prefrontal cortex can be mapped onto F5 in non-human primates. Based on recent single cell recording studies in monkeys and functional imaging as well as TMS studies in humans, she stated that it has been argued that the mirror-neuron-system can serve as a model for human language. The problem, she posed, is that although it is valid that language comprehension is supported by a temporo-frontal network, it is not clear which particular areas in the prefrontal cortex can be considered to support grammar processing. She then presented data showing that the left ventral premotor cortex subserves processing of probabilistic structures (finite state grammars), but that Broca's area, in particular BA 44, is needed to process phrase structure grammars. As all natural grammars are of the latter type, she concluded that it appears that BA 44 plays a crucial role for human language processing. Further, in humans the two brain regions under observation differ cytoarchitectonically in that BA 44 is part of the dysgranular cortex whereas the ventral premotor cortex is part of the phylogenetically older agranular cortex. Given this, much discussion was devoted to what the relation between these two areas in humans and F5 in monkeys may be.

The second talk of the session was presented by **Harold Bekkering** (Nijmegen Institute for Cognition and Information, Netherlands). His entertaining paper, entitled *Grasping your intention*, focussed on perceiving and performing grasping hand actions. Of interest was the basic organizational and control principles that are involved in generating intentional actions (for example, as in recent 'forward models' of the production of goal-directed actions involving grasping hand actions) and how these principles may be also involved in the perceptual analysis and interpretation of the actions of others. In principle, he argued, we generate goal-directed actions to change our environment, and therefore the intention behind an action is to perceive the environmental consequences of a specific motor act. A big puzzle for cognitive scientists is the question how these anticipated perceptual consequences could be realized by the motor system. Bekkering then reviewed recent behavioural, developmental, as well as neuroimaging experiments (EEG) on action production, perception, and imitation that provide new ways to investigate the neurocognitive mechanisms underlying the perceptual and motor organization and segmentation of behaviour in terms of means and goals in intentional actions and in human tool use.

The final presentation of the session was given by the Hungarian developmental cognitive neuroscientist **Gergely Csibra** (Birkbeck College, London, England). His paper entitled *Mirror neurons or emulator neurons? Predictive and postdictive simulation in the premotor cortex* focussed on the interpretations given to the recently discovered so-called “mirror neurons” and the mirror system in general. In his theoretical paper, Csibra contended that it is widely believed that the function of mirror neurons, discovered in the macaque cortex, is to make observed actions understood by recreating an internal motor representation of them. He challenged this view and attributed mirror neurons a narrower function: anticipation of subsequent actions by predictive simulation (emulation). He argued that this function fits better with the single-cell findings in monkeys and also maps better onto human neuroimaging data. For example, mirror neuron activation reflects not the commencement but the conclusion of action interpretation. He gave several reasons why our interpretation of the functional capacity of mirror neurons must be, at the very least, cautious. He concluded that mirror neurons do not 'mirror' observed actions with sufficient accuracy for effective simulation and perhaps at this stage, their name should be relabeled 'emulator neurons' in order to more closely match their functional characteristics.

The discussion of the afternoon session focussed on the relationships between action processes and language processes. Specifically, it was raised, is it possible that we are investigating the same neural system? Could we talk of action *and* language sequences as subserved by the same neural mechanisms? There was much debate, but it was generally agreed that we *can* begin to talk in terms of common aspects of these cognitive processes, which to this point in time have been regarded as fundamentally distinct from each other.

Session 5, on the topic of *Person perception and the challenge of autism*, was somewhat hampered by the absence of Jacqueline Nadel, who cancelled her talk and her presence at the Workshop, due to illness. However, those presentations that occurred were very well received and had a large impact on the general themes and the general direction of the workshop. The session was chaired by **Marco Iacoboni** (University California Los Angeles, California, U.S.A). The first speakers were **Peter Hobson** and **Jessica Meyer** (University College, London, England). Their talk, entitled *Beyond person perception: the case of autism*, focussed on how we conceptualize the bases for person perception. They explored this question through research on autism. They distinguished between what they proposed as the ability to perceive and copy the actions of someone else, and the propensity to perceive and engage with the other person's attitudes. Through investigating the profile of deficits in autism, they highlighted the significance of 'identification' for understanding the nature and developmental implications of intersubjective engagement, imitation and joint attention. As imitation and joint attention were key aspects of previous sessions, the data presented provoked strong discussions on what is “key” to understanding others. Hobson and Meyer proposed that the *quality* of looking is essential to our ability to classify joint attentional properties of behavior. As this workshop was

exploratory in nature, there were requests by workshop members for a more concrete, testable concept, or at least a more dimensional construct of quality, in order that such research could be conducted.

The second, and final speaker in this session was the Hungarian infant developmentalist **György Gergely** (Institute for Psychological Research, Budapest, Hungary) about his new theory developed together with Gergely Csibra about the hypothesis that the uniquely human characteristics of cultural learning and social cognition can be seen as the result of a primary human adaptation for 'pedagogy'. Pedagogy, he claimed, is a teacher-guided learning process whereby arbitrary associations, a characteristic of most cultural knowledge, can be formed quickly and effectively. He argued that the human-specific inclination to teach each other (i.e., to transmit relevant knowledge to conspecifics) is complemented by a human specific receptivity to benefit from teaching. Human infants are equipped with specialized cognitive resources that enable them to learn from infant-directed teaching: they are sensitive to cues that indicate teaching contexts, they tend to interpret actions occurring in these contexts as referential, they expect the "teacher" to provide relevant information about referents, and they fast-map such information to the referred object. Many phenomena of early social cognition, he claimed, like proto-conversations, gaze following, pointing, social referencing, or imitative learning can be re-conceptualized in this framework. Furthermore, while these phenomena are usually interpreted as manifestations, or precursors, of mentalistic interpretation of others, which then allow the child to engage in communication, according to the present alternative theory it is rather the early ability to expect and receive information by teaching, or more generally, to exchange information with others, that forms one of the sources for the later developing theory of mind.

The final session of the workshop focussed on the topic: *The development of motor function and its relationship with person perception*. This session was chaired by the co-convenor of this workshop, the young developmental cognitive neuroscientist, **Vincent Reid** (Centre for Advanced Studies, University of Leipzig, Leipzig, Germany). The first speaker was the Dutch scientist **Ad Smitsman** (University of Nijmegen, Netherlands), who presented a paper entitled: *The coupling between (person) perception and action: Infant's decision to act and co-act on basis of what they perceive*. The talk focussed on the relationship between the person who is performing actions, and the wider world. In an impassioned plea, Smitsman outlined how thinking of infants and children in terms of a dynamical system of interrelated associations between perception, action production and its effects on the environment effectively allows a greater understanding of the capacities of children and infants. Such a perspective, he claimed, effectively takes into account the dynamical interplay during the action between brain and sensory and/or motor variables when action proceeds. Such interplay, he argued, is needed to make the different parts of the body communicate and the planning of future actions directed and flexible in so far as the person can take advantage of upcoming circumstance that are fortuitous for

the desired outcome of the action. It is precisely this perspective that appears to be missing from many current theories of action perception and action production, he suggested.

The second speaker of the session was the Italian child psychologist **Elena Pizzuto** (Institute of Cognitive Sciences and Technologies, Rome, Italy). Her presentation, entitled *Deictic Gestures and Words for Person Reference in Early Development: a Window on the Links Between Meaningful Motor Action, Cognition and Language*, focussed on relationships between performing gestures and their relationship with words. She started by clarifying the relationship between gesture (conceived as a particular kind of meaningful motor action), cognition, and language via an investigation of the ontogeny and development of deictic, person reference devices in the gestural and vocal modalities. She then proceeded to present longitudinal data on the spontaneous gestural and vocal productions of Italian children from 12 to 25 months of age. She then drew a major distinction between deictic vs. content-loaded or representational elements produced in both the gestural and the vocal modalities. Her study suggested fundamental differences in types of deictic elements, each referring to objects, locations and to other people. The fundamental issue, she claimed was that the acquisition of spoken languages and gestural and vocal devices for person reference develop either in parallel, thereby suggesting that they rely on a common cognitive substrate, or whether they follow different developmental patterns, suggesting the existence of different underlying mechanisms. Her results suggest, she stated, that the gestural expression of person reference relies on cognitive processes that are inherently linked to linguistic communication with resulting implications for our understanding of the relationships between motor production, language and cognition.

The final paper of the session, and of the workshop, was presented by the Swedish developmental scientist **Claes von Hofsten** (Uppsala University, Uppsala, Sweden). His presentation focussed on the infant's ability to perceive and produce actions. Specifically, he outlined his well-known research into how early development of saccadic eye movements changes between tracking a moving object and how saccades change when the infant is moved and the object is stationary. He then produced new data on how infant's perceive and observe people during conversations, utilising recently developed eye tracking systems. These results suggest that attention is paid primarily to the mouth, rather than the eyes, as has been assumed by many, based upon previous research. His comparison of typically developing children observing the conversation compared with children with autism, suggest that looking is fundamentally erratic and is not *person centred* for children with autism when compared with the control group. Von Hofsten's talk effectively summarised the workshop by touching on many of the fundamental topics and issues raised during the past three days, as well as presenting data that was obtained via many of the differing methodologies that were offered by presenters during the workshop.

The general discussion of the workshop was chaired by **Tricia Striano** (MPI for Evolutionary Anthropology, Leipzig, Germany), and **Vincent Reid** (Centre for Advanced Studies, University of Leipzig, Leipzig, Germany). First, Reid summarised the central topics of the workshop, before proceeding to outline the relationships between the fundamental issues. He then presented the fundamental issues and problems that had been uncovered by the workshop. Gergely Csibra then suggested that the workshop conceptualise the fundamental question of developmental processes in person perception in the following way: *What do we need in order to build a robot that is capable of understanding human action and is capable of producing and participating in actions?* This issue was taken as a basis for discussion by the workshop. Many opinions were offered. These included the fundamental need for some type of vascular system (Iacoboni); The need for the robot to be able to discriminate subtle emotional aspects of social encounters (Hobson); and the need of the robot to realise that the observed persons were similar in some way to the robot itself, in order for the robot to associate the perceived actions to itself (Meltzoff). The general discussion effectively summarised the positions and views of the participants into a cohesive whole. The general discussion clearly proved that our understanding of person perception during infancy is still very unclear in parts and that we must work together in order to further our understanding of infant social cognition and its relationships with brain development.

### **3. ASSESSMENT OF THE RESULTS, CONTRIBUTION TO THE FUTURE DIRECTION OF THE FIELD**

The workshop was a highly successful event. Over the course of the three days, we were able to achieve all of the primary goals that the ESF workshop was designed and set up to accomplish. The Workshop was highly interdisciplinary and international. The small size of the exploratory workshop allowed for a unique opportunity to explore the theme of “person perception” with leading experts from various fields and countries that generally do not intermix. One unique aspect of the workshop was the unique chance to have leaders in respective interdisciplinary fields interact within a small atmosphere.

This is not the case in larger workshops that may invite only one expert to lecture to a large audience on the relevance of one field on another. It is also not the case in small workshops that involve individuals within one field generally working on a similar theme. In this way, the ESF workshop was truly an interdisciplinary event. Due in large part to the prestige of the ESF, we were able to recruit top scientists across disciplines to take part in this event. Leading scientists presented cutting edge findings; they learned from colleagues and even speculated about other fields based on their own empirical works. The workshop set the stage for future grants and collaborative initiatives such as European Science Foundation Networks. In addition, small collaborative

initiatives were also discussed among various scientists. This would not have been possible were it not for the interdisciplinary mix of participants.

The small and intimate nature of the workshop afforded substantial opportunities for discussion and debate between participants. In doing so, this workshop afforded a new outlook on many issues associated with person perception during infancy. One unique feature of the workshop was the panel discussions that were centred around a particular theme of the workshop and included scientists from across fields whose work followed different approaches and methodologies with which to focus around a common theme.

The general mix of senior and junior scientists appeared perfect. Scientists had no problem in interaction and in developing collaborative projects. The workshop was commended for its relaxed atmosphere and for plenty of opportunity both inside and outside the conference room for debate and discussion.

One potential limitation of the workshop was that it was inaccessible to students. This problem was solved at one level by providing a satellite broadcast to another location. We trust that the scientists who took part will convey what they learned and discussed to students and that these students will be involved in collaborative studies. However these students will be the main contributions to the future of science in Europe and generally are the ones who generate the most interesting ideas for the future and for discussion in general. We imagine that in the future it would be useful to open these small workshops to a small number of students - perhaps even one or two students for each workshop participant. This would assist in developing collaborative projects and in general would assist in ensuring the future of research on the theme by integrating and involving young scientists who are just getting involved in research.

We are sure that various collaborative projects will ensue from this workshop and that the workshop will result in larger collaborative networks in the future. In addition, we are planning an edited volume on the topic which will be of interest to a range of scientists and students working in fields of neuropsychology, developmental psychology, comparative psychology and the cognitive neurosciences.

#### 4. FINAL PROGRAMME

##### Sunday, June 26, 2005

Evening *Arrival*  
Reception at CBS, on the terrace from 19:00-21:00

##### Monday, June 27, 2005

- 09.30 - 10.00 **Overview and Greeting** *Tricia Striano* (Convenor)
- 10.00 - 12.15 **Session 1: Perspectives on person perception**  
Chair: *György Gergely* (Institute for Psychological Research, HU)
- 10.00 - 12.00 *Three 30-minute talks each followed by a 5-minute discussion period:*
- Vincent Reid* (Center for Advanced Studies, University of Leipzig, Germany) *“Perspectives on person perception during infancy: Beyond the descriptive”*
- Marco Iacoboni* (Centre for Brain Mapping, UCLA, U.S.A)  
*“Existential empathy: The intimacy of self and other”*
- 11.10 – 11.25 Coffee Break
- 11.25 – 12.00 *Michael Tomasello* (Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany) *“What apes understand about others”*
- 12.00 - 12.30 **Panel Discussion of Session 1**
- 12.30 *Lunch*
- 13.30 - 15.15 **Session 2: Person perception and the adult brain: Challenges for the developmental sciences from adult research**  
Chair: *Claes von Hofsten* (Uppsala University, Sweden)
- 13.30 - 14.40 *Two 30-minute talks each followed by a 5-minute discussion period:*
- Marcel Brass* (Max Planck Institute for Human Cognitive and



Brain Sciences, Germany) *“Is it me or is it you? Self/other distinction and the inhibition of imitative behaviour”*

**Julie Grezes** (Institute of Neurology, London, UK) *“Perceiving intentions and emotion in other people’s gestures”*

14.40 – 14.55

*Coffee Break*

14.55 - 15.15

**Panel Discussion of Session 2**

15.15 - 17.30

*Workshop visit to **The Wilhelm Wundt Museum and Laboratory***

19.00

*Dinner at „Bayerischer Bahnhof Brau & Gaststättenbetrieb“*

## **Tuesday, June 28, 2005**

09:15 - 12.00

**Session 3: Person perception in infancy: Action processes**

Chair: **Gergely Csibra** (Birkbeck College, London, England)

09:15 - 11:30

*Three 30-minute talks each followed by a 5-minute discussion period:*

**Ildikó Király** (Institute for Psychological Research, Budapest, HU)

**Petra Hauf** (Max Planck Institute for Psychological Research, Munich, Germany) *“Action perception and action production: A milestone for social communication?”*

10.40 - 10.55

*Coffee break*

10.55 – 11.30

**Andy Meltzoff** (University of Washington, U.S.A.) *“Development of social cognition: Imitation, gaze following, and other persons ‘like me’”*

11.30 - 12.00

Panel Discussion of Morning Session

12.00

*Lunch at the Institute*

13.00 - 15.30

**Session 4: The role of language and action sequences in person perception**

Chair: **Andy Meltzoff** (University of Washington, U.S.A.)

*Three 30-minute talks each followed by a 5-minute discussion period:*

**Angela D. Friederici** (Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany) ”Dissociating the function of the left ventral premotor cortex and the Broca’s area”

**Pines Nuku, Oliver Lindemann and Harold Bekkering** (Nijmegen Institute for Cognition and Information, The Netherlands)  
“*Grasping your intention*”

14.10 – 14.25

*Coffee Break*

14.25 – 15.00

**Gergely Csibra** (Birkbeck College, London, England) “*Mirror neurons or emulator neurons? Predictive and postdictive simulation in the premotor cortex*”

15.00 - 15.30

Panel Discussion of Session 4

15.30 - 17.15

*Workshop visit to the Wolfgang Köhler Primate Research Center* (<http://wkprc.eva.mpg.de>)

19.00

Dinner at „*Gasthaus Barthels Hof*“

21.30

Tour of Leipzig Infant laboratory

### **Wednesday, June 29, 2005**

09.15 - 12.00

**Session 5: Person perception: The challenge of autism**

Chair: **Marco Iacoboni** (Centre for Brain Mapping, UCLA, U.S.A)

09.30 - 11.30

*Two 30-minute talks each followed by a 5-minute discussion period:*

**Peter Hobson & Jessica Meyer** (University College London, U.K.)  
“*Beyond person perception: The case of autism*”

10.40 - 10.55

*Coffee break*

10.55 – 11.30

**György Gergely** (Institute for Psychological Research, HU)

11.30 – 12.00

Panel Discussion of the Morning Session

12.00

*Lunch at the Institute*

12.40 – 15.15

**Session 6: The development of motor function and its relationship with person perception**

Chair: **Vincent Reid** (Center for Advanced Studies, University of Leipzig, Germany)

*Three 30-minute talks each followed by a 5-minute discussion period.*

**Ad Smitsman** (University of Nijmegen, Netherlands) “*The coupling between (person) perception and action: Infant’s decision to act and co-act on basis of what they perceive*”

**Elena Pizzuto and Micaela Capobianco** (Institute of Cognitive Sciences and Technologies, Italy) “*Deictic gestures and words for person reference in early development: a window on the links between meaningful motor action, cognition and language*”

**Claes von Hofsten** (Uppsala University, Uppsala, Sweden)

13.50 - 14.05 *Coffee break*

14.45 - 15.15 **Panel Discussion of Session 6**

15.15 - 18.00 **Session 7: onwards**

**Group discussions of issues raised during ESF Workshop and the outlining of collaborative research possibilities**

Chairs: **Tricia Striano** and **Vincent Reid** (Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany)

19.00 Dinner at “*MDR Hochhaus – Panorama Restaurant*”

**Thursday, June 30, 2005**

*Departure*

## 5. FINAL LIST OF PARTICIPANTS

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## 6. STATISTICAL INFORMATION ON PARTICIPANTS

### Country Distribution

		%	Young Scientist
England	3	17	1
France	1	6	1
Germany	6	33	4
Hungary	2	11	1
Italy	1	6	
Netherlands	2	11	1
Sweden	1	6	
U.S.A.	2	11	
TOTAL	18	100	8

### Sex Distribution

		%
Male	11	61
Female	7	39

### Position Distribution

		%
Assistant Professor	2	11
Associate Professor	1	6
Lecturer	3	17
Ph.D Student	1	6
Post-Doctoral Fellow	2	11
Professor	7	39
Researcher	2	11