



BCCCD 2014

Budapest CEU Conference on Cognitive Development

Program and Abstracts



CENTRAL
EUROPEAN
UNIVERSITY



BCCCD 2014

Budapest CEU Conference
on Cognitive Development

ORGANIZED BY

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Central European University

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09-11 January, 2014
Budapest, Hungary



CONFERENCE ORGANIZATION

The conference is organized by the Cognitive Development Center at CEU
Cognitive Science Department, led by Professors Gergely Csibra and György Gergely

CONFERENCE CHAIRS

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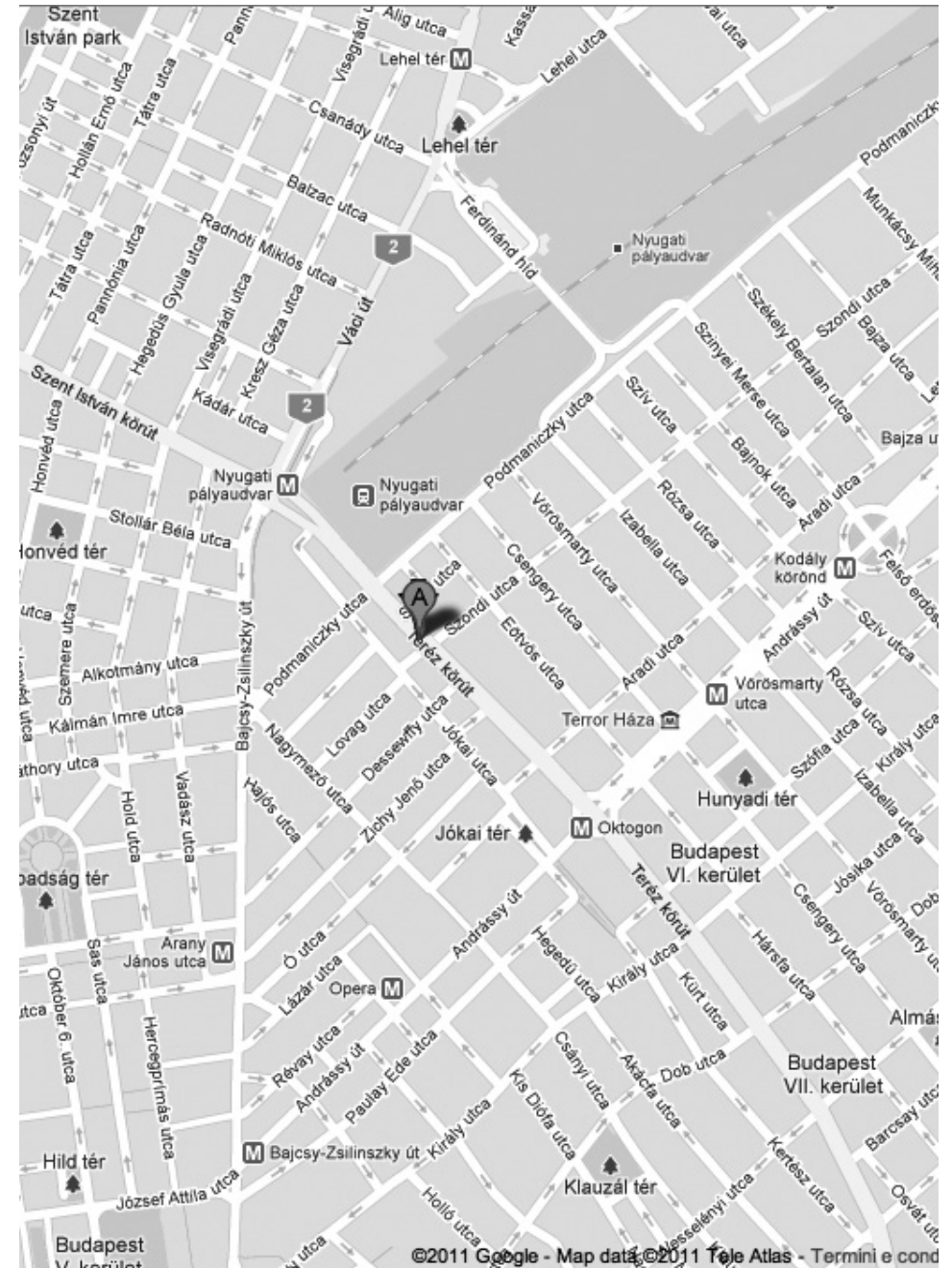
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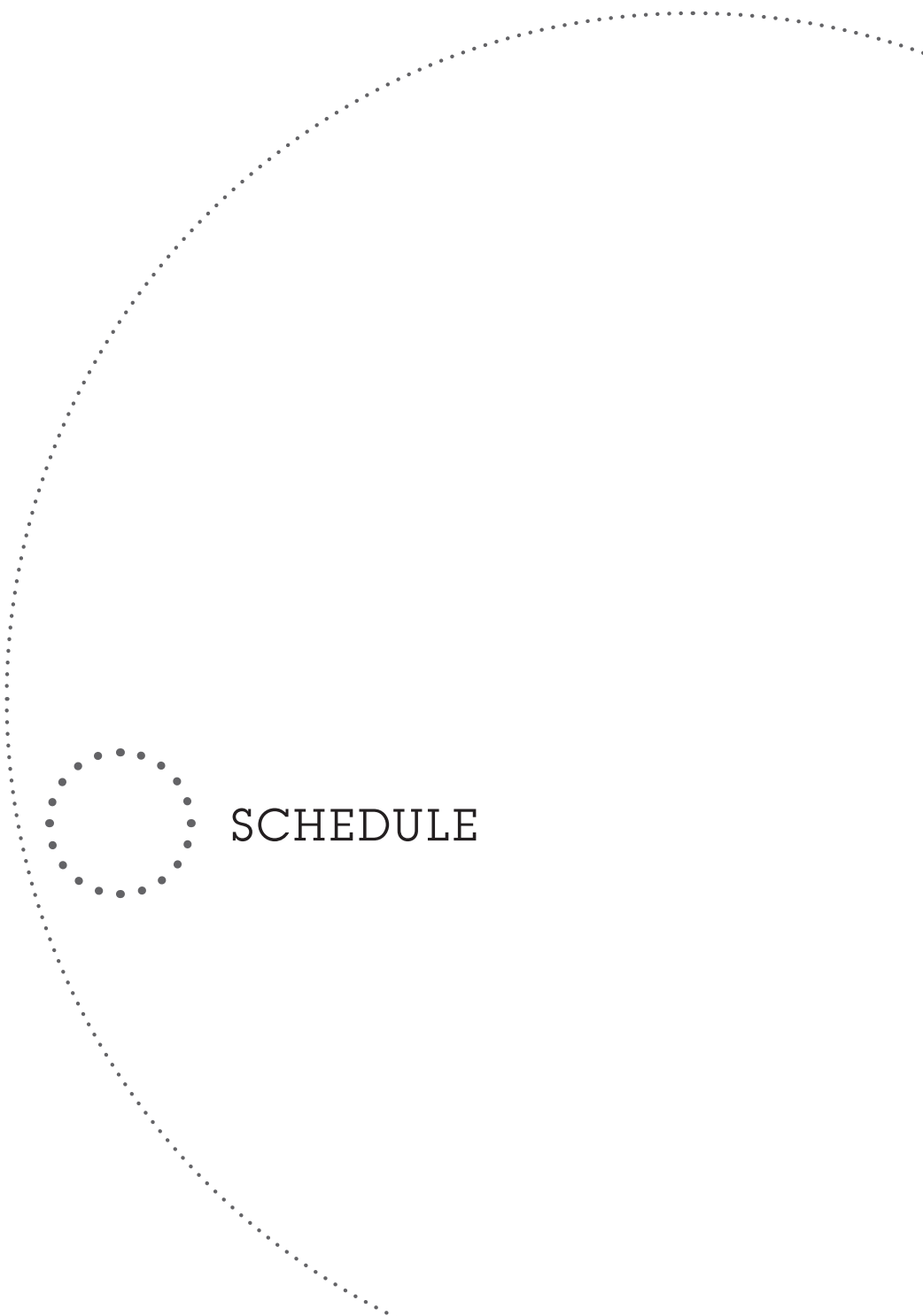
CONTACT

Andrea Schrök
E-mail: bcccd14@ceu.hu

ORGANIZING SECRETARIAT

ASSZISZTENCIA Congress Bureau
Szent István krt. 7, H-1055 Budapest, Hungary
Phone: +36 1 350-1854
Fax: +36 1 350-0929
E-mail: bcccd@asszisztencia.hu





SCHEDULE

January 9, Thursday

TOBII PRE-CONFERENCE SESSION

08.45 - 10.00 Part 1 - presentation
10.30 - 12.00 Part 2 - hands on workshop

BUDAPEST CEU CONFERENCE ON
COGNITIVE DEVELOPMENT 2014

12.45 - 13:00 **WELCOME**

13.00 - 15.00 **REGULAR SYMPOSIUM I**
 Novel approaches to children's developing
 understanding of social norms.

15.00 - 15:30 **COFFEE & SNACKS BREAK**

15.30 - 17.00 **PAPER SESSION I**

17.00 - 17:30 **COFFEE BREAK**

17.30 - 18.45 **KEYNOTE LECTURE I**
 Action video games as exemplary learning tools
 Daphné Bavelier

19.00 **RECEPTION**

January 10, Friday

8.30 - 10.30 **REGULAR SYMPOSIUM II**
 Early negation in infancy

10.30 - 11:00 **COFFEE & SNACKS BREAK**

11.00 - 12.30 **PAPER SESSION II**

12:30 - 13:30 **LUNCH**

13.30 - 15.00

POSTER SESSION "A" WITH COFFEE & SNACKS

15.30 - 17.30

INVITED SYMPOSIUM

The nature and consequences of children's concepts
 of social groups
 Gil Diesendruck

18.00-19.00

ICE SKATING

January 11, Saturday

8.45 - 10.00

KEYNOTE LECTURE II

Use of hammers and anvils to crack open nuts
 by wild capuchin monkeys
 Elisabetta Visalberghi

10.00 - 10:30

COFFEE & SNACKS BREAK

10.30 - 12.30

REGULAR SYMPOSIUM III

Contextual, prosodic and gestural cues to meaning
 in human infant and primate communication.

12:30 - 13:30

LUNCH

13.30 - 15.00

POSTER SESSION "B" WITH COFFEE & SNACKS

15.30 - 17.00

REGULAR SYMPOSIUM IV

Conceptual Influences on Perception and memory
 at the onset of Language

17:00 - 17:30

COFFEE BREAK

17.30 - 19.00

REGULAR SYMPOSIUM V

The role of direct experience and observation
 on action perception and prediction

20.00

CONFERENCE DINNER

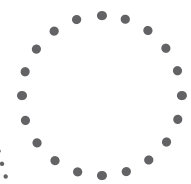


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KEYNOTE
LECTURES

KL1**Daphné Bavelier**

University of Geneva, Switzerland & University of Rochester, NY, USA

Action video games as exemplary learning tools

From chatting on the Internet to playing video games, technology has invaded all aspects of our lives. For better or for worse, it is changing who we are. But can we harness technology to effect changes for the better? In the midst of reported negative effects, recent studies show that this might indeed be the case. In a surprising twist, an often-decried activity such as playing action video games enhances various sensory, attentional and cognitive skills. A training regimen whose benefits are so broad is unprecedented and provides a unique opportunity to identify factors that underlie generalization of learning and principles of brain plasticity.

KL2**Elisabetta Visalberghi**

National Research Council, Italy

Use of hammers and anvils to crack open nuts by wild capuchin monkeys.

The use of stones as hammers and anvils has been considered a behaviour characterizing our ancestors and the Western chimpanzees, and only recently it has been discovered in wild capuchin monkeys. The EthoCebus team has investigated the use of stone tools to exploit encased foods on two groups of wild bearded capuchin monkeys living in Fazenda Boa Vista (Brazil). Cracking hard foods using stone tools, as practiced by bearded capuchins, involves planning, decision-making, modification of species- typical action routines, modulation of action to accommodate variable materials and settings, and monitoring activity throughout the course of performance. I will illustrate these features and the social foundations of skilled practice, including the role of physical alterations of the environment that shape development, and here again tool use provides a useful case example on the basis of field experiments and observational studies. Our results challenge the notions that selectivity, transport and physical skill in tool use are characteristic only of humans, human ancestors, and great apes. The behaviour of wild capuchin monkeys opens up a new reference point for thinking about tool use across species.



INVITED
SYMPOSIUM

IS1**THE NATURE AND CONSEQUENCES OF CHILDREN'S CONCEPTS OF SOCIAL GROUPS**

Organizer & Discussant:

Gil Diesendruck, Bar-Ilan University, Israel

Speakers:

Yarrow Dunham, Princeton University, USA**Katherine Kinzler**, University of Chicago, USA**Marjorie Rhodes**, New York University, USA**Adam Rutland**, Goldsmiths, University of London, UK

Social psychologists have for long been demonstrating the ways in which adults reason about groups. In particular, this work has demonstrated that adults readily classify people into groups, develop rigid representations about groups, and manifest attitudinal biases with regard to group membership. A variety of theories have been proposed to account for these findings, having to do with – among others – adults' social identity, dominance orientation, and justification for social systems. In the last few years, a burst of work on the development of group cognition has produced evidence that imposes new challenges to theoretical accounts of group cognition. In this symposium, some of the researchers leading this burst will present some of their recent work on different aspects of children's group cognition.

One of the important first steps in the study of group cognition is identifying the dimensions by which children and infants identify social groups. Kinzler will present evidence about the importance of language as a marker of social groups, for both young children and infants. In particular, in a series of studies with 5-6 year-olds, Kinzler found that children regard accent as a dominant cue for inferences about social relationships. Extending this line of work to infants, Kinzler found that already by 9-months of age, infants expect speakers of different language not to affiliate. Crucially, once identified, certain social groups get imbued with substantive meaning, both conceptually and affectively. Rhodes will discuss why certain social categories become targets of children's essentialist beliefs, and what some of the implications of such beliefs to children's attitudes and behaviors are. Specifically, Rhodes reports on the importance of particular linguistic structures to the essentialization of social categories, and how essentialist beliefs can lead to the development of negative attitudes towards essentialized groups.

As it is clear in the work on adults, one of the critical aspects of group cognition is its implications to intergroup relations and behaviors. The last two presentations focus on these. Dunham will describe studies suggesting that from a young age, group membership information influences the way in which children interpret information. In particular, Dunham finds that children might be especially sensitive to negative information about groups, but that group membership biases such information in favor of the ingroup. Finally, Rutland will discuss findings on how older children's evaluations of others are affected by others' group membership versus moral/conventional behaviors. Rutland finds that 8-9 year-olds give more weight to others' moral behaviors (e.g., distributing resources in an egalitarian fashion) than their group membership (e.g., if the other is an in- or out-group member).

Diesendruck will discuss the interactions among basic motivational, cognitive, moral, and cultural processes underlying the establishment, maintenance, nature, and functioning of social categories, revealed in the presentations. The understanding of these processes is of the utmost importance given the ubiquity of inter-group contact and conflict.

IS1-01**Building Representations of Us & Them****Yarrow Dunham**

Princeton University, USA

There is increasing evidence that young children and even infants possess a set of basic intuitions regarding social relationships, potentially including the function of social groups. However, less is known about how these initial intuitions interact with subsequent learning to produce richer representations of groups and their properties. I will present research in which preschool children are exposed to third party intergroup scenarios involving novel groups or are assigned to “minimal” social groups, and are then provided with information characterizing the group in some way. The primary question is how group membership affects the way in which further information is incorporated into richer group representations. Results suggest that: a) children are particularly sensitive to negative portrayals of groups and readily generalize such information to new group members; b) membership systematically skews multiple learning systems, including memory and person attribution, in the direction of increasing ingroup bias; c) membership protects children from internalizing globally negative evaluations of the ingroup while preserving their ability to make substantive generalizations about group behavior. In sum, these results suggest that early-emerging orientations towards groups constrain the process of category enrichment, most prominently by channeling learning in ingroup-favoring ways.

IS1-02**The origins of language as a social category****Katherine Kinzler**

University of Chicago, USA

Infants and children express social preferences for individuals who speak with a native accent of their native language. Do such choices exclusively reflect a child's own preference for interactions with familiar individuals, or are children's predictions about others' third-party social interactions also influenced by language? In first series of experiments, 5-6-year-old monolingual English-speaking children were presented with three people whose speech varied: a target and two potential friends. Children were asked which of the two potential friends was more likely to be friends with the target. Children predicted that social relationships would occur between individuals who spoke with a common accent, even if those people could not communicate effectively (e.g., if one used unconventional semantic meaning or grammatical structures). A second series of studies tested whether the tendency to view language as indicating social relationships begins in infancy. Nine-month-old infants from monolingual English-speaking environments viewed familiarization videos of two bilingual actors who either spoke the same language, or spoke in two different languages. All infants then viewed test trials in which the actors affiliated or disengaged. Infants' patterns of looking suggested that they expected actors who spoke different languages to disengage rather than affiliate. Infants familiarized to two individuals who spoke the same language did not exhibit this same pattern of results. Taken together, these studies provide evidence that language serves as a marker of social categorization that guides infant's and children's expectations about third-party social relationships.

IS1-03**The cultural transmission of social essentialism****Marjorie Rhodes**

New York University, USA

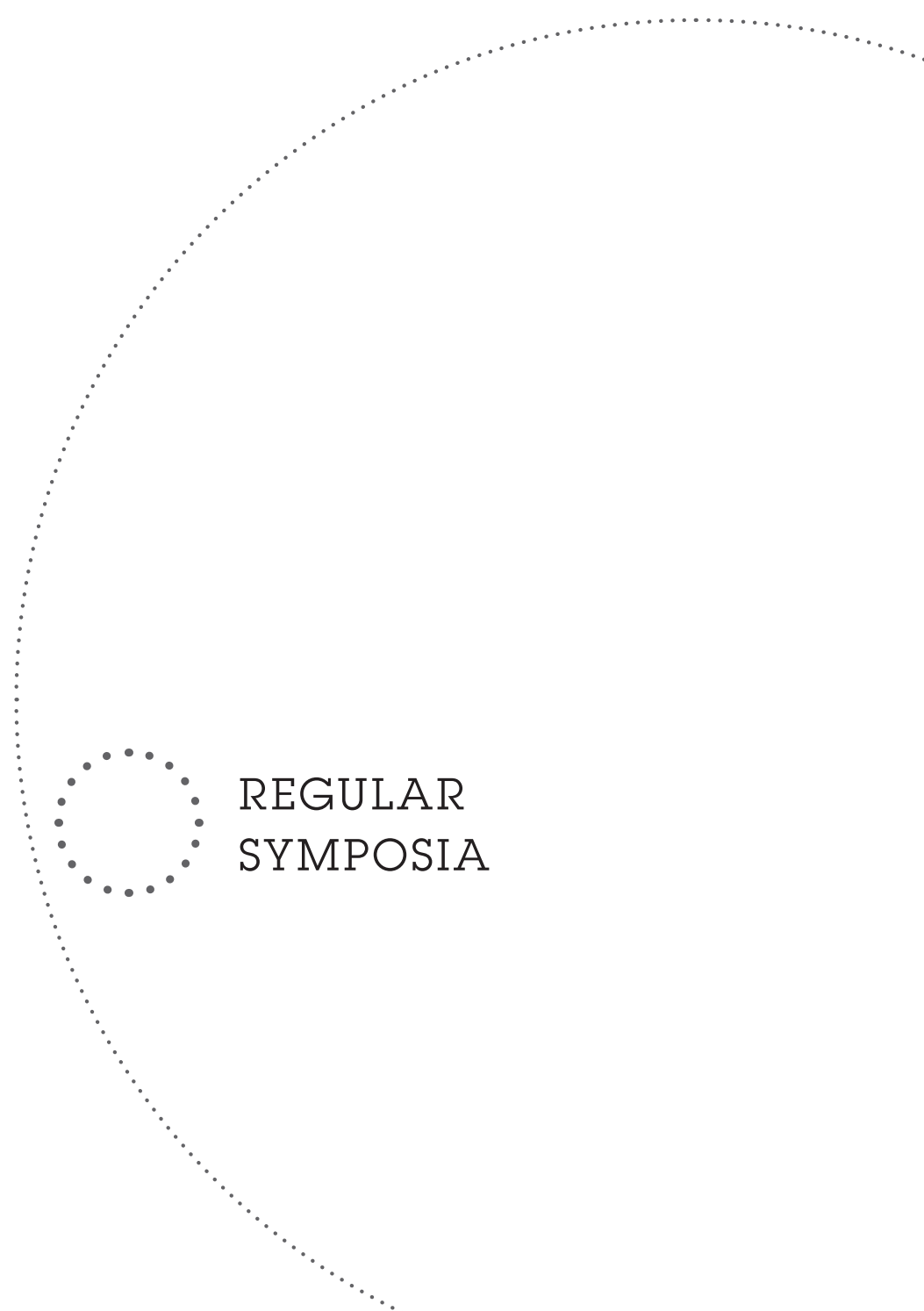
The conceptual system that underlies social categorization is flexible enough to accommodate a wide range of flexible criteria; thus, by the preschool years, children readily categorize people in many different ways (e.g., by gender, race, religion, language, shirt color, traits, and so on). A subset of these varied social categories takes on particularly important roles in cognition and social behavior, shaping social inferences and often becoming targets of stereotypes and prejudice. This talk will present research indicating that the social categories that take on these central roles in cognition and behavior are those to which children apply essentialist beliefs—those categories they view as marking fundamentally distinct kinds of people. Research will be presented documenting that (a) children apply essentialist beliefs to a select, culturally variable subset of social categories, (b) language facilitates the cultural transmission of essentialist beliefs about particular social categories, and (c) developing essentialist beliefs about specific social categories causes children to develop negative stereotypes and attitudes regarding those groups.

IS1-04**In-group bias among children and adolescents?
Contextual and developmental differences****Adam Rutland**

Goldsmiths, University of London, UK

Research shows that from early infancy individuals begin to make sense of their social world by classifying people into social groups (i.e., gender, race, ethnicity). An extensive body of research has shown that these social groups readily become either 'Us' or 'Them' with individuals typically favoring 'Us' over 'Them' (i.e., the supposed basic tendency, known as, in-group bias). Recent research has shown the early development of in-group bias, with children generally preferring their own ethnicity or race, language group, gender and minimal group. Two studies will be presented in this paper which suggest children and adolescents do not automatically show in-group bias, instead it will be argued that their attitudes are influenced by how the behavior of their peers fits with group norms.

In Study 1 participants, aged 9.5 and 13.5 years, evaluated members of their own gender group who deviated from group norms about resource allocation. When deciding between group loyalty and equal allocation, children and adolescents gave priority to equality, rejecting group decisions to dislike in-group members who advocated for equality. In Study 2 participants, in the 4th and 8th grades, chose between including someone in their group who shared their group norm (moral or conventional) or group membership (school affiliation or gender). Younger children were more likely to include an out-group member who supported equal norms than were older children and, in the context of a social-conventional norm, there was greater in-group preference in the school than in a gender intergroup context.



REGULAR
SYMPOSIA

RS1**NOVEL APPROACHES TO CHILDREN'S
DEVELOPING UNDERSTANDING
OF SOCIAL NORMS**

Organizer:

Marco F. H. Schmidt, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany
Audun Dahl, University of California, Berkeley, USA

Invited discussant:

Marjorie Rhodes, New York University, USA

Social norms are present in all human societies. They govern social interactions and are key to maintaining human cooperation and coordination (Chudek & Henrich, 2011; Fehr & Fischbacher, 2004; Hechter & Opp, 2001). As such, social norms are intricate socio-cultural phenomena: People – as members of a group – acquire, apply, enforce, create and transmit norms. Thus, from early in ontogeny, children's social lives are structured by normativity. So far, however, little is known about norm acquisition, creation, and enforcement in early development, or later, more mature reasoning about norms and their application within and across group boundaries. The four papers in this symposium seek to address these topics by integrating innovative research using a variety of methods well suited to illuminate the development of norm psychology.

Paper 1 looks at naturalistic observations of early mother-infant interaction patterns following different types of norm transgressions. Paper 2 experimentally investigates toddlers' spontaneous reactions to norm violations and young children's understanding of the scope of jointly created novel norms. Paper 3 uses interview and active behavioral methods to explore how preschoolers evaluate norm enforcers. Finally, Paper 4 employs interview techniques to assess how school-aged children and adolescents evaluate norm violators in intergroup contexts.

Taken together, this symposium will provide a unique perspective on the development of understanding and applying social norms from infancy to adolescence. It aims to help integrate different theoretical frameworks focusing on cognitive, affective, and motivational factors of children's developing norm psychology. More broadly, the papers in this symposium will help us gain a better understanding of the mechanisms that enable coordination and cooperation in human groups and societies.

RS1-01**Norm differences in early social interactions****Audun Dahl**

University of California, Berkeley, USA

Some norms matter more than others. Preschoolers think that it is worse to hit someone [a moral transgression] than to spill food [a pragmatic transgression]. Moreover, they draw distinctions between moral, pragmatic, safety-related (prudential), and conventional norms. Understanding the differences between norms is crucial to dealing with multifaceted situations encountered in everyday life [Smetana, 2013; Turiel, 1983].

Social interactions are integral to children's construction of norms. What kinds of information do early social interactions provide that allows young children to begin grasping the difference between moral and other norms? The second year of life is a particularly interesting period for studying this question, being characterized by increasing mother-infant conflict and limited infant communicational abilities.

This paper will report data from two studies investigating mother-infant interactions following moral, prudential, and pragmatic transgressions of 14-24 month-old infants. Study 1 was a naturalistic study of mother-infant conflicts. Study 2 was an experimental study in which mothers' vocalizations were elicited using videotaped transgressions.

Preliminary data from Study 1 show that mothers are more insistent when intervening on moral transgressions than on pragmatic transgressions, with interventions on prudential transgressions falling in between. In both Study 1 and Study 2, mothers respond with more intense anger-like vocalizations to moral transgressions, fearful vocalizations to prudential transgressions, and playful or comforting vocalizations to pragmatic transgressions.

These data suggest that, from early in the second year, social interactions provide information about how moral norms differ from prudential and pragmatic transgressions in both verbal and non-verbal (physical and emotional) ways.

RS1-02**Acquiring and creating social norms in early ontogeny****Marco F. H. Schmidt¹, Hannes Rakoczy², Michael Tomasello¹**¹Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany²University of Göttingen, Germany

Recent research has found that young children appreciate normative aspects of human cultural life [Rakoczy & Schmidt, 2013; Schmidt & Tomasello, 2012]. Less is known, however, about the developmental origins and the breadth of understanding normativity. Key aspects of norms are that they are (i) generic, and (ii) human-made social facts, that is, they can be jointly created. Thus, this paper will present work that investigates whether very young children understand conventional norms as generic, and that asks whether young children would enforce novel agreed-upon conventional norms.

In Study 1, 18-month-old infants witnessed an adult model demonstrating a game-like action. Prior to performing the action, the model either expressed certainty regarding the game rules [game context] or uncertainty because of ignorance [discovery context]. When a puppet later deviated from the demonstrated action, infants intervened more in the game context than in the discovery context, suggesting that they understood the model's act as generic in the game context only.

In Study 2, 3-year-old children had the opportunity to jointly agree upon novel arbitrary game rules with four puppets. When one puppet – that explicitly entered into the agreement – later deviated from the rule, children corrected her. However, when the same action was performed by a puppet that was ignorant about the novel rule or did not enter into the agreement, children did not protest.

Together, these findings suggest that important prerequisites for mature normativity are present in the first years of life, and that preschoolers participate in constructing and enforcing novel norms.

RS1-03**Preschoolers value those who sanction non-cooperators**

Amrisha Vaish, Esther Herrmann, Christiane Markmann,
Michael Tomasello

Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

Large-scale cooperation among unrelated individuals requires the enforcement of social norms. However, such enforcement poses a problem because non-enforcers can free ride on others' costly and risky enforcement. One solution is that norm enforcers receive reputational benefits relative to non-enforcers. We examined this possibility in preschool-aged children.

In Study 1, we presented 4.5- and 5.5-year-old children with two videos in which a transgressor destroyed a victim's property while an observer watched the transgression. The two videos featured different observers. One observer responded to the transgression by enforcing the norm that the transgressor had broken, whereas the other observer did not enforce the norm. After viewing the videos, children judged the enforcer more positively than the non-enforcer, but did not personally prefer her or distribute more rewards to her. Thus, preschoolers value (but do not personally prefer) those who enforce norms, and this reputational benefit may sustain norm enforcement.

Study 2 assessed the subtlety of children's evaluations by comparing their evaluations of the enforcer and non-enforcer to their evaluations of the actual transgressor. Children judged not only an enforcer but also a non-enforcer of norms more positively than a moral transgressor who caused harm. They also personally preferred and rewarded the enforcer and non-enforcer more than the transgressor, thus showing a stronger aversion to transgressors of first-order norms than to violators of second-order norms (non-enforcers). Together, these studies show that the ability to sustain not only first-order but also second-order cooperation is in place early in ontogeny.

RS1-04**Children's and adolescent's evaluations of deviant acts in the context of a social-conventional norm**

Adam Rutland ¹, Aline Hitti ², Kelly Lynn Mulvey ²,
Dominic Abrams ³, Melanie Killen ²

¹Goldsmiths, University of London, UK

²University of Maryland, College Park, USA

³University of Kent, Canterbury, UK

The social world is structured by numerous expectations and rules. Many expectations reflect social conventions which are culturally shared uniformities or norms that are often functional in regulating social interaction and establishing distinct group identities (Turiel, 1998). Children from an early age begin to understand social-conventional norms and evaluate peers who deviate from these norms (Abrams & Rutland, 2008).

When an intergroup context exists (i.e. an ingroup and outgroup is salient), researchers (Bloom, 2013; Dunham, Baron & Banaji, 2008) have recently suggested children always prefer their own group (i.e. the ingroup). We examined whether this was true when individuals evaluated deviant acts in the context of an intergroup context and a social-conventional norm. Participants (N = 462), aged 9-16 years, were made to focus on their own school identity and that of another group of children from a different school. They had to judge and reason about ingroup or outgroup deviant acts in the presence of a generic school norm of wearing a club shirt to school assembly.

The outgroup deviant act was significantly more acceptable than the ingroup deviant act. Participants used autonomy reasoning to justify acceptable acts and group functioning or group identity reasoning to question unacceptable acts. The relationship between participants' understanding of group dynamics and their own judgments of deviant acts also increased significantly with age. Our findings question the inevitability of ingroup preference, and suggest evaluations of ingroup and outgroup peers depend on the norm and children's reasoning about group processes.

RS2**EARLY NEGATION IN INFANCY?**

Organizers:

Roman Feiman, Department of Psychology, Harvard University, Cambridge, USA**Jean-Rémy Hochmann**, Ecole Normale Supérieure, Paris, France

Invited discussant:

Gergely Csibra, Central European University, Hungary

The last thirty years of research have successfully examined infants' representations in domains including objects, numbers and agents. These representations, which are common to many other species, do not exhaust the whole of human cognition. It has been proposed that humans also possess a different type of representations, which are compositional and stated over variables, allowing abstract combinatorial thinking and reasoning outside of and across content domains. While linguistic abilities constitute strong evidence that human adults have such representations, the case of young infants remains inconclusive. As an abstract, domain-general logical operator, the concept of negation is a strong test case to study such abilities. This symposium will bring together a series of studies that look at infants' representation and understanding of negation.

First, two contributions will focus on an inferential schema that would support the representation and use of a logical negation operator, the resolution of the disjunctive syllogism: given A or B, not-A implies B. In the literature, the main phenomenon suggesting that infants can solve the disjunctive syllogism is the evidence for the mutual exclusivity assumption in word learning. Presented with an object, whose label infants know (e.g., a ball), and a novel object, infants map a novel word (e.g., blicket) onto the novel object. It was suggested they engage in the following reasoning: a blicket is either the cup or the novel object, a cup is a cup therefore not a blicket (mutual exclusivity assumption); it follows that the novel object is a blicket. This phenomenon has not been reported in infants younger than 17-months. Saksida, Langus and Nespors will present provocative findings, suggesting that 4-month-old infants already have the mutual exclusivity assumption. Cesana Arlotti & Bonatti will present looking time and eye-tracking experiments suggesting that infants may solve the disjunctive syllogism by 12-months in the domain of object cognition. Feiman and colleagues will ask at what age toddlers understand verbal negation as a logical operator and can integrate it into this inferential schema to solve a search task. Finally, Hochmann and colleagues studied infants' representations of the abstract relational concepts SAME and DIFFERENT. In

adult cognition, these concepts are linked by negation (i.e., DIFFERENT = NOT SAME; SAME = NOT DIFFERENT). Hochmann and colleagues' results suggest that 14-month-olds do represent SAME, but not DIFFERENT, thus arguing against the use of a negation operator in this context.

Together, these contributions help advance our understanding of the emergence of a domain-general logical operator NEGATION. While some of the experiments presented here suggest surprising reasoning abilities in very young infants, older infants' and toddlers' failure to understand that this operator maps onto a word they know and use, or that it relates two concepts like SAME and DIFFERENT suggests that a domain-general negation operator is not freely used before certain linguistic tools develop. We hope to explore the connections between logic and language and to foster discussion on the basis of the available data.

RS2-01**Labeling objects and movements at 4 months**

Amanda Saksida, Alan Langus, Marina Nespor

SISSA, Trieste, Italy

It was recently suggested that infants as young as 6 months understand some commonly heard words [Begelson&Swingley, 2012]. The problem of associating new labels to new referents has usually been studied in older infants and adults. However, little is known about how does the process of labeling start in this very early age. Our study aims to explore whether 4-month-old infants associate their auditory and visual inputs, and if so, what are the possible strategies.

In our experiments, we used the "rapid visual recognition" procedure where in each trial short familiarization with one item (an object moving in a certain direction) is followed by a test phase with two items. One item is a partial repetition of familiarization (movement or object repeated), the other is a novel combination of movement and object. We added labels and tried to see whether looking patterns are different from the experiments without labels [Langus et al., submitted]. Infants heard a label during familiarization, whereas in the test phase, they heard the repeated word, or a different word, or silence. The results show that infants look longer to the repeated object/movement when they hear repeated word, more to the novel object/movement when the word is new, and show no preference when there is silence. We suggest infants can rapidly associate words to their referents and infer about a novel pairing using disjunctive syllogism.

RS2-02**Logic at 12-months: disjunctive reasoning**Nicoló Cesana-Arlotti ¹, Ernő Teglás ², Luca Bonatti ¹¹Center of Brain and Cognition, Universitat Pompeu Fabra, Barcelona, Spain²Cognitive Development Centre, CEU, Budapest, Hungary

Studies on the mutual exclusivity constraint offer evidence that 17-month-old infants may be able to execute a form of reasoning by exclusion [e.g., Halberda, 2002]. This may suggest that basic logical representations are deployed for word-learning when infants already produce language. However, what logical resources prelinguistic infants possess and whether they are limited to domain-specific contexts such as word acquisition remain open questions.

We tested whether 12 and 19-month-olds can reason logically outside of word-learning contexts. In the "Partial Containment" task, an object partially hidden inside a container offers partial evidence of its identity. An observer can identify the object by first representing disjunctively alternative hypotheses about its identity and then updating their beliefs by exclusion. A series of experiments shows that 19-month-olds can solve the task and, under certain conditions, so can 12-month-olds. Another series of experiments rules out plausible alternative explanations that do not require attributing logical reasoning to infants. Furthermore, we compared infants' reactions as revealed by the standard Looking Time measures in a VOE paradigm to their oculomotor behavior as revealed by eye-tracking measures. Eye-tracking data show that the proportion of time spent looking at relevant areas of the stimuli is consistent with the hypothesis that infants deploy disjunctive reasoning in making sense of the situations. Looking time results are less clear, potentially suggesting that finer behavioral measures are needed to study the emergence of logical reasoning in prelinguistic infants.

RS2-03**Children's understanding of logical "Not" in a disjunctive syllogism task**

Roman Feiman, Shilpa Mody, Susan Carey

Department of Psychology, Harvard University, Cambridge, USA

Linguistic connectives like "Not" and "Or" connect different concepts and propositions, playing an important role in one of the most interesting of human capacities – the ability to combine a finite array of concepts and words into infinite new ideas. In order to establish whether the human capacity for combinatorial thought arises only in the context of language, it is important to determine when children master the logical force of linguistic connectives.

We test children's comprehension of logical "Not" in a disjunctive syllogism task, reasoning from two premises: 1) either A or B are true, and 2) A is false, to a conclusion that B must be true. Children were presented with a bucket and truck. These were occluded, and a ball was hidden in one or the other. Children were then told either where the ball was (e.g. "It's in the bucket!") or where it wasn't ("It's not in the truck!"). 26-28 month-olds searched correctly on both the positive, $t(23)=6.0$, $p<.001$, $M=75\%$ correct, and negative trials, $t(23)=3.9$, $p<.01$, $M=69\%$ correct. 19-21 month-olds searched above chance on positive trials, $t(21)=3.1$, $p=0.01$, $M=62.5\%$ correct, but significantly below chance on negative trials, effectively treating them as if they were positive and ignoring the negation, $t(21)=2.5$, $p<0.05$, $M=37.5\%$ correct. Ongoing work on 22-25 month-olds explores the period of transition to understanding and using linguistic negation, and relates success on this task to other measures of comprehension of the word "not".

RS2-04**Same and different relations in match- and mismatch-to-sample**Jean-Rémy Hochmann¹, Shilpa Mody², Susan Carey²¹Ecole Normale Supérieure, Paris, France²Department of Psychology, Harvard University, Cambridge, USA

In match-to-sample (MTS) and mismatch-to-sample (mMTS) paradigms, participants are shown a sample stimulus, and must choose between two alternatives: the SAME-alternative, which is identical to the sample; and the DIFFERENT-alternative, which is different from the sample. Success on MTS consists in choosing the SAME-alternative and is thought to show the representation of the abstract relation SAME. Success on mMTS consists in choosing the DIFFERENT-alternative and is thought to show the representation of the abstract relation DIFFERENT. However, representing only one of these relations may be sufficient to succeed in both tasks. For instance, participants may learn to pick the SAME-alternative in MTS, and avoid the SAME-alternative in mMTS, thus basing their responses only on the SAME relation in both tasks. We studied 14-month-olds' behavior in MTS and mMTS using an anticipatory looking paradigm. In Familiarization trials, participants were shown a sample, a SAME-alternative, and a DIFFERENT-alternative. The correct alternative was indicated by a short animation. We observed an increase of correct anticipations to the SAME-alternative in MTS, and to the DIFFERENT-alternative in mMTS. In Test trials, only one alternative was revealed. Results suggest that infants anticipated to the known SAME-alternative in MTS, and avoided that alternative in mMTS. Crucially, infants in mMTS failed to look at the correct DIFFERENT-alternative when only that alternative was known. We thus found strong evidence that infants learned rules based on a representation of the relation SAME, but we found no evidence of such representation for the relation DIFFERENT.

RS3

CONTEXTUAL, PROSODIC, AND GESTURE CUES TO MEANING IN HUMAN INFANT AND PRIMATE COMMUNICATION

Organizers:

Pilar Prieto, ICREA-Universitat Pompeu Fabra

Ulf Liszkowski, University of Hamburg

Invited discussant:

György Gergely, Central European University, Hungary

Research on the origins of human communication has gained important insights from the study of infants' gestural communication in the second year of life and the comparison of vocal communication across primates. Relatively little is still known about (a) how vocalizations and prosodic aspects contribute to the meaning of gestures; (b) whether such meaning is universally accessible across different cultures; and (c) to what extent early patterns of vocal communication in infants are shared with non-human primates. Regarding infants' gestural communication, recent work has shown that infants in the second year of life comprehend adults' different intentions behind a pointing gesture by relying on social context and common ground [e.g., Aureli, Perucchini & Genco, 2009; Behne, Liszkowski, Carpenter & Tomasello, 2012; Liebal et al., 2009, among others], and that they embed their own pointing within common ground [e.g., Liszkowski, 2013; Liebal et al., 2011]. Regarding earlier vocalizations in human infants and other primates, one proposal has been that these are relatively inflexible, constrained in their meaning, and not used in pragmatic ways [e.g., Tomasello, 2008; Cheney & Seyfarth, 1996]. The current symposium brings together new and recent findings to shed new light on these and related issues.

The first talk presents new results from two new experiments showing that 12-month olds can understand the motives behind pointing acts (requestive, informative, and expressive) based on accompanying intonation and gesture shape alone, when no deeper common ground is available and lexical context is controlled. The second talk presents experimental evidence that 14-month-olds use accompanying vocalizations to distinguish the social intentions underlying their own pointing (requestive; expressive; informative intentions) and differentially mark given and new referents across modalities. The third talk reports natural observations on how infants from two different cultures (Scotland; Uganda) consistently use distinct non-linguistic vocalisations in 5 different behavioural contexts. A play-back experiment shows that adults can

match these vocalizations to the distinct contexts irrespective of cultural or parenting experience. The fourth talk presents new data on how monkeys respond to each others' alarm calls based on social-contextual information, suggesting a considerable pragmatic component in how non-human primates interpret each others' calls.

The symposium presents new findings on the early patterns of gestural and vocal communication in human infants and other primates in order to discuss a pragmatic interpretation of these patterns of non-verbal exchange as the origins of human communication.

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RS3-01**Infant's understanding of intentions in vocalizations: prosodic, gestural, and lexical cues**Núria Esteve-Gibert ¹, Pilar Prieto ²¹Pompeu Fabra University²ICREA – Pompeu Fabra University

In this study we explored the role of prosodic, gestural, and lexical cues in helping 12-month-old infants to infer the adult's intention when the preestablished common ground does not give them enough information. Infants participated in two experiments in which they had to comprehend either an expressive, imperative, or informative meaning behind an adult's act when the preestablished common ground was the same across pragmatic conditions (Experiment 1) and when the common ground and the lexical information were the same across pragmatic conditions (Experiment 2). Results of Experiment 1 show that infants reacted differently in each condition depending on the adult's intent (attending the object in the expressive condition, offering the object in the imperative condition, and attending the specific feature of the object in the informative condition). Thus, if infants cannot rely on previous contextual information to understand the intended meaning of a deictic gesture, they rely on the visual and vocal cues available to construct the common ground on-line. Results of Experiment 2 showed that some intentions more easily understood than others: infants associated an expressive intention with expressive and imperative gesture-prosodic strategies, they inferred an imperative meaning when the adult used imperative and informative gesture-prosodic strategies, and they inferred an informative intent when informative gesture-prosodic strategies were used. In conclusion, results suggest that 12-month-old infants understand the intentional motive of a deictic gesture with the help of a combination of prosodic and gesture cues.

RS3-02**Infants' use of prosody to differentiate referential and social intentions underlying their pointing acts**

Ulf Liszkowski

University of Hamburg

Study 1 tested whether point-accompanying vocalizations give clues to infants' social intentions when pointing. We elicited pointing in three different contexts: imperative-requestive; declarative-expressive; declarative-informative. Patterns of intonation, intensity and speech-like characteristics of the accompanying vocalizations significantly distinguished imperative from declarative pointing acts. Study 2 tested whether infants switch to the vocal modality to express referential intentions when visual attention is obstructed. We found that infants pointed significantly less when the recipient could not see the point; however, they also vocalized significantly less, suggesting that infants do not use vocalizations like pointing to direct attention to locations of novel events. Study 3 tested whether vocalizations and points express different aspects of referential intentions. Previous studies had confounded reference to novel location and novel object. We familiarized infants with the same referent at the same location. After pointing and vocalizing had decreased we varied in a subsequent test trial systematically whether location, object, both or none was new. When the object was known but the location was new, infants increased pointing; when the location was known but the object was new, infants increased vocalizations. Results reveal that infants are sensitive to given and new information and differentially express their referential intentions across modalities. Together, findings support a pragmatic interpretation of early prelinguistic communication and illustrate that beyond a shared background the style of the act contributes to meaning.

RS3-03**Assessing the information content of non-linguistic infant vocalisations**Verena Kersken¹, Juan-Carlos Gomez², Klaus Zuberbühler^{1,3}¹University of St Andrews, Budongo Conservation Field Station²University of St Andrews³Universite de Neuchatel

The non-linguistic vocal behaviour of human infants shows systematic acoustic variation that is linked to the contexts in which these vocalisations are produced. For example, in an observational study we identified that infants between the ages of 11 and 18 months produce acoustically distinct non-linguistic vocalisations in 5 different behavioural contexts (declarative pointing, giving an object, requesting an action, protesting, and requesting food). Moreover, these variations show consistency between infants growing up in Scotland and rural Uganda. Such systematic acoustic variations could be a potential source of information about the infant's well-being for the caregiver. Further we investigated whether listeners can actually use this information to infer the context in which a vocalisation was produced independently of their original culture and language. To this end, we designed a playback study that tested whether listeners (parents and non-parents) from two different cultures (Scotland and Uganda) can correctly match a vocalisation produced by an infant either of their own or another culture to its respective production context. Results suggest that participants are able to match vocalisations to their production context above chance level, regardless of their experience with infants and their own cultural background. This suggests the existence in humans of some additional classes of non-linguistic vocalisations that transmit information about the signaller's motivations. Such vocalisations can help to refine the meaning of or direct attention to prelinguistic gestures such as pointing or requesting. We suggest that these types of vocal behaviour are referentially more similar to animal signals than language.

RS3-04**Primate roots of human communication**

Klaus Zuberbühler

University of St Andrews

Humans tend to direct communication to targeted recipients, usually with some intent to persuade or inform, while meaning is extracted from a range of sources, including context and experience. What are the evolutionary roots of these capacities? Virtually all higher primates produce rich arrays of species-specific signals that allow recipients to identify the causing event, sometimes by taking into account pragmatic cues. As signallers, however, the default case in primates seems to be that information is provided without an intention to do so. Great apes may be somewhat of an exception: there is evidence that, as signallers, apes can take their audience into account, particularly in terms of the recipients' identity and social role, but sometimes also in terms of their perceptions and knowledge. This pattern is consistent with the more general hypothesis that a major transition in human language evolution was the ability to perceive others as intentional agents with their own history of experience.

RS4**CONCEPTUAL INFLUENCES ON PERCEPTION
AND MEMORY AT THE ONSET OF LANGUAGE**

Organizers:

Teodora Gliga, Birkbeck College, University of London

Discussant:

Jessica Horst, Sussex University

We revisit one lengthily debated topic in both adult cognitive research and in developmental research – that of how conceptual information, as provided by object names or object category inclusion, affects object representations. Two views have polarized this field, the first proposing that any effects linguistic information may have can be explained by multi-modal learning models, which predict both facilitatory and interfering effects. The second view builds on the „special” nature of labels and concepts as place-holders.

This symposium brings together four complementary contributions which aim to go beyond establishing the existence of conceptual effects on perception to understanding the underlying mechanisms. Nadja Althaus will show that timing is crucial for measuring interfering effects in category learning (but even in this case learning is not abolished). Barbara Pomiechowska will explore the effects words or ad-hoc categorisation have beyond the act of learning, when objects representations have to be maintained in memory. Feature information is lost for (more relevant) category information to be maintained. Finally, Eugenio Parise will demonstrate that labels do not only act on visual representations through highlighting category-relevant features, since they succeed in binding together a class of very dissimilar objects. Communicative cues are highlighted as the key ingredient, in this talk.

Our discussant, Jessica Horst, has worked extensively on early language and category learning, including, recently, demonstrating that category learning can influence, in turn, word learning. Her own view is that a mechanistic understanding of these processes requires appreciating the dynamics of learning as a word progresses from completely novel to familiar to well-known. She will discuss the other three contributions to the symposium in terms of dynamic systems theory, where learning is the product of real-time interactions between different aspects of the naming situation including both presentation of referents and social cues (e.g., ostensive cues).

These four presentations will fuel further discussion onto the developmental origin of these effects (e.g. how do labels or ostensive cues become invitations to form categories) and their underlying mechanisms (e.g. the role of general learning and of hypothesis testing in concept acquisition).

RS4-01**Timing matters: The role of label synchrony in infant categorisation**

Nadja Althaus, Kim Plunkett

University of Oxford

Whether verbal labels influence category learning in preverbal infants is controversial: past research has produced contradictory results indicating that labels may facilitate learning, but under some circumstances can disrupt categorisation. Our studies explore the role of the timing of visual and auditory events, in one year old infants. We specifically tested the hypothesis that synchronous presentation of object and label may induce higher processing load, thereby interfering with learning.

Our results demonstrate that synchronous presentation indeed leads to diminished novelty preference in comparison to presenting the label 1 second after the visual onset, indicating that infants fail to categorise. However, detailed analysis of infants' eye movements reveals that infants' learning is not completely disrupted, but the observed pattern rather reflects a delay in novelty preference.

We will discuss the implications of these findings in the context of the role of cognitive load, and the process of word-object integration as an instance of cross-modal learning.

RS4-02**Conceptual knowledge biases infants' object representations**

Barbara Pomiechowska, Teodora Gliga

Centre for Brain and Cognitive Development, Birkbeck College

Development of categorization and word learning skills in infancy has been abundantly studied, however little is known about how conceptual and language knowledge modulates infants' perceptual and memory processes. Using electroencephalography, we investigated whether object processing and object storage in short-term memory is influenced by the apriori knowledge of labels [Experiment 1] or by ad-hoc category membership [Experiment 2], in 12-month-old infants.

We recorded scalp EEG during an occlusion paradigm in which infants were confronted with featural and categorical information violations (i.e. we manipulated the item being revealed after the occlusion). Infants saw either the same object revealed [no change], another exemplar of the same category [within-category change], or an object from a new category [across-category change].

Infants detected both across-category and within-category changes only while presented with unfamiliar objects. While watching objects for which they had labels or which they were able to categorize nonlinguistically, infants detected across-category changes, but not within-category changes. This suggests that infants who were able to access conceptual representations of objects, did not store surface feature information and used categorical information to represent the items in memory.

We will discuss possible mechanisms through which both labels and visual categories modify the nature of visual representations and the implications this has for learning.

RS4-03**Labels and pictures co-refer to object categories
in adults and 9-Month-Old infants**

Eugenio Parise¹, Gergely Csibra²¹Lancaster University, UK²CEU, Budapest, Hungary

Previous research has shown that spoken words facilitate the categorization of perceptually similar objects in infants. Here we addressed the question whether labels alone, without perceptual similarities, could make adults and 9-month-olds group objects together. We measured the desynchronization of alpha-band EEG oscillations in a category oddball paradigm.

Adults learnt one of two pseudo-words for each of six unfamiliar objects without shared perceptual features. Subsequently, four of the six objects, three sharing the label and one having the other label, were presented without labels on screen, with equal frequency. Participants responded to the oddball category with stronger attenuation of alpha oscillation over the left frontal region. A similar response was found for known categories.

Nine-month-olds were engaged in a live familiarization with an experimenter presenting them the six unfamiliar objects one by one, while uttering the two novel labels in an ostensive-referential communicative situation. Right after the familiarization, we presented them with the four objects the same way as above. Stronger alpha attenuation in response to the oddball category suggested that 9-month-olds, just like adults, exploited the labels to form two object categories. Moreover, when passively watching pictures of known objects belonging to known categories they produced a similar electrophysiological response, but only when the pictures were introduced by ostensive-referential cues.

Our data strongly suggest that ostensive communication helps infants to interpret both labels and objects as symbols referring to object categories.

RS5**THE ROLE OF DIRECT EXPERIENCE
AND OBSERVATION ON ACTION
PERCEPTION AND PREDICTION**

Organizers:

Eugenio Parise, Vincent M. Reid, Centre for Research in Human
Development and Learning, Department of Psychology, Lancaster University, United Kingdom

Discussant:

Harold Bekkering, Radboud University Nijmegen

This symposium aims to present different perspectives on infant action perception and prediction

In the first talk the role of direct experience in early development is investigated. These data suggest that the experience of mere reflex walking alters infants' perception of point light walkers. This raises questions about the amount of experience required in order to influence perceptual mechanisms and what type of experience is needed for this modification to take place.

The second and third talk will focus specifically on action perception and the kind of experience infants need to be able to predict human actions. This is a field that has been highly debated in the past few years and the two talks will present opposite perspectives. The second speaker will show eye tracker data supporting the idea that direct motor experience is required for the infants to predict action outcomes. Different aspects of action understanding such as the goal and the timing will be considered, showing that the accuracy of the prediction increases with the experience in performing those actions. The third speaker will present data in support of the idea that motor experience is not always necessary for successful action prediction. Using looking time and electrophysiological measurements in an occlusion paradigm, the speaker will show that infants who are not walking yet are nevertheless able to specifically predict the timing of stepping actions. Presenting the stimuli upside-down, namely in a way that infants do not have previous observational experience with, disrupts the effect, suggesting that sometimes visual experience alone might be sufficient for action prediction.

From three different theoretical perspectives, these talks show that infants can learn about other people's actions using different sources of information, both related to self produced and observed actions.

RS5-01**Infant experience of walking alters the perception of walking biological motion**

Vincent M. Reid, Katharina KadukCentre for Research in Human Development and Learning, Department of Psychology,
Lancaster University, United Kingdom

In order to understand how experience of an action alters functional brain responses to visual information, we examined the effects of reflex walking on how 10-week-old infants processed biological motion. We gave experience of the reflex walk to half the participants, and did not give this experience to the other half of the sample. The participant's electrical brain activity in response to viewing upright and inverted walking and crawling movements indicated the detection of biological motion only for that group which experience the reflex walk, as evidenced by parietal electrode greater positivity for the upright than the inverted condition. This effect was observed only for the walking stimuli. This study suggests that parietal regions are associated with the perception of biological motion even at 9-11 weeks. Further, this result strongly suggests that experience refines the perception of biological motion and that at 10 weeks of age, the link between action perception and action production is tightly woven.

RS5-02**Action prediction in infants depends on action experience**

**Janny Stapel, Sabine Hunnius, Marlene Meyer,
Harold Bekkering**Radboud University Nijmegen

How infants come to an understanding of the world, and especially how they come to understand others' behavior, is a question that has spurred much research. The hypothesis has been put forward that infants' own action experiences play a crucial role in their understanding others' actions. We tested this hypothesis with two eye-tracking experiments that investigated whether experience is crucial for predicting what [experiment 1] will happen when [experiment 2] during an action. In both experiments, two infant groups and a group of adults participated to examine the role of action experience. Preliminary results of experiment 1 show that grasping expertise allows participants to predict the goal of an action based on kinematic features of the observed action. That is, the velocity of a grasping hand, due to the constraints Fitts' law imposes on actions, can be used as cue for predicting the target of an action. Results of experiment 2 indicate that experienced walkers [30-month-old infants and adults] more accurately predict the timing of walking actions than inexperienced walkers [13-month-old infants]. In contrast, the groups were equally accurate in predicting the timing of crawling actions, an action they were all experienced in. The studies provide insight in how motor experience is crucial for infants' predictions of different aspects of an ongoing action.

RS5-03**Action prediction without motor experience in 8-month-old infants**

Carina de Klerk¹, Gergely Csibra², Victoria Southgate¹¹Centre for Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom²Cognitive Development Centre, Central European University, Budapest, Hungary

A popular idea in cognitive neuroscience is that in order to predict others' actions observers need to map those actions onto their own motor repertoire. If this is true, adults and infants should be unable to predict actions for which they have no previous motor experience. However, recently it has been suggested that observational experience might facilitate prediction and shape the sensorimotor regions of the brain in a similar manner as physical experience does [Cross et al., 2009]. In this talk we will present evidence for this idea from looking time and electrophysiological studies with 8-month-old infants.

In the first study we compared looking times when infants were predicting visually familiar and unfamiliar actions, i.e. upright and inverted stepping actions. To measure prediction we used an occlusion paradigm in which videos of upright and inverted stepping actions were briefly occluded from view followed by either a correct (time-coherent) or an incorrect (time-incoherent) continuation of the action. We found that infants looked significantly longer at the incorrect compared to the correct continuations of the upright, but not the inverted stepping actions. As the infants in this study were not walking yet, this demonstrates that motor experience is not always necessary for accurate action prediction and that sometimes visual experience alone might be sufficient. We will also discuss the results of electrophysiological studies investigating the neural mechanism underlying action prediction. These studies demonstrate that sensorimotor cortex is involved in predicting events, irrespective of the infants' motor experience with these events.



PAPER
SESSION 1

Invited Discussant:

Dan Sperber, Central European University, Budapest, Hungary

PS1-01**A False Sense of Confidence: Children's Guessing Under Epistemic and Physical Uncertainty**

Catherine Darnell, Sarah Beck

University of Birmingham, Birmingham, UK

Under physical uncertainty (when an outcome is yet to occur) children acknowledge that there are multiple possibilities, yet children behave as if they know the outcome and prefer to guess under epistemic uncertainty (when an outcome has occurred but remains unknown). The imagination account suggests this is due to a false sense of confidence. To test this prediction, 5-to-7 year-olds rated how confident they felt whilst guessing what number a die would land on before (physical) and after (epistemic) it was rolled. Children were allocated to a rating or non-rating group, with the former rating confidence on a 4-point scale. After 2 epistemic and 2 physical trials children chose when they would like to guess. In Experiment 1 (N=91), children in the non-rating group, showed a preference for guessing under epistemic uncertainty ($p < 0.001$). However, children in the rating group showed no preference ($p = 0.25$) and no difference in confidence ratings between epistemic and physical trials (ANOVA, all $p > 0.07$). In Experiment 2 (N=121), the numbers of trials were reduced (1 epistemic, 1 physical and 1 choice trial) as repeatedly rating confidence may have inadvertently removed the preference for epistemic uncertainty. Although a preference for epistemic uncertainty was found in the non-rating ($p < 0.05$) and rating groups ($p < 0.05$), children still demonstrated no difference in confidence ratings (ANOVA, all $p > 0.37$). Against the predictions of the imagination account, children's preference for epistemic uncertainty is not driven by a false sense of confidence. It appears children's behaviour and experienced confidence are driven by distinct metacognitive processes.

PS1-02**The Development of Co-representation Effects in a Joint Task: Do Children Represent a Co-actor?**

S.J. Milward, S. Kita, I.A. Apperly

University of Birmingham

The current study investigated whether co-representation effects (Sebanz, Knoblich & Prinz, 2003) can be observed in 4-5 year-old children. In Experiment 1, two children performed a task based on the Bear Dragon task (Kochanska, Murray, Jacques, Koenig & Vandegest, 1996), where children were required to point to a picture when instructed by one of two puppets and inhibit pointing when instructed by the other.

In the Joint Task condition, each child in a pair had to perform a different task rule, whereas in the Same Task condition, they both performed the same rule. Children made more errors in the Joint Task condition than the Same Task, suggesting they were experiencing interference from their partner's rule. Experiment 2 replicated these findings and added a switching dimension, where half way through participants had to swap to the alternative rule. Participants showed less of a switch cost in the Joint Task condition than in the Same Task condition. This provides further evidence that they were representing their partner's task rule, as previous representation of the alternative rule meant they were not switching to something entirely novel. This highlights a potential mechanism that may explain children's apparent joint action abilities at a young age.

PS1-03**Representational underpinnings of perspective taking and belief computation in infancy**Dora Kampis¹, Eugenio Parise^{1,2}, Gergely Csibra¹, Ágnes M. Kovács¹¹ Cognitive Development Center, Central European University, Hungary² Lancaster University, Lancaster, UK

Perspective taking and belief computation, as essential requirements of everyday social interactions, had been at focus of research on social cognition. In an EEG study involving 8-month-old infants, we presented participants with a simple scene containing an object and an agent. The object was occasionally occluded either from only the agent, or from the participant's view as well. In the control condition, the object dissolved before the occluder started to move, resulting in the same overall movement without an object being occluded. We measured event-related oscillatory activity in both conditions. Compared to the control condition, our results show larger gamma-band activation in temporal areas both in the case of occlusion of the object (1) from the participant and (2) from the agent. Similar activation appeared in our subsequent study when after the object being occluded from the agent, the object dissolved, hence creating a false belief of the agent who continued to believe that the object is behind the occluder.

Together, these results show that in perspective taking and belief computation infants compute a social partner's object representation, and perform manipulations on it, such as sustaining it in the case of occlusion from the other, or re-activating it in the case of false belief induction. Furthermore, they perform these computations in a similar manner as they do it with their own object representations, reflected by similar brain activation in the case of occlusion from the infants themselves.



PAPER
SESSION 2

Invited Discussant:

Luca Bonatti, Universitat Pompeu Fabra, Spain

PS2-01**The acquisition of basic grammar – A supervised machine learning task**

Yonata Levy, Eva Kelman, Ari Rappoport

Hebrew University, Jerusalem, Israel.

Data collected in a longitudinal follow-up of the development of basic grammar in children with Williams syndrome (WS) and children with Down syndrome (DS) was submitted as a Supervised Learning Machine task. Developmental trajectories were compared to typically developing (TD) children, matched on mean utterance length (MLU). Onset of combinatorial language and acquisitional pace were compared as well. Children were native speakers of Hebrew. Data collection lasted 2-3 years, covering MLU 1.6 - 4.5. Supervised Learning is based on inferring a function from labeled training examples. The algorithm produces a function which is used for mapping new examples. This process is thought to mirror concept learning in children. Support Vector Machines (SVM) represents the training examples as points in space, divided by a clear gap. New examples are predicted to belong to a category based on which side of the gap they fall. Grammatical agreement, tensed verbs, morphological forms, use of predicates, relative clauses, subject ellipsis and obligatory prepositions were compared. Based on these grammatical variables, the algorithm could not distinguish DS from TD, WS and TD, and DS and WS were indistinguishable as well. However, when developmental timing and acquisitional pace were added, the algorithm could easily distinguish among the groups. These results support earlier analyses, in which traditional statistical methods were used (Levy & Eilam, 2012). We conclude with a discussion of the following hypothesis: The critical parameter distinguishing typical development from pathology is developmental timing, while universal developmental trajectories characterize language acquisition across populations.

PS2-02**Learning the Rules: 12-Month-Old Italian-Learning Infants Understand Gender and Plural Morphology**

Alissa Ferry, Marina Nespore, Jacques Mehler

SISSA, Trieste Italy

Infants begin learning words during the first year of life. Yet, language learning requires more than building a vocabulary; infants must also learn the rules of their language. We examined how infants acquire morphological rules in Italian, a language with rich inflectional morphology. Italian nouns mark gender and plurality on the article and on the noun's final vowel (e.g., il ragazzo; i ragazzi; la ragazza; le ragazze). During each trial 12- to 24-month-old infants viewed two images that differed either in gender (one male, one female;

two males, two females) or in plurality (one male, two males; one female, two females). Infants were directed to one of the images (e.g., "Guarda il ragazzo!"). At every age, infants increased their looking to the target in both gender comparison conditions and in the feminine singular/plural condition but not in the masculine singular/plural condition. The singular/plural distinction seems to be driven by exposure to the different genders (and thus situations to learn the mapping). Regardless of age, infants who regularly see more males perform better on the masculine singular/plural distinction than those who see fewer and infants who regularly see more females perform better of the feminine singular/plural distinction. These findings indicate that infants understand gender morphology and that singular/plural morphology is also learned if infants have adequate exposure to the distinctions marked by the morphology. By 12 months, infants comprehend morphological regularities and the rules they mark.

PS2-03**Eight-month-old infants' acquisition of word order: a French-Japanese cross-linguistic ERP study**Carline Bernard¹, Tomomi Mizuochi-Endo², Hiroaki Oishi², Reiko Mazuka², Judit Gervain¹¹ Laboratoire psychologie de la Perception, Université Paris Descartes and CNRS, Paris, France² RIKEN Brain Science Institute, Wako-shi, Japan

Infants can use the distributional properties of frequent function words as cues to bootstrap the basic word order of their native language prelexically. Indeed, in a behavioral artificial grammar study, eight-month-old monolingual Japanese (functor-final: Tokyo kara 'Tokyo from') and French (functor-initial: de Paris 'from Paris') infants preferred frequent word final and frequent word initial phrases, respectively, mirroring the opposite orders of their native languages. Frequency-based bootstrapping could be a useful universal strategy to break into grammar, if it operates rapidly and automatically when infants parse new linguistic material. Behavioral methods relying on looking times measured post hoc, during the test phase are uninformative about the time course of infants' parsing strategies. We, therefore, conducted an EEG study with Japanese (n=19) and French (n=11, ongoing) 8-month-old infants. We presented infants with an 8-minute-long stream whereby frequent and infrequent words alternated. During the first 4 minutes, the stream was continuous, after that 480msec pauses were inserted, half after frequent words, half after infrequent ones. Thus, half of the pauses were consistent with native word order for one group and inconsistent for the other; vice versa for the other half of the pauses. A preliminary analysis of the ERPs time-locked to pause-onset suggests that the two groups show different responses to the pauses following frequent as compared to infrequent words starting at 350msec at left centro-frontal sites (C3, F3, Fz). Additionally, a time-frequency analysis during the initial continuous 4-minutes will be performed.



POSTER
SESSION A

PA-001**Young Children Stipulate and Enforce Novel Conventional Norms**M. F. H. Schmidt¹, H. Rakoczy², M. Tomasello¹¹ Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany² University of Göttingen, Göttingen, Germany

Young children's socio-cultural learning is aimed not only at reproducing what others actually do in certain situations, but also at what people ought to do in those situations (Bruner, 1993; Mead, 1934; Tomasello, 2009). Recent research has documented that young children appreciate this normative aspect of the social world: They actively correct third parties who violate a norm (e.g., Rakoczy et al., 2008). In prior research, however, the norms, such as game rules, were introduced by authorities as already existing. Thus, we do not know whether young children understand that a fundamental feature of human institutional reality is that norms can be brought into existence (including their scope) by jointly agreeing on a course of action. We therefore developed an action-based paradigm in which 3-year-old children had the opportunity to jointly create a novel conventional norm based on constitutive rules (Searle, 1995) with others. More specifically, children played together with four puppets at a table. We found that children jointly created novel conventional norms with the puppets, and that they considered the scope of the novel norm: They criticized a puppet (the "actor") who deviated from the created game rules, if the actor had previously agreed on the rules, but not if the actor had been ignorant of the agreement or had stated that she would not enter into the agreement. These findings suggest that even young children participate in the process of norm creation and understand the scope of stipulated norms as limited to participants of a social practice.

PA-002**Children infer friendship and status relations from watching others imitate**

Harriet Over, Malinda Carpenter

University of York, York, UK; Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

Imitation often takes place within a broad social context in which the imitative exchange is observed by others. We predicted that 1) children would be able to extract information about others' relationships from watching them imitate and 2) imitation would have reputational consequences, making the imitator look good or bad in the

eyes of onlookers. In a series of studies, we investigated whether children are able to infer affiliative relations and relative status from others' imitative interactions. In each study, we presented children (N=40 per study) with videos in which one individual imitated another and then asked them questions about the relationship between those individuals. In studies 1a and 1b, we investigated whether children use imitation to infer affiliative relations. Results showed that five-year-olds ($\chi^2(1)=12.1, p<.001$) but not four-year-olds ($\chi^2(1)=.9, p=.63$) assume individuals imitate people they like. In studies 2a and 2b, we investigated whether children use imitation to infer the relative status of two individuals. Results showed that five-year-olds ($\chi^2(1)=4.9, p=.03$) but not four-year-olds ($\chi^2(1)=.1, p=.75$) assume that an individual who imitates another is relatively lower in status. Strikingly, the results of study 2 demonstrate that, although there may be many advantages to imitating others, there can also be reputational costs. These results add to a growing body of evidence demonstrating just how deeply social imitation is.

PA-003**The development of the child's make-believe play**

Marietta Kékes Szabó

Institute of Psychology, Faculty of Arts, University of Szeged, Szeged, Hungary;

Doctoral School of Educational Science, Faculty of Arts, University of Szeged, Szeged, Hungary

Make-believe play is a complex representational activity with significant social, cognitive and emotional effects on the child's development. While this activity usually emerges during the second year of life and the child will increasingly be able to use symbols in his/her make-believe play, autistic individuals have several problems with the use of pantomimed or symbolically transformed acts. The origin of the difficulties seems to come from the lack of the generalization of ideas and difficulty of switching attention from one act to another one. It is probable that the child's imitation skills are important mediators of his/her ability to demonstrate make-believe play, although imitative ability cannot be considered as a unified construct, just as not each of its forms and functions is affected with autism. But how could we grasp the relationship between the preschoolers' imitation problems and the paucity of their spontaneous make-believe play? Are the difficulties of object use/play limited to handling symbols or other types of play activities can be also affected by deficiencies? The aim of the study was to explore the correlation between problems of imitation and make-believe play in autism by analyzing the behaviour patterns that could be observed in child-mother dyads' interactions during the offered semi-structured sets. The data entry

and the behaviour analysis were performed by the Noldus Observer XT 8.0 program software. The results confirmed the presence of the reduced ability to imitate and flexibly manipulate with symbols, although further research is needed to expand our knowledge on the subject.

PA-004
**Mental representations of the family system
 in dysfunctional families**

Marietta Kékes Szabó

Institute of Psychology, Faculty of Arts, University of Szeged, Szeged, Hungary;

Doctoral School of Educational Science, Faculty of Arts, University of Szeged, Szeged, Hungary

All the interpretations of life events, the certainty of the stable relationships and the individuals' illness perception greatly influence health care use. Similarly, the mental representation about the family system that gave someone's primary social background also has an increased effect on the health status. There are persons who are not always aware of their sensations or seem to be prone to suppress their perceived feelings (living with inward orientation), while others pay increased attention to certain bodily signs and everyday events. In addition, the members of the latter group can quite often be characterized by somatization problems (living with outward orientation). Even though the combined effect of several factors forms our mental health, this study is confined to exploring more deeply the role of family representations by patients with psychosomatic and/or somatization disorder(s) and in healthy condition. Gehring's Family System Test [FAST] was used to investigate the family cohesion and hierarchy in various situations. The quantitative and qualitative analyses were also performed in the patients' groups, as well as the experimental persons' siblings were also involved in my research. According to my assumption, asthmatic patients demonstrated a balanced family structure more frequently, while young adults with panic disorder rather expressed their dissatisfaction with the current situation and presented an unstable-balanced family structure. The difference from the sibling's family representation was the biggest in the group of asthmatic patients. However, further studies are needed to explore the role of other significant factors and their interactions with one another. (This research was realized in the frames of TÁMOP 4.2.4. A/2-11-1-2012-0001 "National Excellence Program – Elaborating and operating an inland student and researcher personal support system". The project was subsidized by the European Union and co-financed by the European Social Fund)

PA-005
Infants avoid the bad guy at a cost

Arber Tasimi, Karen Wynn

Yale University, New Haven, Connecticut, USA

A wealth of research has overturned traditional assumptions that people behave selfishly in order to maximize personal gains. In the present work, we explore the origins of this behavior and ask whether infants behave in ways assumed by classical economic models. Twelve- and thirteen-month-olds were introduced to two characters, one that behaved prosocially and another that behaved antisocially in a third-party interaction. In a forced-choice paradigm, infants were offered one cracker from the prosocial character and two crackers from the antisocial character. If infants' behavior is entirely rational and selfish, then they should ignore a character's actions towards others and choose the larger offering. However, we found that infants significantly preferred to interact with a prosocial character, even at a personal cost. In order to examine whether infants are weighing the costs of their decisions, we tested a separate group of infants and asked whether they avoid an antisocial character at a larger cost. Here, infants were offered one cracker from the prosocial character and eight crackers from the antisocial character. We found that the majority of infants accepted the larger offering. Taken together, these findings suggest that early human behavior is sensitive to personal costs that could be incurred, and yet not wholly influenced by maximizing personal gains.

PA-006
**Is pictorial development modality-specific? Evidence from
 children's understanding of photographs and drawings**

Emma Armitage, Melissa Allen

Lancaster University

Photographs and drawings possess unique properties, and it has been suggested that a complete understanding of pictorial representation requires children to learn about the different rules associated with different media, as well as the divergent processes of picture production. We used a forced-choice question paradigm to investigate 4-8-year-old children's (N=128) understanding of the distinction between photographs and drawings. Children were introduced to two puppets, an artist (Jack) and a photographer (Luke). To ensure they could identify the puppets and the type of picture they create, children were asked to match 4 pictures (2 photographs and 2

colour drawings) to the correct puppet. Children were then asked ten questions of the format “I want a picture of [subject matter]. Who could make me that picture, Jack (A) or Luke (P)?” These were intended to address children’s understanding of four broad topics: 1) the ability of artists (and inability of photographers) to depict absent or non-existent entities, 2) the enhanced realism of photographs compared to drawings, 3) the necessary skill level of artists and photographers, and 4) the spatio-temporal constraints associated with photography and artistry. An understanding of both modalities increased with age, although the developmental trajectory was steeper for the artist questions. Between the ages of 5 and 8 children demonstrated an increasing appreciation that artists, but not photographers can alter the world in their pictures. Children had most difficulty with questions concerning the depiction of absent entities. Results will be discussed in relation to a developmental theory of pictures.

PA-007

Reality and imagination in the pictorial domain: Do children think non-existent entities can be photographed?

Emma Armitage, Melissa Allen

Lancaster University

One of the clearest distinctions that can be made between photographs and drawings is that the former is constrained by the ‘fidelity to reality’ principle. Photographs cannot, without the aid of post-production editing, depict anything that is not present during capture. Drawings, on the other hand, are not constrained by reality. Artists are free to use their imagination to depict anything they choose. Previous research has found that children overestimate the extent to which photographs reflect the world, in some cases choosing photographs as more reliable sources of reality than real world scenes themselves. Using a picture pair task we investigated whether 4-8-year-old children understand that photographs cannot depict fantastical entities whilst drawings can. Children were told that the experimenter’s friend Sarah had been given some new crayons (Drawing condition) or a new camera (Photograph condition) for her birthday and had made some pictures, which she had then mixed up with someone else’s. Children were then shown 17 picture pairs, each consisting of a real entity (e.g. a horse) and a fantastical entity (e.g. a unicorn), and for each pair was asked, ‘which picture do you think is Sarah’s?’ In the Photograph condition, children tended to select real pictures, while in the Drawing condition, children selected significantly more fantastical pictures (although a bias for real pictures was evident throughout). This pattern of results was more

pronounced with age, and thus indicates that with age children become increasingly aware that photographs cannot depict non-real subjects, whilst drawings can.

PA-008

Why can't children innovate tools?

Nicola Cutting, Clare Williams, Ian Apperly, Jackie Chappell, Sarah Beck

University of Birmingham, Birmingham, UK

Children have great difficulty innovating simple tools to solve novel problems. The majority of children under 8 years fail to make a hook by bending a pliable wire to retrieve a bucket from a tall tube. We investigated this difficulty by exploring which elements of tool innovation are particularly difficult for 4- to 7-year-olds.

In experiment 1 half of the children first chose between a hook and a straight pipecleaner to retrieve the bucket. All children were then given the innovation task requiring them to bend a straight pipecleaner into a hook. All children used the hook correctly to retrieve the bucket in the choice experiment. Children were more successful in innovating a hook if they had previously chosen and used one.

In experiment 2 different aspects of tool making were highlighted to children. Properties of the materials were highlighted to half of the children through bending practice prior to engaging with the innovation task. If unsuccessful on the innovation task, children were shown a readymade pipecleaner hook. Older children successfully innovated a hook after seeing the target tool only if they received bending practice. Older children without bending practice and all younger children performed at floor.

Together these experiments suggest that children's difficulty is not the result of a simple lack of knowledge. Children's difficulty on tool-innovation tasks is likely to be due to their ill-structured nature. Tool innovation is difficult due to the need to bring to mind relevant knowledge and then coordinate that knowledge into a solution.

PA-009**The motivation underlying in-group bias in children**David Buttelmann¹, Robert Böhm²¹ Research Group "KiT", University of Erfurt, Erfurt, Germany² School of Business and Economics, RWTH Aachen University, Aachen, Germany

Humans demonstrate a clear bias for members of their own group over members of other groups in a variety of ways. It has been argued that the motivation underlying this in-group bias in adults may be to favor one's own group (in-group love), or to derogate the out-group (out-group hate), or both. Although some studies have demonstrated the presence of in-group bias in children and infants, nothing is known about its underlying motivations. Whereas some researchers have argued that in-group love and out-group hate are inseparable motivations that emerge simultaneously (Sherif, 1966), others have argued that in-group bias is primarily motivated by in-group love with out-group hate being a possible additional motivation developing later in life based on experiences (Allport, 1954). Using a novel computer-mediated third-party mini-dictator game, we asked 6- and 8-year-old children (n=45 and n=36, respectively) to allocate positive and negative resources to either an in-group member, an out-group-member or to a box (neutral option). Both age groups differed for the allocation of both resource domains. We show that in-group love is already present in children of both age groups and can motivate in-group biased behavior across childhood. In contrast, an analysis of the allocation of negative resources revealed that out-group hate develops only after a child's sixth birthday and is a sufficient motivation for in-group biased behavior from school age onwards. By demonstrating a primacy of in-group love these results help to better identify the motivation underlying the in-group bias in children. Results reported are highly significant.

PA-010**Do children really have a gravity bias? The influence of inhibitory control on performance in the tubes task**

David Buttelmann, Philipp Berger

Research Group KiT, University of Erfurt, Erfurt, Germany

One of the most prominent findings concerning children's physical cognition within the last few decades was the discovery of children's proneness of the so-called gravity bias. It refers to their tendency to search for a ball right beneath the opening of a tube instead of the correct opening in the 'tubes task' (Hood, 1995). We investigated whether spatial-

conflict inhibitory control problems, instead of children's use of the principle of gravity, provides a better explanation for this bias. Given the spatial proximity between the incorrect location and the opening, it might be difficult for younger children to avoid this location. The current study examined the relation between a modified version of this task and two measures of spatial-conflict inhibition in 3- to 5-year-olds (N=88). In our version of the task, children had to predict whether a ball would fall in a straight or an oblique line. The distance between the correct location and the tube's opening was varied by having three differently arranged tubes to determine whether spatial proximity influences task performance. Additionally, performance on this task was compared to that of two spatial-conflict inhibitory-control tasks. Performances on all three tasks were significantly related to age, with older children solving more trials. No significant effects were found for spatial proximity, and no relation was revealed between the tubes task and the two measures of spatial-conflict inhibition. These findings suggest that spatial proximity does not explain children's failure in the tubes task, with the 'gravity bias' still being the most appropriate explanation.

PA-011**Infants' reactions to antisocial actions directed towards fair and unfair agents**Luca Surian¹, Marek Meristo²¹ Department of Psychology and Cognitive Sciences, University of Trento, Italy² Department of Psychology, University of Gothenburg, Göteborg, Sweden

The present study investigated whether 10-month-olds react differently to events that instantiate punishment directed toward fair and unfair agents. Infants were first familiarized with two agents (i.e. simple geometrical shapes with eyes and mouth) who distributed resources to two identical potential recipients. One agent always distributed the resources fairly (equally), while the other always performed an unfair (unequal) distribution by giving all to one recipient and ignoring the other. In the test phase of the first experiment, infants then saw a third agent, an orange circle, hitting and pushing away either the fair or the unfair distributor. Infants' looked reliably longer when the hitting was directed towards the unfair agent. In a second experiment, a human hand was depicted to behave antisocially towards one of the two distributors by taking away a strawberry that was placed close to it. Infants again looked longer when the antisocial action was directed towards the unfair agent. The results of the present experiments suggest that infants' evaluated fair agents more positively than unfair agents, encoded the antisocial character of the third agent's action in

the test phase, and preferred to look at test events that were more coherent with the events seen in the familiarization phase. These findings support the view that infants possess a tacit socio-moral competence that is independent of linguistic experience and domain-general learning mechanisms.

PA-012 **Investigating a new method for studying social dilemmas in preschoolers**

Martina Wittig¹, Sebastian Kirschner², Keith Jensen³, Claudio Tennie⁴, Michael Tomasello²

¹ Department of Developmental Psychology, Institute for Psychology, University of Kassel, Kassel, Germany; ² Department of Developmental and Comparative Psychology, Max-Planck-Institute for Evolutionary Psychology, Leipzig, Germany; ³ School of Psychological Sciences, University of Manchester, Manchester, United Kingdom; ⁴ School of Psychology, University of Birmingham, Birmingham, United Kingdom

Human cooperation is unique in terms of its diversity and complexity (Hill et al., 2009). Situations in which individual and collective rationalities are conflicting depict social dilemmas (Kollock, 1998) and can be experimentally studied in the Public Goods Game. In this group game, each participant can choose whether or not to invest a proportion of an endowment he received into the public good. Every player's contributions are multiplied and divided evenly among all group members. From the group's perspective, it is most advantageous to invest all of the endowment into the group, from the individual's perspective, it is more advantageous to withhold the own investment. When adults play the Public Goods Game, they show fairly high rates of cooperation that decline over time. Children have rarely been studied in such an experimental setup and the methods applied so far cast doubt on their applicability for studying the behavior of preschoolers. In our study, preschoolers were given a reduced form of the game: they could invest all or none of their endowments into the public good, and the distributional outcomes were made comprehensible. Using this simplified method, preschool children are already able to comprehend the rules of this game. The players' choices are affected by previous experiences in a reasonable manner, becoming less cooperative after having experienced defection by others. However, in contrast to adults, their contributions to the public good are low to begin with, suggesting that cooperating in the group context is an ability children yet have to learn.

PA-013 **Animacy cues and the processing of goal-directed actions.**

Maurits Adam, Birgit Elsner, Ivanina Henrichs
University of Potsdam, Germany

From early on infants show signs of understanding goal-directed actions. In an eyetracking-study with 7-month-olds and adults we investigated the impact of certain animacy cues on action processing. The participants, depending on the experimental condition, saw videos of a mechanical claw either presented with or without animacy cues (self-propelled movement, equifinality of goal-achievement and a salient action effect) approaching a goal object. Thereafter sequences of images were presented in a Posner-Paradigm, in which a central presentation of the claw facing either to the left or the right was followed by a subsequent presentation of a peripheral stimulus with a position either congruent or incongruent to the claw's line of gaze. Anticipatory gaze shifts to the goal object were measured in the video phase, whereas reaction times were assessed as indicators of covert attention in the image phase. In the video phase we found anticipatory looking behavior in the animate, but reactive looking behavior in the inanimate condition in the adult sample, whereas the infants tracked the action reactively in both conditions. For reaction times we found that adults shifted their gaze to the peripheral stimulus significantly faster than the infants, while both age groups shifted their gaze to the stimulus faster in the animate than the inanimate condition. Our results suggest that the importance of animacy cues was stronger for adult participants than for the infants. Furthermore, we currently assess data of another sample of 11-month-olds to further investigate the developmental process of action processing.

PA-014 **Executive function is a predictor of effective collaboration in children with autism**

Tamas Borbely, Nicola Yuill
University of Sussex, Brighton, UK

High-functioning children with autism (HFA) are typically impaired in collaboration, a capacity that forms the basis of social play and group learning. Despite its developmental importance, the predictors of poor collaboration are little understood; previously identified candidate mechanisms include theory of mind (ToM) and responding to joint attention. We contribute to the executive dysfunction account of social impairments in autism by

exploring the links between inhibition and three component mechanisms of cooperation: reciprocity, accepting the play partner's input, and fairness. In Study 1, twelve HFA children in mainstream primary schools completed an inhibition battery and a collaborative drawing task. Their performance was compared to that of twelve age-matched typically-developing (TD) peers. The groups did not differ on ToM and joint attention, but inhibition was found to predict reciprocity and accepting the play partner's input as well as social difficulties in everyday life. In Study 2, we investigated the discrepancy between HFA children's ability to reason about fairness in hypothetical scenarios and their sharing behaviour in real life. We also compared their performance to that of TD peers. We hypothesised that the behavioural differences between hypothetical and actual settings for HFA children would be more extreme than in the TD sample, and that it would be a function of the severity of impairments in inhibition. The results of these studies are discussed in terms of a model of social impairments in HFA whereby executive dysfunction acts as a moderator between relatively intact social knowledge and profoundly impaired social competence.

PA-015

Ostensive addressing signals and quality of previous interaction modulate attention in 2-year-old children

L. Horn¹, K. Oláh^{2,3}, F. Elekes^{2,3}, O. Kanizsár², J. Topál²

¹ Department of Cognitive Biology, University of Vienna, Austria; ² Institute of Cognitive Neuroscience and Psychology, MTA TTK, Budapest, Hungary; ³ Department of Cognitive Psychology, ELTE, Budapest Hungary

One of the key components for successful social interactions is the attention towards the social partner. Previous studies suggest that children's attention towards a certain individual can be influenced by factors like familiarity or the specific relationship. However, much less is known about whether they attend differently to people depending on short previous interactions. Another factor known to influence children's attention is the use of ostensive addressing signals, as these cues can change the context and interpretation of the social interaction.

In this study we investigated how long children (aged 20-24 months) attended to their caregiver, an experimenter that interacted with them in a positive way prior to the test (i.e., joint play), and an unfamiliar experimenter. Half of the children were addressed with ostensive signals during the test (i.e., establishing eye contact, calling the participant's attention), the other half were not. We found that the children that were not addressed with ostensive signals did not differentiate between the models. In contrast, when ostensive

signals were used during the test, the participants attended differently to the different models. This suggests a modulating effect of communicative cues on the perception of the test situation; ostensive communication seems to increase subjects' sensitivity towards potential differences between the models. Moreover, the children's attention to their previous interaction partner during the test was related to the quality of the preceding interaction: the more instances of positive emotion (i.e., laughing) the children displayed during the play phase, the more attention they paid to the experimenter.

PA-016

Majority bias and independent-sources bias in the imitation of language use by three-year-old children

Colin Bannard

University of Texas at Austin

Young children are more likely to imitate behaviors displayed by multiple rather than a single actor [e.g. Haun, Rekers and Tomasello, 2012]. In two studies we show that a) this tendency extends to the imitation of multiword speech, and b) that this 'majority bias' varies depending on whether the multiple speakers are independent sources or potentially mutually-mistaken confederates.

Study 1: Twenty-four three-year-olds played a game involving 20 drawings that were described with novel adjective noun pairs. In the corroboration condition, one experimenter and then another described 10 pictures (both using the same adjective noun pair), before it was then the child's turn. In the repetition condition a single experimenter described 10 pictures twice before it was the child's turn. The order of conditions was counterbalanced. The children copied the experimenter-produced phrase more in the corroboration condition than in the repetition condition.

Study 2: Thirty-two 3-year-olds heard two sets of 10 phrases being produced by a recorded voice while they looked at pictures depicting them. In a dependent sources condition an experimenter who had been jointly attending to the pictures/recordings labeled the same pictures in the same way. In an independent sources condition another experimenter who had been absent labeled the same pictures in the same way. Condition order was counterbalanced. In early trials the children copied the experimenter-produced phrases more when they had been produced by the familiar dependent experimenter. For the remaining trials, however, they copied significantly more when the phrases had been corroborated by the independent source.

PA-017**Ten-month-old infants consider distributors' intentions in evaluating fairness**Karin Strid ¹, Luca Surian ², Marek Meristo ¹¹ University of Gothenburg, Sweden² University of Trento, Italy

Recent research suggests that preverbal infants are able to evaluate agents on the basis of their distributive actions (Meristo & Surian, 2013; Schmidt & Sommerville, 2011). It is however unclear whether infants' evaluations are based on their understanding of the actors' intentions (i.e. good agents intend to distribute resources equally), or only the outcome of their actions (i.e. good agents perform actions that lead to equally distributed resources). In the present study, infants observed a scene with two identical recipients, with eyes and mouth, on top of two hills. A distributor climbed the first hill and gave a strawberry to the recipient on top of it. In the unable condition, the distributor then repeatedly and unsuccessfully tried to climb the second hill to give the second strawberry to the second recipient. In the unwilling condition the distributor kept the second strawberry for itself without trying to climb the second hill. In both cases the outcome of the events led to an unequal distribution of strawberries. In the test event, a new agent, who previously witnessed the distributors' behaviours, approached one of them. Infants who saw the unwilling distributor being approached looked significantly longer than infants who saw the unable distributor being approached ($p < .042$). There were no differences between the conditions when the recipients on top of the hills were replaced by inanimate squares ($p = .68$). The results suggest that infants consider distributors' intentions when evaluating actions that lead to unequally divided resources.

PA-018**Context-specificity of children's overimitation – the role of conventional and rational normative assumptions in the reproduction of causally irrelevant actions**Stefanie Keupp ^{1,2}, Tanya Behne ^{1,2}, Hannes Rakoczy ^{1,2}¹ Department of Developmental Psychology, University of Göttingen² Courant Research Centre Evolution of Social Behaviour

Recent studies emphasized the role of normativity in children's "overimitation" (Kenward, 2012; Keupp et al., 2013). In these studies, children interpreted irrelevant actions as an obligatory and normatively binding part of the activity they were doing,

and criticized others for not performing them. Such action interpretation seemed to be driven by children's understanding of the act as conventionally (not causally) necessary part of the activity. One feature of conventional normativity is its context specificity. Studies involving pretend games demonstrated children's understanding of this aspect when it comes to using an object in a certain way (Wyman et al., 2009). The current projects (ongoing) investigate a) context-specific action interpretation with regard to conventional normative assumptions in overimitation scenarios, and b) influences of different kinds of normativity. The normative account predicts that children should perform irrelevant actions less frequently, and criticize others less frequently for omitting them, when they are acting in a different context from the one in which the initial demonstration took place. Preliminary results show that children criticize others for omitting irrelevant actions more often when they are acting in the same context as the model. Also, children's action interpretation is influenced by instrumental-rational aspects: overimitation rate drops when irrelevant actions have costly material consequences, and irrelevant elements seem to be considered as less conventionally binding when an activity is performed under such conditions.

PA-019**Selective social referencing, imitation and exploration depending on context and social cues**Andy Schieler ¹, David Buttelmann ¹, Melissa Koenig ²¹ University of Erfurt, Erfurt, Germany² University of Minnesota, Minnesota, USA

Some studies claim a basic understanding of other people's knowledge in certain circumstances even in infancy (Walden & Kim, 2005; Stenberg, 2009). However, these studies often lack important controls. Here we investigated infants' understanding of others' expertise by varying the presenter of an ambiguous object (social-cue) and the setting of the study (context-cue). Additionally, we included a variety of measures such as referencing, imitation and explorative behaviours. Specifically, after measuring infants' referencing behavior, in the imitation tasks both the experimenter and the parent used different tools to model an identical action on novel apparatuses. In the subsequent response phase participants were given the chance to choose a tool to act on the apparatus themselves. In the exploration task no demonstration was provided by the adults except emotional cues towards the novel object. The study took place in the laboratory and at children's homes.

PA-020**Children's Understanding of Intention Transmission in Communication**

Xinyi Jin, Mowei Shen, Zhongqiang Sun, Jifan Zhou, Meng Zhang, Jie He
Zhejiang University, Hangzhou, China

Human possess the unique social cognitive skill of intention sharing, which involves the essential understanding of intention transmission between agents. The ability to transmit intention across agents is fundamental to communication and collaboration. This study explored how young children understand intention transmission from one to another in communication. Three-year-olds were repeatedly shown two agents respectively pursuing two different objects in the learning trials, and then in the test trial, one (the communicator) interacting with a new agent (the recipient) whereas the other (the non-communicator) not. Results suggested that children preferentially recognized that the recipient had the same intentional action as the communicator versus the non-communicator (Experiment 1). This tendency disappeared when the interaction was not between agents (Experiment 2) or when it did not include communicative cues such as face-to-face gesture and contingent responsivity (Experiment 3). The intention was transmitted from the communicator to the recipient but not generalized across others (Experiment 4). The subsequent behavior of the communicator (left after communication in Experiment 5) and the group information of the communicator and the recipient (in-group versus out-group in Experiment 6) also had critical effects on the understanding of intention transmission. These results highlighted critical components in children's understanding of intention transmission, which may contribute to the complex nature of human communication and shared intentionality.

PA-021**Cortical activation to social touch in young infants: A functional near-infrared spectroscopy study**

R. Braukmann¹, S. Lloyd-Fox², T. Gliga², L. Pirazzoli², M. Johnson²

¹ Radboud University Nijmegen Medical Centre, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, NL; ² Centre for Brain and Cognitive Development, Birkbeck, University of London, London, UK

Touch plays a vital role in social interactions and although its importance for early development has been shown, little is known about the cortical processing of social touch in infancy. Research has shown that in adults slow, affective social touch elicits broad activation in several brain regions, including the posterior insula, superior temporal sulcus

[STS], medial prefrontal cortex (mPFC), orbitofrontal cortex (OFC) and the amygdala. The current study used functional near-infrared spectroscopy to assess how social touch is processed in the developing brain. The hemodynamic responses of 4-6month-old infants were measured over temporal and frontal sites, while they were presented with different forms of touch. More specifically, an experimenter touched the infants' arm either with her hand (social touch condition) or with a spoon (non-social touch condition). The touch was administered with a constant speed (~1 stroke every 2 seconds) in alternating blocks of 10 seconds followed by a 10-second resting period. The side of touch as well as the order of the conditions was counterbalanced between participants. Preliminary results showed that social and non-social touch elicited broad cortical activation. More extensive analyses will be focused on comparing the hemodynamic responses to social and non-social touch in selected regions of interest and results will be presented at the conference. This basic first study will be used as a basis for future experiments investigating the early processing of social touch in more detail.

PA-022**Exploring the link between early multimodal communication abilities and vocabulary measures at 18 months of age**

Alfonso Iguualada¹, Laura Bosch^{2,3}, Pilar Prieto^{4,1}

¹ Universitat Pompeu Fabra, Barcelona, Spain. ² Universitat de Barcelona, Barcelona, Spain

³ Institute for Research on Brain, Behavior and Cognition (IR3C), University of Barcelona

⁴ ICREA - Institució Catalana de Recerca i Estudis Avançats

Recent studies have shown that the early appearance of declarative pointing seems to predict vocabulary development. But little is known about the integrated use of multimodal communication strategies in relation to caregivers' social interaction conditions, and specifically whether these strategies, combining pointing, looking and vocalization are related to vocabulary development. The present study investigates the predictive value of the integrated use of infants' multimodal abilities during controlled social interactions on later language development. Liszkowski et al.'s (2008) experimental task was used to obtain multimodal communicative samples at 1;0 and 1;3 in baseline trials and in two different social conditions, namely when the adult was or was not visually attending to the infant. These controlled contexts of social interaction challenged infants' communicative abilities to direct adult's attention to an object. Caregivers reported vocabulary measures with the MacArthur CDI at 1;0, 1;3, and 1;6. Nineteen infants completed the procedure in this longitudinal study. Preliminary results show significant differences of age and

social condition on infants' communicative productions: that is, infants' use multimodal productions during the attending, socially demanding condition, and this ability increases with age. Early simultaneous pointing-speech combinations seem to work as a strong communicative resource to attract the adult's attention in socially demanding contexts. Multimodal communicative behavior at 1;3, rather than at 1;0 seems to be related to expressive vocabulary measures at 18 months of age.

Liszkowski, U., Albrecht, K., Carpenter, K. & Tomasello, M. [2008]. Infants' visual and auditory communication when a partner is or is not visually attending. *Infant, Behavior & Development*, 31:157-167.

PA-023

Mimicry by membership: 4- to 6-year-olds mimic ingroup members more

Johanna E van Schaik, Nina van den Broek, Sabine Hunnius

Radboud University Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Centre for Cognition, the Netherlands

Behavioral mimicry, the copying of an interaction partner's behaviors that occurs outside of awareness, is an important aspect of social interactions. Studies indicate that adults' mimicry is affected by group membership, yet little is known about how this social sensitivity develops. Interestingly, different aspects of children's behavior, such as their affiliative and helping behaviors, are affected by group boundaries. The present study investigated whether young children's mimicry is sensitive to group membership. Forty 4- to 6-year-olds chose whether to belong to a yellow group or a blue group, and proceeded to play a simple game they were told would earn points for their group. The children then observed videos of one model wearing the child's group's color (the ingroup model) and one who was wearing the other color (the outgroup model). In these videos, each model carried out a different subset of typically-mimicked behaviors (i.e. yawning, side-to-side nodding, mouth-rubbing, and cheek-scratching). Children's behavior during the initial game, which served as the baseline, and while watching the videos of the models was coded for the four target behaviors. Children spent significantly more time carrying out the behaviors demonstrated by their ingroup model than by their outgroup model while watching the videos, whereas this was not the case during the baseline. Time spent looking at the ingroup and outgroup models did not differ. This study demonstrates that already at a young age children identify with groups to the extent that their social mimicry behavior becomes sensitive to novel group boundaries.

PA-024

Knowledge transfer in 22-month-olds: The role of executive functions, parenting goals and beliefs about self-regulation

Sabrina Bechtel, Sabina Pauen

Department of Developmental Psychology, Heidelberg University, Heidelberg, Germany

Knowledge transfer is a key aspect of human learning and problem solving. Although this ability seems to be present early in life [Brown, 1990; Chen et al., 1997], some factors are known to impede transfer performance in toddlers. One example is the perceptual salience of non-functional features [Bechtel, Jeschonek, & Pauen, 2013]. Successful transfer of tool knowledge requires children to focus on relevant aspects while ignoring irrelevant features. Such skills are closely related to executive functions (i.e. working memory, inhibition and set-shifting), which undergo substantial developmental changes during the first years of life [Diamond, 2013]. Beyond that, social influences related to parental beliefs and goals concerning self-regulation of their child may also affect children's learning and transfer performance.

The present study investigated 22-month-olds' transfer performance in a tool-choice task, parent's beliefs and goals concerning the child's self-regulation, as well as the child's executive functions. Parent's beliefs about self-regulation ($r=.58$, $p<.01$, $n=24$), as well as their parenting goals regarding self-regulation ($r=.51$, $p<.05$, $n=24$) correlated with children's tool learning. In addition, parenting goals correlated with the child's response to feedback during transfer ($r=.66$, $p<.01$, $n=15$). Children's working memory was associated with performance in the transfer task ($r=.42$, $p<.05$, $n=20$).

Based on this set of findings we conclude that the development of tool understanding depends on both: basic cognitive skills of the child as well as parental attitudes towards self-regulation of their offspring. The complex interplay of social influences and dispositional attributes of the child on tool learning needs further investigation.

PA-025**Investigating co-representation effects in 3-5 year-olds: A computerised joint task**

S. Milward, S. Kita, I. Apperly

University of Birmingham

This study used a computerised version of a co-representation task used in a previous study [Milward, Kita & Apperly, under submission]. The previous study found co-representation effects in 4-5 year-olds, whereby children were more likely to make errors on a joint task if they were given a different task rule to that of their partner than if they were given the same rule. The current study aimed to modify the methodology in order to test younger children and therefore identify whether there is a cut-off point in development where co-representation does not occur. Children played a computer game with the experimenter, where both participants were required to press a button when either a picture of a bear or a duck appeared on the screen. In the Different Task condition, the child and the experimenter responded to the same animal. In the Same Task condition, they responded to different animals. A 2x2 between subjects ANOVA showed a borderline significant interaction [$F = 3.85$, $p = .054$], whereby older, Reception class children [59-69 months] responded more quickly in the Same Task condition than in the Different task condition [$t = 12.79$, $p < .01$], but younger, Nursery-age children [36-51 months] did not [$t = .17$, $p = .86$]. This suggests that co-representation is a phenomenon that develops with age, giving us a valuable insight into the mechanisms that underlie it.

PA-026**I won't tell: 4-year-olds show loyalty to their group by keeping group secrets**Antonia Misch¹, Harriet Over^{1,2}, Malinda Carpenter¹¹ Max Planck Institute for Evolutionary Anthropology² University of York

Previous research has shown that young children value loyalty to the group.

However, little is known about children's own feelings of loyalty and their loyal behavior. We tested whether 4-year-old children (N so far = 21) remain loyal to their group even when betraying it would be materially advantageous. The child and four puppets were allocated to two novel groups. Then, two of these puppets told the child about their group's secret book and prompted the child not to disclose their

secret. Depending on condition, these puppets were either in the same group as the child or a different group. The puppets then hid the secret book in the test room and left. Following this, a neutral puppet entered and bribed the child with stickers to tell the secret. Preliminary analysis suggests that children are significantly less willing to reveal the secret when it is their own group's secret, compared to the out-group's secret [Mann-Whitney Test; $U=24.5$, $p<.05$]. This shows that 4-year-old children are able to act in a loyal fashion towards their own novel group even when disloyalty would lead to material gain. Thus, from an early age, children are committed members of their own social groups. This commitment helps them to become reliable collaboration partners and thus enables successful group cooperation.

PA-027**Toddler's understanding of false beliefs about object identity**E. Fizke¹, S. Butterfill², R. Runge¹, N.J. Schöndorfer¹, L. van de Loo¹, E. Reindl¹, Hannes Rakoczy¹¹ Institute of Psychology & Courant Research Centre "Evolution of Social Behaviour", University of Göttingen, Germany² Department of Philosophy, University of Warwick, UK

Theory of mind researchers broadly agree that the ability to explicitly ascribe mental states emerges around age 4. However, recent studies with implicit measures (e.g. helping behaviour) suggest that even infants succeed on tasks that require to take into account a character's false belief [FB] (e.g. Southgate et al., 2007).

In response to these divergent findings nativist accounts argue that early ToM competence is masked by performance problems in explicit tasks (e.g. Leslie, 2005). More sceptical positions in contrast explain infant's success on implicit ToM tasks with sophisticated behaviour reading, denying true ToM competence before the age of around 4 [Perner & Ruffmann, 2005].

Recent two-system-theories [Apperly & Butterfill, 2009] might provide a more comprehensive explanation: they distinguish between an early system, spontaneously tracking simple forms of mental states, and a later flexible capacity, based on fully-developed concepts of belief and other propositional attitudes. The early efficient system is expected to show clear signature limits in terms of flexibility: For example, it is assumed to be able to represent FB's about object location, but not FB's about identity [Apperly & Butterfill, 2009].

Following recent behavioral paradigms [Buttelmann et al., 2009; Southgate et al., 2007] we developed two studies with 2 [identity/location] X 2 [false/true belief] designs to measure 2 - 2.5 year olds active helping behavior. Data suggest that infants succeed on a location-change task but not on an identity-change task. A 3rd follow-up study, showing improved performance also on an identity change task, contributes to interpret the findings.

PA-028 Young children's understanding of promises

Patricia Kanngiesser, Michael Tomasello

Department of Developmental and Comparative Psychology, Max Planck Institute for Evolutionary Anthropology

A promise is a voluntary obligation to perform a future act, which arises from uttering the words "I promise to do X" [Searle, 1969]. Developmental research has shown that children do not understand promising until they have reached their teens [Astington, 1988; Maas & Abbeduto, 1998; Maas & Abbeduto, 2001]; yet, recent studies have found that three-year-olds already understand joint commitments [Gräfenhain et al., 2009; Gräfenhain et al., 2013]. We investigated three- and five-year-olds' understanding of promises using a task, in which children and a puppet-partner had to work together to pull in a board with sticker-rewards. All rewards were clustered on the puppet's side of the board and we manipulated whether the puppet promised the child to share half of its stickers [promise condition; N = 20 three-year-olds, N = 20 five-year-olds] or made no promise [no-promise condition; N = 20 three-year-olds, N = 20 five-year-olds]. Yet, once the puppet had obtained the stickers, it kept all the stickers to itself. We coded children's verbal protest against the puppet's behaviour. We found that children protested 33 - 47 % of the time across the different conditions, with no significant difference between age groups and conditions. In the promise condition, however, 16% and 27% of the three- and five-year-olds, respectively, referred to the puppet's promise, while children in the control primarily complained about the unfair sticker distribution. These findings indicate that three-year-olds already understand that promises entail an obligation to fulfill the promised act.

PA-029 Effects of presentation and measurement type on a social learning paradigm

Johannes Bätz, Birgit Träuble, Sebastian Wahl

Heidelberg University, Heidelberg, Germany

Socio-cognitive development is an emerging, prominent research field and natural pedagogy [Gergely & Csibra, 2009] one of its highly distinguished theories. One pillar of the theory is the shareability assumption, which was recently supported in live studies by Egyed et al. [2013] with 18 month-olds and Träuble and Bätz [submitted] with 12-month-olds. The latter has been modified to work with an eye-tracking-system in order to use predictive measures to investigate the detailed processes underlying this shareability assumption.

Daum et al. [2012] found a difference in outcomes of goal directed action tasks depending on measurement type in children younger than 3 years of age. They compared post-hoc measures like "time duration" [as acquired by violation of expectation procedures] with predictive measures like "first look" [as acquired by anticipatory looking procedures]. Given that predictive measures are often gathered with video stimuli while post-hoc measures are frequently used in behavioral live environments, the presentation type should also be considered when comparing measurement types.

To investigate the co-dependencies of presentation and measurement type in a communicative context, this study compares post-hoc with predictive measures in a live as well as in a video presentation of the procedure used by Träuble and Bätz [submitted]. Preliminary data suggest that both, the post-hoc live measure as well as the predictive video measure yield similar results. The findings will also be discussed in light of the video deficit effect [Anderson & Pempek, 2005].

PA-030

Children’s reasoning about the changeability of self-invented versus pre-existing game rules

Susanne Göckeritz, Marco F.H. Schmidt, Michael Tomasello

Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

In his qualitative investigations on children’s moral judgment, Piaget [1932] described young children as rigidly heteronomous rule followers who understand rules as unchangeable laws. So far, however, a systematic experimental investigation of children’s rule understanding beyond the rules that children get handed down from authorities has not been conducted. Therefore, a situation in which children have the opportunity to create their own rules together with peers and without any adult interference should provide a glimpse into children’s rule understanding within a mutualistic context. Importantly, this understanding would be detached from the unilateral relationship in which children merely receive rules from adults. In the current study, we investigated triads of 5-year-olds that either invented game rules themselves or were given the game rules by an adult [between-subjects]. Afterwards, children were interviewed about their reasoning and willingness to allow different rule changes. Preliminary results suggest that children respond much more flexibly and allow changes to rules more readily when they have invented the rules themselves compared to children who have been told the exact same rules by an adult. While the specific rules in both conditions were the same, it seems that active participation in creating the rules led children to be more advanced in their rule understanding. The findings of this study will be discussed in the context of children’s developing conception of social norms in general and their different grasp of “top-down” social norms given by an authority and “bottom-up” social norms that they mutually participated in creating.

PA-031

The relation between caregiver contingent talk, SES and language learning: an intervention study.

Michelle McGillion¹, Julian Pine², Jane Herbert¹, Anna Ryder¹, Danielle Matthews¹

¹ University of Sheffield, UK; ² University of Liverpool, UK

Contingent talk, which occurs when a caregiver talks about what their infant is attending to, is strongly correlated with vocabulary learning and is proposed to explain the association between SES and language development [Carpenter et al, 1998; Hoff,

2003]. However, based on correlations alone, we do not know whether contingent talk is a cause of better language outcomes and whether it can be promoted. We report preliminary results from an intervention study to test this [Current sample: 50 infants, half randomized to language training]. Parents of widely-ranging SES were asked to practice engaging in contingent talk for a month. Contingent talk was measured at baseline [infants 11 months] and after training [12 months] by coding a 30-minute video and by automatically analyzing 32 hours of LENA audio-recordings. Outcome measures include temporal contingency [responses to infant vocalizations] and semantic contingency [talk about infant’s focus]. Infant control measures include ability to follow gaze, frequency of vocalising and pointing. Caregiver factors, including their goals, wellbeing, parenting self-efficacy and social support were measured along with several SES indicators. Baseline analyses will assess the relation between SES, control measures and contingent talk. Post-intervention analyses will test for an effect of training on rates of contingent talk and for interactions with SES. Finally, the effect of SES and training on vocabulary at 15 months will be reported. Preliminary observations demonstrate a large difference in the rates of temporally contingent talk on the video-recordings [median: .96] compared to the longer audio-recordings [median: .12].

PA-032

The social benefits of early multilingual exposure

Zoe Liberman, Amanda L. Woodward, Samantha P. Fan, Boaz Keysar, Katherine D. Kinzler

University of Chicago, Chicago, IL, USA

While bilingualism enhances cognitive development [e.g. Bialystok et al., 2009], less work focuses on social benefits of growing up in a multilingual environment. This study asked whether infants’ language background [monolingual or multilingual] influenced early social development, specifically the ability to take another person’s perspective in a communication task. Fourteen- to 17-month olds sat across from an experimenter who requested objects. A barrier was positioned such that infants always saw two objects, for instance a car and a duck, while the experimenter only saw one. The experimenter requested the object she could see [e.g. the car] by saying, “Ooh, a car, I see the car! Can you give me the car?” Half the trials featured two different objects, while the other half featured two identical objects [e.g., two cars]. Identical object trials required taking the experimenter’s perspective to select the intended object, while different object trials could be solved using vocabulary. On different object trials, infants from all language backgrounds selected the requested seen

object more often than the hidden object. However, on identical toy trials, infants from monolingual backgrounds did not reliably reach for the requested seen toy more than the hidden toy. While all infants were engaged in the task and able to use vocabulary to select objects, only infants with early multilingual exposure were able to resolve the ambiguity in identical object trials and take the experimenter's perspective. Thus, early diverse language exposure may have unexplored social benefits, such as in the development of communicative skills.

PA-033 **Modality Preference and its Change in the Course of Development**

Claudia Wille, Mirjam Ebersbach

Kassel University, Kassel, Germany

Four-year-olds and infants are more likely to rely on auditory than visual information (Sloutsky & Napolitano, 2003), whereas adults show a preference for visual stimuli (Koppen & Spence, 2007). Little is known about the change of modality preference in the course of development. Therefore, we conducted two experiments in which children (6-7, and 8-10 years-of-age) and adults were tested. They were first presented with two different auditory-visual compound stimuli [AUD1VIS1 / AUD2VIS2] and learned that each compound predicted a different target. Thereafter, the same stimuli were presented as well as „incongruent“ stimuli in which the auditory and visual components were switched [AUD1VIS2 / AUD2VIS1], so that the auditory and visual component predicted opposing target events. If participants relied more on visual information they would make visual-predictions in the incongruent trials, whereas the effect should be reversed if they relied more on auditory information. In the first experiment, participants had to predict whether a cartoon-animal would pop up on the left or right panel of the screen by touching the accordant panel [spatial predictions]. In the second experiment, participants had to predict whether an animated cartoon-animal would perform a certain activity by responding verbally [saying „dancing“ or „eating“]. In both experiments, adults showed a strong visual preference in the incongruent trials, whereas both groups of children exhibited a strong auditory preference, suggesting that the auditory preference persists beyond mid-childhood.

PA-034

Giving reasons for joint decisions in peer interactions

Bahar Köymen, Lena Rosenbaum, Michael Tomasello

Max Planck Institute for Evolutionary Psychology, Leipzig, Germany

This study investigates how children gave reasons for joint decisions in their peer interactions and how they appealed to cultural common ground as warrants – the general knowledge shared by the members of a social group. Reasoning with a peer to make a joint decision requires children make a proposal (e.g., “Let’s put polar bears here”) and to justify it with relevant facts (e.g., “This is ice”) based on common ground assumptions or warrants (e.g., polar bears need ice). Twenty-four pairs of 3- and 5-year-olds were presented with toy items to build a zoo. The items were either conventional (e.g. animals, cages) or unconventional (e.g. washing machine). Children’s reasoning about the placement of items was coded for justificatory facts and for how explicitly it articulated, if at all, the common ground warrant. When discussing conventional items, both 3- and 5-year-olds used justifications that relied on implicit warrants only, thus assuming that their partner shared this knowledge (e.g., stating only the fact “This is ice”, assuming that they both know that polar bears need ice). When discussing unconventional items, they more often articulated the warrant explicitly in order to create the necessary common ground before invoking relevant facts. Overall, 5-year-olds produced more justifications, made warrants explicit more often, and incorporated the perspective of the partner into their joint decision to reach a mutual agreement more often than did the 3-year-olds. Thus, preschool children can reason with one another appropriately and can justify their proposals based on appropriate common ground assumptions.

PA-035**Young children integrate biological motion information from multiple agents**

Martyna Galazka¹, Laëtitia Roché^{2,3}, Pär Nyström¹ Terje Falck-Ytter^{1,4}

¹ Uppsala Child and BabyLab, Department of Psychology, Uppsala University, Uppsala, Sweden

² Inserm U930, Tours, France

³ University François-Rabelais of Tours, UMR930 Imaging et Brain - Team 1 Autism, Tours, France

⁴ Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Stockholm, Sweden

Many aspects of learning and socio-cognitive development involve processing behavioural interactions between people. Research has demonstrated that young children have a remarkable capacity to orient toward and process biological motion when presented with point-lights depicting a single individual [Kuhlmeier, Troje, & Lee, 2010; Moore, Goodwin, George, Axelsson & Braddick, 2007]. The present study asked whether three-year-old children are able to integrate biological motion information from multiple agents when observing meaningful interactions.

Interactions between two individuals were created using motion capture technology, and presented in a series of point-light video presentations. Using eye-tracking in a split-screen preferential looking design, we presented three-year-old -olds (N = 20; M = 1099 days) with two types of scenes: meaningful interactions between two individuals and control scenes created from mirroring the individuals within the interaction.

The results indicate that by three years, children preferentially attended to the meaningful interactions as opposed to control. The effect was especially evident in the latter part of the stimulus presentation [MPhase1 = .45, SD = .18; MPhase2 = .64, SD = .23, $t(18) = -2.495$, $p = .023$] and was modulated by inversion, which effectively disrupted biological motion processing [$F(1, 18) = 4.899$, $p = .040$].

The present study demonstrates that biological motion is sufficient for children in detecting the interactions of others and provides an initial step toward understanding of how biological motion contributes to children's processing of other people's interactions.

PA-036**Short-term task adaptation and (in)stability of performance in complex-explicit theory of mind tasks in high functioning adults with autism. Preliminary findings from an exploratory study.**

Zsófia Borsos^{1,2}, Miklos Gyori¹, Krisztina Stefanik³

¹ Institute for the Psychology of Special Needs, ELTE University, Budapest, Hungary

² Autism Foundation, Budapest, Hungary

³ Department for the Pedagogy of Learning Disabilities and Intellectual Disabilities, ELTE University, Budapest, Hungary

BACKGROUND: Our working hypothesis is that a so-far not demonstrated, possible short-term cognitive instability may characterise autism spectrum disorders (ASD). This, if demonstrated, may explain some behavioural characteristics, and is in line with some suggested neural features of ASD.

OBJECTIVES: We explored short-term cognitive stability in ASD in a complex study. Here we focus on complex-explicit theory of mind (ToM) performance, measured multiply within hours/days, and its relation to behavioural symptoms.

METHODS: Adults with ASD (N=20) and matched non-autistic control subjects participated in repeated measurements of multiple cognitive functions. Tasks on complex-explicit ToM ability were: False Irony Task; Strange Stories Task; Eyes Task. Symptoms were quantified by ADOS.

RESULTS: We compared changes in performance across test administrations in the two groups. This brought ambiguous results on stability, but indicated different task adaptation patterns in the two groups. We used correlative analyses to explore two kinds of relations. Relations between results of each ToM task at different measurements were weaker and showed more varying pattern in the ASD. Correlations between performance in ToM tasks and symptom domains showed slightly different relationships at different times of measurement in ASD.

CONCLUSIONS: Although their validity is limited by occasional ceiling effects in the control group, some results suggest the presence of atypical instability in complex-explicit ToM performance in ASD, and indicate short-term task adaptation patterns that are deviant from those of neurotypicals. Further studies are clearly needed to clarify the presence and significance of these features in ASD.

PA-037

**Can infants use robot gaze for object learning?
The effect of verbalization**

Yuko Okumura ¹, Yasuhiro Kanakogi ¹, Takayuki Kanda ², Hiroshi Ishiguro ^{2,3},
Shoji Itakura ¹

¹ Kyoto University, Kyoto, Japan; ² ATR, Kyoto, Japan; ³ Osaka University, Osaka, Japan

Previous research has shown that although infants follow the gaze direction of robots, robot gaze does not facilitate infants' learning for objects. However, robots may offer some potential to affect infant learning. There is growing evidence that communicative signals play a primary role in facilitating social learning in young infants. Therefore, it may be possible that infants learn and acquire information from a robot when the robot displays communicative signals. The present study examined whether robot gaze affects infants' object learning when the gaze behavior was accompanied by infant-directed verbalizations as a communicative signal. Twelve-month-old infants were shown videos in which a robot with accompanying verbalizations gazed at one of two objects. After that, in the test phase to assess object processing, infants were presented with the two objects. The results demonstrated that infants not only followed the robot's gaze direction but also preferentially attended to the cued object when the verbalization was present. Moreover, in the test, infants showed a novelty preference for the uncued object when the verbalizations were quantitatively increased, showing enhanced processing of the cued object from robot gaze. These effects were not observed when mere nonverbal sound stimuli instead of verbalizations were added to the robot. Taken together, our findings demonstrate that robot gaze accompanying verbalizations facilitates infants' object learning, suggesting that verbalizations are important in the design of robot agents from which infants can learn.

PA-038

Attribution of mental states to animated triangles in Down syndrome

J. Csakvari, Zs. Varnagy-Toth, M. Gyori

Institute for the Psychology of Special Needs, ELTE University, Budapest, Hungary

BACKGROUND: Down syndrome [DS] is the most common chromosomal abnormality with intellectual disability, a neurodevelopmental disorder with general cognitive and adaptive behaviour impairments. Adults with DS show relatively spared social skills in everyday life, but impaired social cognitive development, including atypical theory

of mind [ToM] abilities, is well documented in both childhood and adulthood. In this study our goals were to explore [1] mental state attribution and [2] related eye movements in DS, using the method of Frith & Happé [2011], presenting animations of geometric shapes as stimuli and collecting data from verbal interpretations and by eye-tracking.

METHOD: 15 adults with DS and 15 matched neurotypical controls participated. We used 4 animation clips with 'random' movements and 4 'ToM' clips with interactions eliciting mental state attributions in neurotypical observers in previous studies. Verbal interpretations and key gaze variables were compared across groups.

RESULTS: Participants with DS [1] attributed significantly higher intentionality in 3 random clips, lower in 1 'ToM' clip, and their emotional score in 'ToM' clips was significantly lower as compared to controls. [2] Their mean fixation duration was lower in both conditions and although an increasing tendency in the ToM condition was present, it was significantly less intensive than in controls.

CONCLUSIONS: Results confirm atypical mental state attribution processes and the usability of eye-tracking method in DS adults. Atypical over-attribution of mental states, less precise emotional recognition, and related atypical fixation patterns seem to characterise this group.

PA-039

Working memory, sensory discrimination and their contribution to fluid intelligence in elementary school children

Annik Voelke, Stefan Troche, Thomas Rammsayer, Claudia Roebers

University of Bern, Bern, Switzerland

Despite a century of empirical research and large numbers of models and theories, intelligence is still an elusive concept. Contemporary views emphasize that psychometric intelligence is a broad and multi-faceted concept embracing various aspects of information processing. However, the question of which of the information processes are more, respectively less essential to intelligence is still a hotly debated issue. On the one hand, researchers from a cognitive perspective have often focused on working memory [WM] as being an [if not the most] important predictor of intelligence. On the other hand, in the individual differences perspective, general sensory discrimination ability [GDA] has been suggested to be functionally related

to intelligence. There is ample evidence to show that these two information processes explain substantial portions of overall variability in intelligence on their own, studies assessing their relative contributions when investigated simultaneously however, are relatively rare. To gain a better understanding of the contribution of each of these processes to intelligence, the present study systematically investigated the interplay between GDA, WM and fluid intelligence in 8- to 12-year old children using a latent variable approach. Results showed that the three latent variables were substantially related with each other but also clearly distinct constructs. Furthermore, structural equation models showed that WM explained portions of variance of fluid intelligence above and beyond GDA, while the relationship between fluid intelligence and GDA was completely mediated by WM. These results are discussed against a background of findings of fMRI studies and the brain areas involved.

PA-040

Early collaborative sharing is intrinsically motivated and undermined by external rewards

J. Ulber, K. Hamann, M. Tomasello

Max Planck Institute for Evolutionary Anthropology, Department of Developmental and Comparative Psychology, Leipzig, Germany

According to the Overjustification Hypothesis, intrinsic but not extrinsic motivations can be undermined by salient external rewards [Lepper & Green, 1981]. For instance, infants who receive a material reward engage less in further helping as compared to infants who receive no reward [Warneken & Tomasello, 2008]. The current study investigated whether children's collaborative sharing behavior is intrinsically motivated given that already 3-year-old peers spontaneously equalize disadvantageous resource distributions that were obtained collaboratively [Hamann et al., 2011].

In the current study, 3-year-old children received marbles by pulling ropes together with a puppet. "Accidentally" children received three marbles, whereas the puppet received only one. In the Reward condition the puppet encouraged the child to equalize the outcome in exchange for an extrinsic reward [small toy]. In the Control condition the puppet did not provide any external reward but instead verbalized her desire if necessary. In the following identical test phases the puppet showed no reaction to disadvantageous allocations. We hypothesized that children would share less in the Reward condition than in the Control condition.

Preliminary analyses (N = 16) showed that almost all children in the Control condition were willing to share with the puppet (M = 86%), compared to only 33% in the Reward condition [Fisher's exact test $p = 0.06$]. Data collection and testing of a Social Praise condition is ongoing.

The study contributes new evidence for the underlying intrinsic origins of early sharing behavior. Findings are discussed with respect to the educational implications of external reinforcements in early moral development.

PA-041

The more boring the testing materials, the better the participant? Affordances of study materials and their influence on children's performance in an inhibitory-control task

Frances Butteltmann, David Butteltmann

University of Erfurt, Erfurt, Germany

The windows task [Russell et al., 1991] is the most common task used to test children's inhibitory control. In this task children are presented with two boxes, with one containing a reward. The task is to point at the empty box in order to receive the reward. Thus, to succeed they have to inhibit the prepotent impulse of pointing at the box with the reward. Four-year-olds usually pass this task, whereas 3-year-olds fail and most often point to the box that contains the reward.

In previous studies different objects [e.g., sticker, symbols] were used as rewards. It is known from other fields of research that the affordances of study materials can influence children's performance in the tasks [Morrison & Rosales-Ruiz, 1997; Suchman & Trabasso, 1966]. Although the windows task is used frequently, until now no one has paid attention to study materials as an influential factor. In the current study we investigated whether children's preferences for specific test objects influence their performance in this task. In order to do so, we have examined forty 4-year-olds' preferences for single test objects and tested them with these objects in the windows task.

Results show that children's performance in the windows task did not differ depending on whether the more or the less favored reward-objects were used [Wilcoxon test = 11.00, N=40, $p = n.s.$]. Therefore, children's motivation for passing this inhibitory control task is independent from their preference for the test object used.

PA-042**Who you ask matters: The influence of informants on finding relations between Theory of Mind and children's behaviour**

Karen Kühn, David Buttelamm

Universität Erfurt, Erfurt, Germany

The role of Theory of Mind (ToM) as a potential influencing factor on social behaviour in children of preschool age has attracted little empirical investigation so far. Some studies indicated a connection between ToM and peer acceptance, as well as pro-social behaviour (Slaughter et al., 2002; Walker, 2005). Recent research has provided evidence of negative correlations between ToM and aggression, and positive correlations between ToM and a shy-withdrawn personality (Wellman et al., 2011; Lane et al., 2012). These studies, however, only considered the behavioural assessment submitted by a single source. We investigated the false-belief understanding of 3- (N=90) and 4-year-old children (N=80) by applying two tasks; an unexpected-transfer (ut) and an unexpected-content task (uc). To gain information from different sources, mothers and teachers were given comparable questionnaires to assess children's behaviour (Child Behaviour Checklist and Teacher Report Form, Achenbach & Rescorla, 2000). Our results confirmed the negative correlation between ToM and aggression only in the case of the mothers' assessment [$r_{ut-3y} = -.240$, $p = .032$; $r_{uc-4y} = -.251$, $p = .047$], whereas teacher ratings for aggression were positively correlated with ToM [$r_{ut-4y} = .254$, $p = .034$]. Furthermore, a negative correlation between ToM and emotional reactivity was found for mother assessments [$r_{ut-3y} = -.244$, $p = .029$]. Contrary to previous findings, more withdrawn children showed lower ToM abilities. Importantly, there was no correlation between mother and teacher ratings for the 4-year-olds. These results strengthen the assumption that when investigating relations between children's ToM abilities and their social behaviour several sources of information should be included.

PA-043**Haptic picture perception: Development with age and relation to short-term memory capacity**A. Mazella ^{1,2}, J.-M. Albaret ¹, D. Picard ².¹ University of Toulouse 3, Prissmh EA4561, Toulouse, France² Aix Marseille University, PsyCle Research Center EA3273, Aix en Provence, France

Pictures are usually visual and children identify them using the visual modality. Pictures may also be tactile (raised-line drawings), and children can use their sense of active touch (or the haptic modality) to explore by hand their raised-line content. Most of the studies on haptic picture perception have been conducted with adults. The present study used a developmental approach to assess changes with age in haptic picture perception and their possible relation with short-term memory capacity. The participants were 13 sighted children aged 5-7 years, 13 adolescents aged 13-17 years, and 13 young adults aged 20-25 years with no prior experience with tactile pictures. The participants were blindfolded and they had to identify a series of 8 raised-line drawings of common objects (e.g., car, banana...) by touch. To make the task easier, we provided them with the category name (e.g., vehicle, fruit...) prior to the presentation of each picture. The participants were additionally assessed on their haptic short-term memory capacity, and had to perform a shape span task. The results indicated aged-related improvements in picture identification scores. Children identified about one third of the picture set, whereas adolescents and young adults named correctly 69 to 86% of the corpus of tactile pictures. Interestingly, we found that memory scores accounted significantly for the variability in picture identification scores. We concluded from this study that haptic picture perception develops with age, and that the concomitant improvement in haptic short-term memory capacity may play a role in the development of haptic picture perception.

PA-044**Developmental Differences in Function and Structure of rSMG and Reduced Functional Connectivity with DLPFC Explain Increased Affective Egocentricity Bias in Childhood**

Nikolaus Steinbeis, Boris C. Bernhardt, Tania Singer

Max-Planck Institute for Human Cognitive and Brain Sciences, Leipzig

Humans often judge the states of other people egocentrically, assuming that others will feel or think similar to them. Such an emotional egocentricity bias (EEB) occurs frequently in situations when others feel differently to oneself. We studied the neurocognitive mechanisms underlying the developmental capacity to overcome such EEB in children compared to adults using a novel speeded monetary game. We show that children showed a stronger EEB than adults. This was not due to any basic developmental changes in lower level abilities such as fluid intelligence or reorienting attention. Importantly, we show no correlation between the EEB and false-belief attribution, suggesting that affective egocentricity can be differentiated in development from other types of cognitive egocentricity, a dissociation already shown previously in adults. Instead, the functional imaging data suggest that the children's greatly enhanced EEB compared to adults results from reduced activation in right supramarginal gyrus (rSMG) as well as reduced functional connectivity between rSMG and left dorsolateral prefrontal cortex (IDLDFC). Further, functional recruitment of rSMG was associated with age-related differences in cortical thickness of this region. Finally, resting state analyses comparing connectivity patterns of rSMG with rTPJ, a region typically implicated in cognitive perspective-taking and self-other distinction, suggested a unique role of rSMG for self other distinction in the emotional domain. Thus, observed difficulties of children to overcome EEB may be due to the late maturation of brain regions that distinguish between conflicting socio-affective information and then to fully relay this information to regions necessary for implementing accurate judgments.

PA-045**What is a group? Young children's perceptions of different types of groups and group entitativity**Maria Plötner¹, Harriet Over², Malinda Carpenter¹, Michael Tomasello¹¹ Max Planck Institute for evolutionary Anthropology, Leipzig, Germany; ² University of York, UK

To date, developmental research on groups has focused mainly on in-group biases and intergroup relations. However, little is known about children's understanding of different types of groups. Lickel and colleagues (2000) found that adults intuitively distinguish four types of groups: intimacy groups, task groups, social categories, and loose associations. This study investigates young children's evaluations of these types of groups. Forty-eight 5- to 6-year-olds were shown pictures of four group prototypes: friends (intimacy group), people building a house (task group), people who look alike (social category), and people at a tram stop (loose association). Children judged these groups on 13 group traits (e.g., entitativity, joint goals, permeability, member similarity, interdependence, shared preferences, liking, familiarity, sharing, helping, loyalty, common ground). Children's evaluation patterns of the group traits differed significantly from chance [all chi-square p 's $\leq .01$]. Most children appropriately perceived the intimacy group, task group, and social category, but not the loose association, to possess entitativity. Intimacy group members were perceived to like and be familiar with each other, share, and be loyal. Task group members were perceived to have joint goals, be interdependent, and help each other. Social category members were perceived as being similar, familiar with each other, and as having common ground and similar preferences. The loose association was perceived to be temporary. Thus, we found that children, like adults, distinguish four types of groups and attribute distinct patterns of group traits to each type. This casts new light on children's intuitive understanding of groups and group members' behavior.

PA-046**Task adaptation in a digital environment in autism – an eye tracking study**

Zsombor Varnagy-Toth, Miklos Gyori

ELTE University, Budapest

Background: One feature of autism spectrum disorders (ASD) is the lack of cognitive flexibility, which renders adaptation to novel tasks difficult. As a consequence of this in educational settings, it is a must to first ensure the predictability and consistency

of the learning environment, which then enables learning. Thus, digital environments are very promising assistive and educational tools in ASD, as they can be made predictable and deterministic. In this study we compared task adaptation (including attentional adaptation) of neurotypical and ASD participants in the course of digitally assisted task completion in a digital task environment.

Method: 11 teenagers with ASD and matched control subjects solved 3 simple tasks on a desktop computer. Subjects completed the tasks independently, as they received instructions from, and solved tasks in, the digital environment. We monitored subjects' gaze with an eye tracker, and used key fixation and saccade parameters to explore how they adapted their gaze behaviours to the tasks requirements.

Results: Subjects in both groups demonstrated a quick task adaptation. During the three tasks, their task completion speed increased up to 147%; adaptation also manifested itself in significantly decreasing fixation durations and number of verification saccades. No between-groups difference emerged in these variables.

Conclusions: Our results support that digital environments can boost the performance and can alleviate deviations from neurotypical gaze behaviours in people with ASD.

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PA-047

Do humans expect others to act efficiently?

E. Kayhan, C. Monroy, S. Gerson, S. Hunnius, H. Bekkering

Radboud University Nijmegen, Nijmegen, the Netherlands

The theory of teleological reasoning proposes that infants' understanding and predictions of observed actions are guided by the principle of rational action. That is, they assume that actions are performed to achieve goals in the most efficient possible way. Alternatively, others propose that infants and adults learn about action goals based on events they have observed repeatedly in their environments. Our research aims to further investigate the role of teleological reasoning and frequency learning in action prediction. Adults and 24-month-old infants observed an agent walk towards a goal either in the most efficient manner possible or in an inefficient way, along a path that

diverges in several locations. We measured observers' predictive eye movements at each divergence in order to assess whether they anticipated that the agent would take the more or less efficient path. Results indicated that adults tend to base their predictions on efficiency principle since they learned to predict the agent's movements relatively faster when the agent was walking efficiently. On the other hand, 24-month-old infants did not seem to make use of either the efficiency principle or frequency learning over trials. We are currently testing 42-month-olds to shed light on the developmental trajectory of this shift in predictive strategies. Overall, we aim to explain the contributions of teleological reasoning and frequency learning to action prediction in development.

PA-048

Relations between Executive Functions and Pretend Play Object Substitution in Two-Year-Olds

Julia Wissner¹, Stefanie Peykarjou^{1,2}, Sabina Pauen¹

¹ Heidelberg University, Heidelberg, Germany

² Université Catholique de Louvain, Louvain, Belgium

Pretending that an object is standing for something else holds multiple challenges for two-year-olds: the real identity of the object needs to be overwritten by the pretend identity; the new rule for acting according to the pretend identity needs to be applied; the real and the imagined world need to be separated but kept in mind simultaneously. Many of these challenges also apply to executive functions (EF) tasks. Therefore we investigate the relation between an object substitution task in a pretend play (PP) imitation setting and EF-tasks tapping working memory, shifting and inhibition. In the PP-task, we show 26-month-olds (N=24) five highly familiar artifacts, each used in two different actions: one conventional action [e.g. brushing teeth with toothbrush] and one unconventional action [e.g. using toothbrush to make a phone call]. We analyse whether children imitate accurately or fulfill corrective actions instead, by either (i) executing the conventional action [e.g. brushing teeth with toothbrush] or (ii) using the conventional object instead [e.g. taking the cell phone instead to make a call]. Preliminary results revealed that children who showed more corrective actions were less proficient in the shifting task (N{19}: $r = -0.50$; $p < 0.05$) – they seemed to stick to the conventional rule. Shifting to the new rule implicated by the experimenter may tap similar basic abilities as shifting from one sorting rule to another in the EF-task. Data collection will be completed shortly and additional analyses will further elaborate the relations between PP and EF.

PA-049**Visual and auditory ERP priming effects for human and furniture items in 7-month-old infants**Stefanie Peykarjou^{1,2}, Julia Wissner², Sabina Pauen²¹ Université Catholique de Louvain, Belgium² Heidelberg University, Germany

7-month-olds can discriminate humans and artifacts, but little is known regarding neural correlates of the human-artifact distinction. Therefore, we examined categorical priming for human and furniture items using an ERP paradigm. Pictures of humans and furniture items were primed by pictures [study 1] or voices [study 2].

In study 1, targets were preceded by pictures from the same or the other category. ERPs from N = 16 7-month-olds [8 males] were analyzed. Attention, indexed by the Nc, did not differ between human [M = -10.15, SD = 11.1] and furniture items [M = -5.66, SD = 10.5], $p > .31$. Thus, there was no categorical preference at the level of brain responses. A marginally significant priming effect was observed for the PSW, indicating memory updating. Targets preceded by the other category elicited increased PSW amplitude [M = 3.49, SD = 9.2] compared to those preceded by the same category [M = -2.79, SD = 15.2], $F(1,15) = 3.363$, $p = .076$.

In study 2, targets were preceded by voices saying "Guck mal" [Engl.: "look here"] in an infant-directed or adult-directed manner. In a preliminary sample [N = 14 7-month-olds, 8 males], there were no differences between infant-directed or adult-directed priming, all $ps > .13$. However, the Nc was enhanced for furniture items [mismatching category; M = -8.81, SD = 9.8] compared to human stimuli [M = -1.47, SD = 6.0] regardless of priming condition, $F(1,13) = 4.841$, $p < .05$.

Implications for categorization and priming research will be discussed.

PA-050**What do children learn from ostensibly communicating objects?**

Christoph Konieczny, Sebastian Wahl, Birgit Träuble

Heidelberg University, Germany

Ostensive signals help children acquire general knowledge about the world. Recent studies suggest that toddlers interpret emotional attitudes towards objects as shared by others only if they were presented in an ostensive manner [Egyed et al., 2013; Träuble & Bätz, submitted].

It is still unclear whether the "teacher" in this learning context has to be human in order to produce the aforementioned effects. It has been found that abstract objects and robots are able to guide children's gaze after having reacted contingently to them resp. having looked at them [Deligianni et al., 2011; Okumura et al., 2013]. However, to date knowledge transfer produced by objects has been poorly investigated.

To fill this gap, 15-month-old toddlers were presented a video sequence with a desk lamp as "teacher". In two conditions the lamp turned towards one of two cones, either after addressing the child ostensibly [by moving the shade up and appearing to look at the child] or non-ostensively [by moving the shade down].

Preliminary data analysis (n = 29) suggests that toddlers' eye gaze differed between the two conditions indicating a different processing of the communicative compared to the non-communicative lamp. However, analysis of children's predictive gaze did not reveal a transfer of the lamp's action to another lamp. The findings and further steps for research are discussed.

PA-051**Children's increased emotional egocentricity bias (EEB) compared to adults is mediated by their ability to resolve emotional conflict**Ferdinand Hoffmann¹, Nikolaus Steinbeis¹, Tania Singer¹¹ Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany

Previous attempts to study the emotional egocentricity bias [EEB] in adults and children using the same experimental paradigm have proved elusive. To achieve this goal, we specifically developed a taste-paradigm. In this study we investigated whether children (N=30, 7-12 years) would display a larger EEB than adults (N=30, 20-30 years), and what underlying mechanisms could account for a possible developmental effect. Here two participants tasted either pleasant (fruit juices) or unpleasant (e.g. salt solutions) liquids and participants had to either judge their own emotion or the emotion of the other person. The emotional experiences of both participants could be either congruent or incongruent. The EEB was defined as the difference between ratings in incongruent and congruent trials when judging the other, as compared to the difference when judging one's own feelings. In order to elucidate the underlying mechanisms of the EEB and a possible developmental effect we also assessed children's and adults' abilities in inhibitory control, emotional conflict processing, emotion regulation, attentional reorienting, perceptual fluency, and visual perspective taking. Results indicated a highly significant EEB for both children and adults, but for children this EEB was more than double the size. A mediation analysis indicated that the age-related decrease in EEB was fully mediated by age-related improvements in resolving emotional conflict. Our findings suggest that the increased EEB in children compared to adults is mediated by children's ability to resolve emotional conflict, and not by other cognitive abilities such as inhibitory control, emotion regulation or visual perspective taking.

PA-052**Dance with me? An investigation of early rhythmic and synchronous behaviours in infancy**

Sinead-Elouise Rocha, Denis Mareschal

Centre for Brain and Cognitive Development, Birkbeck College, University of London

Moving rhythmically to music is a universal human behaviour, but relatively little is known about its first manifestations. 'Feeling' the beat within music seems apparent from early in development; infants show the ability to detect a violation of the beat

from birth [Winkler et al., 2009], and process complicated variations in rhythmic structure by 7-9 months of age [Trehub & Thorpe, 1989]. However, despite early rhythm perception abilities, investigations of infants moving to a beat demonstrate that although 5-24-month-old infants show some tempo flexibility [i.e. faster movement to faster rhythms, and slower to slower rhythms], they do not synchronise their movements to the music [Zentner & Eerola, 2010].

We will present pilot data from the current study that further investigates when and why 'feeling the beat' translates to moving rhythmically (at a steady rate) and synchronously (in time with an external stimulus). Specifically, we attempt to disentangle how these behaviours emerge as a function of both increased motor control and social engagement, in light of findings that 2.5-year-olds entrain to another's beat in a drumming task with a human partner, but not with a mechanical partner [Kirschner & Tomasello, 2009]. With innovative use of EMG alongside motion capture technology, we measure motor activation across two conditions: one where infants are engaged in a bell-ringing task to music with a live experimenter, and a matched non-social condition. We hypothesize that EMG will reveal rhythmic sub-threshold muscle activation, with greater accuracy in the social condition, prior to consistent and overt synchronous movements.

PA-053**Differences in cognitive but not affective perspective-taking between individuals with autism spectrum disorder and healthy controls**Ferdinand Hoffmann¹, Svenja Köhne², Nikolaus Steinbeis¹, Isabel Dziobek², Tania Singer¹¹ Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany; ² Cluster of Excellence Languages of Emotion, Freie Universität Berlin, Berlin, Germany

Individuals suffering from Autism Spectrum Disorders [ASD] display deficits in cognitive perspective-taking and self-other distinction. In this study we investigated whether individuals with ASD also show deficits in affective perspective-taking, which we also refer to as emotional egocentricity bias [EEB]. Cognitive perspective-taking was assessed with the Movie for the Assessment of Social Cognition [Dziobek et al., 2006] and the Reading the Mind in the Eyes Test [Baron-Cohen et al., 2001a], self-other distinction by means of the imitation-inhibition task [Spengler et al., 2010]. The EEB was studied with the "affective touch" paradigm [Silani et al., 2013] in which

two participants were touched simultaneously with either pleasant or unpleasant stimuli on their hands and participants had to either judge their own emotion or the emotion of the other person. The emotional experiences of both participants could be either congruent or incongruent. The EEB was defined as the difference between ratings in incongruent and congruent trials when judging the other, as compared to the difference when judging one's own feelings. As expected individuals with ASD showed significant deficits in ToM and imitation inhibition compared to controls. ToM abilities correlated with symptom severity. However there was no significant difference in EEB between individuals with ASD and controls. The EEB also showed no relation to symptom severity. These results suggest that while the ASD group showed deficits in ToM and imitation inhibition, these deficits do not extend onto comparable tasks in the affective domain, indicating spared socio-affective abilities in ASD.

PA-054
The effectiveness of two physical activity intervention programs on the motoric and cognitive development of preschoolers

Marion Stein, Mirjam Ebersbach

Department of Developmental Psychology, Institute for Psychology, University of Kassel, Kassel, Germany

Despite the vast amount of research demonstrating correlations between cognition and motor function, there are – especially for preschoolers – just a few experimental designs. Hence, it is still unknown, which kind of physical activity is most effective and which kind of cognitive function profits most from which physical activity. The aim of the present study was to explore the effectiveness of two different physical activity interventions on motor and cognitive abilities of 5- to 6-year-old preschoolers (N=82). The children were distributed into three groups: an endurance-training group, a coordination-training group and a control group with a non-physical treatment including activities like role playing or guessing games. Only the children who participated at least in 50% of the 16 intervention units (N=75) were included in the data analysis. The children were tested with a motor test battery (MOT 4-6), a six minute run and several cognitive test batteries (CFT, K-ABC and computer based tasks to measure executive function) before and after the intervention. The results revealed that only children with poorer motoric abilities showed a significant gain in motor performance when participating in a physical intervention relative to the control group. In this subsample (N=35) the coordination group showed a larger gain in the accuracy

of movement whereas the endurance group showed a higher speed of movement than the control group. Regarding the cognitive performance, only the coordination group showed a significantly higher improvement in acoustic memory than the control group. The differential results will be discussed.

PA-055
Mapping the Origins of Time: Scalar Errors in Infant Time Estimation

Caspar Addyman, Sinead-Elouise Rocha, Denis Mareschal

Centre for Brain and Cognitive Development, Birkbeck College, University of London

Interval timing concerns our ability to judge, compare and reproduce time estimates for durations shorter than a few minutes. In adults, estimation errors grow linearly with the length of the interval, much faster than would be expected of a clock-like mechanism (Hass & Hermann, 2012). Here, we present the first direct demonstration that this is also true in human infants.

The present study used a 'peek-a-boo' animation in which a cartoon character popped up on the screen at regular intervals (every 3 seconds in one condition, 5 seconds in another) accompanied by a socially engaging sound effect (adult female voice addressing the infant). The infants saw 7 repetitions of this event then the screen remained blank for a further 6 or 10 seconds. This cycle repeated three times and a Tobii T120 eyetracker recorded gaze direction and pupil dilation.

We tested a total of 99 infants across the two timing conditions [3, 5 second] and in four ages groups [4, 6, 10, 14 months]. Analysis of eyetracking data during the critical blank intervals suggest that, at all ages, both fixation and pupil dilation measures were time locked to the periodicity of the test interval. Further, estimation errors grew linearly with the length of the interval, suggesting that trademark interval timing is in place from 4 months.

PA-056**Maternal obesity and hypertension during pregnancy may influence auditory processing in newborn infants**

Renáta Németh^{1,2}, István Winkler^{1,3}, Gábor P. Háden⁴, Miklós Török⁵, Bea R. H. Van Den Bergh^{6,7}

¹ Institute of Cognitive Neuroscience and Psychology, Centre for Natural Sciences, Hungarian Academy of Sciences, Budapest, Hungary ; ² Department of Cognitive Science, Central European University, Budapest, Hungary; ³ Institute of Psychology, University of Szeged, Szeged, Hungary; ⁴ Institute for Logic, Language and Computation, University of Amsterdam, Amsterdam, Netherlands; ⁵ Honvédkórház, Budapest, Hungary; ⁶ Department of Psychology, Tilburg University, Tilburg, Netherlands; ⁷ Department of Psychology, Katholieke Universiteit Leuven, KU Leuven, Belgium

High maternal body mass index (BMI) and hypertension during pregnancy provide a suboptimal intrauterine environment for the development of the fetal central nervous system possibly leading to health and cognitive problems in the offspring. Event-related brain potentials (ERPs) measured in neonates may provide a link between these risk factors and the cognitive outcome observed later in life. Neonates (n=235) were presented with sound sequences in which three types of rare (deviant) events (white noise bursts, environmental sounds, and tones delivered too early within the otherwise isochronous sequence, 10% each) were delivered amongst frequent (standard) tones (1000Hz tones, 70%). Both higher BMI (24.72, SD=3.6) and elevated blood pressure (BP; systolic: 115.53, SD=11.58; diastolic: 69.06, SD=6.48) were associated with higher-amplitude early positive ERP responses to the standard tones (p<.05) and shorter ERP peak latencies for the central positivity in response to the white-noise deviants (p<.05). Furthermore, higher BP was also accompanied by higher-amplitude late negative ERP responses to the novel deviants (p<.01). Thus infants of mothers with higher BMI and/or elevated BP produced higher-amplitude or earlier ERP responses to both frequent and infrequent sounds. The results suggest that maternal obesity and high BP may result in higher arousability and/or less habituation to auditory stimuli in newborn infants.

PA-057**Towards a full understanding of the structure of integers: the successor function in early school years.**

Arnaud Viarouge, Véronique Izard

Laboratoire Psychologie de la Perception, CNRS / Université Paris Descartes, Paris, France

Many studies investigating the development of numerical cognition have pointed towards the role of a pre-verbal approximate representation of the cardinal of sets (numerosity), present early on in infancy. However, some aspects of integers, such as their ordered structure, require going beyond this approximate representation. One global property of this structure consists in the fact that any number can be generated through the use of a successor function. While some knowledge of local aspects of the successor function (e.g. the next number word corresponds to adding only one object to a given set) has been observed in pre-school children within their counting range, it is not yet known when a full understanding of the successor function is reached. Specifically, formal education in symbolic arithmetic could be necessary to observe such understanding in children. A hundred and twenty-two children from First to Third Grade were tested using a computer game in which they were asked to compare the efficiency of different counting processes (adding one by one, two by two, three by three...) in generating any possible integer. The children were tested either on a symbolic, or a non-symbolic version of the task. Our results show that a full understanding of the successor function develops during these early school years. More importantly, children tested on the symbolic version of the task demonstrated an earlier understanding than the children tested on the non-symbolic version, suggesting that early formal math education is crucial for developing knowledge of this specific property of integers.

PA-058**The influence of a motion cue on infants' object processing**

Christine Michel¹, Caroline Wronski², Sabina Pauen¹, Moritz M. Daum², Stefanie Hoehl¹

¹ Heidelberg University, Heidelberg, Germany

² University of Zurich, Zurich, Switzerland

Social cues facilitate object processing in young infants. Using event-related potentials, it was found that objects that were previously cued socially with eye gaze or head turn were processed more effectively and allocated less attention compared to not cued

objects [Hoehl, Wahl, & Pauen, 2013]. A nonsocial stimulus (a car) moving in a similar way as the face did not affect attention. Yet, stronger memory representations were built for cued objects whereas not cued objects needed more memory updating, thus eliciting an enhanced positive slow wave (PSW), when presented again [Wahl, Michel, Pauen, & Hoehl, 2013].

So far, it is not clear which specific features of the stimuli account for the different effects.

The current study therefore investigates the influence of two stimuli characteristics, self-propelled motion and eye-like features, on object processing in 4-month-olds. Infants saw a block with eye-like features either turning toward or away from an object before the object was presented again. Mean amplitude from 1200-1500ms on right and central frontal electrodes after stimulus onset served as the dependent variable.

Data acquisition is still under way and preliminary results are based on 12 infants (7 female). A 2x6 repeated-measures ANOVA with within-subject factors cue and electrode revealed a marginally significant trend towards an enhanced PSW for objects that were not cued by the block [$p=0.066$, $\eta^2=0.275$].

Results suggest that the block affected object processing like a nonsocial stimulus and not like a face, even though it was self-propelled and featured eyes.

PA-059 Respect for property in great apes and human children

Federico Rossano, Andreas Gallschuetz, Michael Tomasello

Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

All human societies care about ownership of at least some things [Brown, 1991] and already at 3 years of age children would intervene to sanction somebody taking away the property of a third party [Rossano et al., 2011]. Other primates might have some sense of possession, as they will fight to protect the food that is in their physical control and often avoid taking it away from the hands of conspecifics [Kummer & Cords, 1991; Sigg & Falett, 1985]. However, little is known about children or chimpanzees' likelihood to respect somebody else's property if placed in a situation in which they could easily steal it without the risk of immediate punishment. In our study, we placed identical rewards on top of each of two adjacent tables. Two conspecifics then sat on opposite sides of

the tables. One subject [the possessor] would then claim the rewards from one table, by raking them in. After 20 seconds, the other participant [the rival] could choose whether to take for herself the rewards that the owner was raking in or take identical rewards from the other table. Overall, 4-year-old children and chimpanzees mostly avoided stealing from possessors, but children were significantly less likely to steal than chimpanzees [9% vs. 45% of trials, $p<.001$]. Moreover, for children, stealing was an accountable behavior [possessors would systematically protest in response] and dominance did not matter. For chimpanzees, stealing was not similarly accountable [possessors protested only in 2% of trials] and was significantly influenced by dominance.

PA-060 Is processing of unfamiliar events governed by perceptual and conceptual processes in 7- and 14-month-old infants?

Maria Schönebeck, Birgit Elsner

University of Potsdam, Germany

In adults and older children multiple sources of information operating in tandem facilitate the ability to process actions with bottom-up perceptual cues complementing top-down conceptual knowledge. Whether action processing and the prediction of action endstates in the first years of life are governed by these processes is currently unknown. Hence, the aim of this study was to investigate whether ERP response to the observation of expected and unexpected action endstates differed for the two domains. For this purpose, 7- and 14-month-old infants were tested in a familiarization-test-procedure using EEG. Infants were first familiarized to a person on video demonstrating either a complete action [CD: complete demonstration of target act], an incomplete action [ID: incomplete demonstration; target act never demonstrated], or a meaningless action [MD: meaningless demonstration; no goal evident]. Next, all children were repeatedly presented with pictures of the complete and incomplete action endstates. Mean activity in the perceptual (100-200ms after stimulus onset) and conceptual domain (300-700ms) was examined. Data from 36 7-month-olds and 30 14-month-olds were retained for analysis. Preliminary results for the 7-month-olds show no differential processing in the perceptual domain for the experimental groups. For the conceptual domain, pairwise comparisons [CD vs. MD; ID vs. MD] show an increased activation, i.e. more negative mean activity, only for the CD group [$p<.05$]. Further contrasts and analyses for 14-month-old children will be presented on the poster. So far, these results suggest that by the age of 7 months, infants employ the conceptual domain when evaluating complete unfamiliar actions.

PA-061**Young children's differentiation of categorical and hypothetical imperatives**

Marina Josephs, Hannes Rakoczy

Institute of Psychology & Courant Research Centre "Evolution of Social Behaviour", University of Göttingen, Göttingen, Germany

One crucial difference between social-conventional norms and moral standards is their generalizability. While moral norms are often taken to apply unconditionally, independently of subjective preferences (what Kant called "categorical imperatives"), social-conventional norms only apply in certain contexts, conditional on the actor's intention to engage in a certain kind of activity ["hypothetical imperatives"]. Research has shown that even young children actively enforce different social norms. The present study explores their understanding of the difference in generalizability by comparing conventional (breaking game rules) and moral violations (losing someone's property).

A game apparatus was used where two kinds of actions could be performed: action B that was in accordance with the game's rule (conventional condition) or protected someone else's property (moral condition) and action A that was against the game's rules or led to the loss of the property. Children witnessed a puppet perform three types of actions varying in the puppet's preference/announcement and her action: [1] action B after announcing to perform B; [2] action A after announcing to perform B; [3] action A after announcing to perform A. While condition [3] should not be subject to critique in the conventional condition, the equivalent action is still blameworthy in the moral condition.

If children show no differences in the amount of protest in conditions [1] and [2] but protest more in the rule condition than in the harm condition in condition [3], this suggests that already young children understand the crucial difference between hypothetical and categorical imperatives. Data collection is ongoing.



POSTER
SESSION B

PB-001**Spontaneous and coordinated peer helping among 18-month-old children**

Nadine Kante, Robert Hepach, Michael Tomasello

Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

Young children during the second year of life are remarkably prosocial in a variety of contexts. However, while by the age of two children readily help adults, much less is known about their helping behavior toward peers. In fact, observational studies suggest that during the second year of life peer cooperation is rather accidental and uncoordinated at best suggesting that very young children do not help one another spontaneously. Here we present a study which investigated instrumental helping among 18-month-old peers in a controlled experimental setting. Thirty-two dyads participated in a between subject design with two conditions. Each pair of children was engaged in a game which involved one player throwing wooden marbles down a shoot producing a fun sound on the side of the other child. Both children were separated by a small fence. This was crucial because in the experimental condition the player ran out of marbles and two additional marbles were provided by the experimenter but only accessible for the second child. For the game to continue, the second child had to hand the marbles over the fence. In a control condition, the two marbles were not needed because an additional box of marbles was provided for the player. The results showed that 11 out of 16 children in the experimental but only 4 out of 16 in the control condition helped each other, $p < .05$. These findings strongly suggest that children spontaneously help each other in coordinated ways from as early as 18 months.

PB-002**The importance of multisensory information in adult statistical learning**

Arit Glicksohn, Asher Cohen

The Hebrew University, Jerusalem, Israel

Infants and adults readily learn statistical regularities in their environment. We ask whether statistical learning benefits from multisensory information. In Experiment 1 adults were familiarized with a structured stream of elements. In the sensory-triplets condition the stream consisted of auditory triplets – reoccurring successive syllables [AAA], or visual triplets – reoccurring successive shapes [VVV]. In the multisensory-triplets condition the stream consisted of multisensory triplets composed of

reoccurring successive shapes and syllables [VAV, AVA]. The relevant statistics were the TPs between adjacent elements. Following familiarization participants completed a recognition test, showing higher learning for multisensory compared to unisensory triplets. In Experiment 2 participants were presented with complicated statistical regularities, consisting of TPs between adjacent as well as non-adjacent elements. In the separate senses condition familiarization consisted of auditory triplets and visual triplets randomly interleaved, such that the elements of an auditory triplet could be interrupted by the elements of a visual triplet [e.g., AVAAVV...]. In the mixed senses condition familiarization consisted of two interleaved sets of multisensory triplets [VAV, AVA]. Lastly, in the separate visual dimensions condition familiarization consisted of two interleaved sets of visual triplets composed of red or green shapes. Learning occurred in the separate senses and mixed senses conditions, but not in the separate visual dimensions condition, highlighting the importance of information from multiple senses in learning adjacent and non-adjacent TPs. We suggest that these findings have implications for developmental research in statistical learning, raising the question of whether a multisensory advantage during initial development exists as well.

PB-003**Development of saccadic control in infancy in dynamic and static complex scenes: A longitudinal study**

Irati R. Saez de Urabain, Mark H. Johnson, Tim J. Smith

Centre for Brain and Cognitive Development, Birkbeck College, University of London

The development of oculomotor control was investigated longitudinally in 12 infants aged 12, 18 and 24 weeks. Eye-movements were recorded while infants were presented with dynamic and static complex stimuli. Each assessment comprised (1) a set of customized naturalistic videos in which three people performed baby-friendly actions, (2) a set of abstract videos created from the first set, and (3) static complex images. Further, all infants performed a gap-overlap task to measure their disengagement abilities. The Ex-Gaussian components (μ , σ) were fit to fixation duration (FDs) histograms for each condition and visit, allowing for the analysis of distributions of FDs. Results revealed systematic differences in mean FDs at 12 weeks between the dynamic and the static stimuli but not between the two dynamic conditions. This corroborates previous research showing greater stabilization of eye-movements in static stimuli earlier than in dynamic stimuli. At 18 weeks, there were significant differences in mean FDs between all the conditions, which became even more prominent at 24 weeks. The same pattern was found for σ , but not for μ or τ , for which significant differences were

only found at 12 weeks between dynamic and static stimuli. This suggests an increase in top-down eye-movement control from 12 to 18 weeks, and highlights the influence of cognitive factors and online control on FDs distributions. These findings form the basis of an analysis that will enable valuable insights into the mechanisms underlying saccadic control in infancy.

PB-004

From rational- to overimitation: Investigating the developmental course of preschoolers' imitative behaviour

Kata Gellén, David Buttelmann

"Kleinkindforschung in Thüringen", University of Erfurt, Erfurt, Germany

Although imitation is central to social learning throughout childhood, children's tendency to imitate changes from imitating rationally at 14 months (Gergely et al., 2002) to overimitating (Lyons et al., 2007) at 3 years of age.

The current study investigates the developmental course of imitative behaviour by examining that of 18-, 24- and 36-month-olds. Unlike previous studies that examined the imitation of children aged between 24 months and 5 years (e.g., Whiten et al., 2009), our study involved two novel tasks (head-touch and sit-touch) wherein the constraints of the model were not identical to those of the children (as in Gergely et al., 2002). Utilising identical actions ensures the possibility of direct comparison of the three age groups' imitative performances to provide an insight into the change in imitative behavioural tendencies. Furthermore, the application of a within-subjects design, where children observe the actions in two conditions (hands-free and hands-occupied) reveals whether they vary their behaviour between the conditions.

Results suggest that preschoolers did not differentiate between the hands-free and hands-occupied conditions (18-months: $Z = -.893$, $p = n.s.$; 24-months: $Z = -.175$, $p = n.s.$; 36-months: $Z = -.378$, $p = n.s.$). However, there was a significant difference in the rate of imitation between age groups [$\chi^2(2,144) = 14.51$, $p = .001$], with 36-month-olds imitating the novel actions significantly more often than 18- and 24-month-olds [$Z = -3.77$, $p < .001$; $Z = -2.48$, $p = .013$; respectively], implying the presence of overimitative behaviour already at 18 months of age and an increase in imitation rates with age, likely due to the tasks' decreasing difficulty.

PB-005

What representation do preschoolers use for numbers: object related representation or analogue magnitude system?

Orsolya Kis¹, Lilla Hodossy², Attila Krajcsi²

¹ Budapest University of Technology and Economics, Budapest, Hungary

² Eotvos Lorant University, Budapest, Hungary

Our research contrasts the analog magnitude system (AMS) and an object based representation in numerical task. According to the AMS model the system stores the values as continuous magnitudes, and this AMS has a strong spatial property. In contrast, an alternative discrete representation stores quantities in an object based representation.

We assume that children can more easily work with stimuli and tools that better suit to the internal representation. According to the AMS model, children should perform better using tools similar to the spatial mental number line, presenting the quantities in a continuous order, e.g. a number line. Conversely, in the case of an object based representation, children should perform better using discrete objects, e.g., disks.

Participants included cardinal-principle-knowers, ranging the age of 5 to 7 years. In order to test the two possible models, we gave the children simple arithmetical operations such as addition and subtraction, using different counting tools: either number line or disks.

The results show that children make less error with disks than with number line, and they prefer using disks over the number line. The number line tool is less intuitive than the disk tool. These results are in contrast with the spatial model of AMS, and confirm the role of the object based number representation in the early developmental phase of exact enumeration.

PB-006**Moral cognition of Turkish preschool children: The interplay between individual and collective values**

Buse Gönül, Hatice Işık, Başak Şahin

Middle East Technical University, Ankara, Turkey

From the first years of life, children make moral judgments by considering moral and socio-conventional values simultaneously (Smetana, 1981). Those judgments are influenced by the culture in which children was born. However; the judgments based on personal and cultural evaluations are not always parallel. Especially in non-Western cultures, children did not favor truth telling behavior if it disrupts the group functioning (Fu, Lee, Cameron, & Xu, 2001). Different from the non-Western cultures, Turkish culture is influenced by Western cultures in terms of life practices, however it is still governed by traditional collective values. Adapting the study designed by Fu, Xu, Ann Cameron, Heyman & Lee (2007), we examined the choices of children by asking them to evaluate age appropriate vignettes developed by writers under four conditions; lying to help the individual-harm the collective; lying to help the collective-harm the individual; telling the truth to help the individual-harm the collective; telling the truth to help the collective-harm the individual. Additionally, mothers of the children are asked to evaluate the importance of individual and collective benefits. According to the preliminary results coming from self-reports of children aged between 48-60 months (N = 24, 10 girls and 14 boys, M=56.1), "lying to help the individual-harm the collective" condition emerged as significant [$2[1, N=24] = 15.7, p < .001$. In other words; children decided to preserve the benefit of individual at the expense of harming the collective. Further results will be discussed in light of data coming from mothers and of existing literature.

PB-007**Pointing in Peer Interaction: Comprehension and Production of Pointing by 2-year-olds in an Object-choice Task**G. Stöber¹, R. T. Moore^{1,2}, M. Tomasello¹¹ Max-Planck-Institute for Evolutionary Anthropology, Leipzig, Germany;² Berlin School of Mind and Brain, Berlin, Germany

Infants and toddlers display remarkable social and communicative skills in interaction with adults (Tomasello et al. 2007). However, it remains unclear to what extent young children can employ these skills in peer interaction. We investigated toddlers' abilities

to produce and comprehend pointing gestures by peers in a controlled experimental context and tested same-sex dyads of 2-year-old children in an object choice task. Additionally, we tested adult-child dyads in the same set-up to allow for a direct comparison.

Preliminary analysis (n=33) suggests that children can succeed in solving a simple coordination problem. However, they are better able to provide information for peers than to exploit information provided by age-mates. Approximately three-quarters of the 2-year-olds pointed for their peers. However, in only just under half of cases where children pointed for an attentive peer did the recipient use the cue to locate a hidden toy. By contrast, in adult-child interaction, 2-year-olds were more likely to point and showed greater competence in interpreting pointing [86.7% correct responses]. Coding for looking times and durations of pointing will help to determine the role of differences in patterns of attention and salience of communicative behavior.

Although data analysis is ongoing for this study, we expect to have a complete analysis by the end of November 2013. This data will help us to better understand the nature of motivations and abilities that children bring to their interactions with peers and adults and to understand why the human infant-caregiver relationship is so conducive to social learning.

PB-008**Infants learn functions of novel tools from the outcomes of instrumental actions**

Mikołaj Hernik, Gergely Csibra

Cognitive Development Center, Central European University, Budapest, Hungary

Tool-kinds are conceptualized through tool function – i.e. an unobservable abstract feature, whose relations to the available structural and behavioral information [e.g. observable physical features or manners of use] are often cognitively opaque. It has been argued that one function of infant goal-attribution is to support early social learning of tool functions from goal-directed instrumental actions and demonstrations, despite the cognitive opacity of tools. The current series of studies provides a direct empirical test of this hypothesis.

Using a violation-of-expectations paradigm, we show that 13.5-months-old infants encode arbitrary outcomes of goal-directed actions in relation to the novel tools

employed to bring them about, even if the tools are operated in the same manner and their physical features provide no cues to the functions. These tool-outcome mappings were not formed if the very same end-states of action sequences could not be interpreted as the outcomes of goal-directed tool-use. Further results suggest that the tool-outcome mappings acquired from infant-directed communicative demonstrations were more resilient to counter-evidence than those acquired from non-infant-directed demonstrations, and thus showed similarities to generic rather than episodic representations.

Altogether, these results suggest that the acquisition of tool functions in infancy is guided by both teleological action interpretation mechanisms and the expectation that communicative demonstrations reveal permanent dispositional properties of artifacts.

PB-009

Social and non-social choices in Relation to Autistic Traits

Indu Dubey, Danielle Ropar, Antonia Hamilton

Department of Psychology, University of Nottingham, Nottingham, United Kingdom.

It is commonly observed that children with autism avoid eye contact, and a recent theory suggests that the motivation to socially engage with others is reduced in autism [Chevallier, Kohls, Troiani, Brodtkin & Schultz, 2012]. However, there are currently no simple behavioural ways to test these claims. The aim of this study was to determine if social motivation can be evaluated and if the social motivation is related to the autistic traits assessed by the Autistic Quotient [Baron-Cohen, Wheelwright, Skinner, Martin & Clubley, 2001] in the typical population. Fifty typical adults were given a behavioural paradigm to evaluate their preference for social (direct gaze), social (averted gaze), and non-social video clips in relation to the cost (number of mouse clicks) required to watch each. The results showed that the typical adults prefer to watch social stimuli over non-social stimuli and also prefer to watch stimuli requiring fewer clicks. Typical adults also prefer direct-gaze videos to averted gaze videos. The preference for social stimuli was weaker in participants with higher levels of autistic traits, measured on the autism spectrum quotient. The preference for direct gaze was not related to autistic traits. Overall, our study shows that social motivation can be quantified using a straightforward behavioural paradigm, and that social seeking behaviour follows typical economic principles used for any other appetitive stimuli. Our data also demonstrate important links between autistic traits and social motivation, which we aim to follow up in future studies.

PB-010

Understanding cardinality

Lilla Hodossy, Attila Krajcsi, Edina Fintor

Eötvös Loránd University, Department of Cognitive Psychology, Budapest, Hungary

It takes over a year for children to learn the meanings of the first three number words. They eventually master the logic of counting and the meanings of all the words in their count list (termed as understanding cardinality), when they learn number four, around age of three or four.

According to our computational analysis children actually have all the prerequisites making them able to understand cardinality much earlier: they understand individualization, they can store fix symbol sequences and they can apply one-to-one mapping. Additionally, we suppose that although children could understand the cardinality principle earlier, they do not reach this stage for a long time, because they do not know what counting is for, and they also misunderstand the meaning of the words “one” “two” and “three”. Based on this new model we hypothesize that understanding cardinality can be triggered much earlier by a special task: this task should clearly demonstrate the problem, which problem can only be solved correctly if the child understands what numbers are used for. Following those guidelines we created the “Feed the animals!” game: the game explicitly points to the problem of quantification and demonstrates how numbers can be used to solve this problem.

According to the result of the training most of the formerly subset knower children were able to understand the cardinality after 2-4 short (20 minutes) sessions. Essentially, the successful training results are in line with our suggested model of cardinality understanding.

PB-011

The role of Quinian bootstrapping in the acquisition of mental state terms

Szabolcs Kiss

University of Pécs, Pécs, Hungary

The present poster discusses the role of the famous Quinian bootstrapping learning process in the acquisition of mental state terms such as happy, believe, pain, etc. At first, the poster characterises Quinian bootstrapping in which the so-called placeholder structure plays an important role. The placeholder structure consists

of symbols whose meanings are initially learned in terms of each other. Later, the placeholder structure is infused with meanings via the so-called modelling processes. A modelling process can be analogical mapping, abduction, induction, etc. Susan Carey (2009) introduced Quinian bootstrapping in her explanation of the acquisition of numeral list representation and rational number as well as certain aspects of intuitive physics. Second, I apply this well-known learning mechanism to the acquisition of the meaning of mental terms. I distinguish between three stages in the learning of the semantics of mental words. The present poster will characterise the three stages in detail. I argue that the meaning of mental terms in each stage is determined by the intuitive theory of mind the child has at that particular age. I will describe this theory of mind development from the age two until the end of the preschool period.

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PB-012
Children prefer structural word order over linear word order in learning artificial grammars

Iga Nowak, Giosuè Baggio

SISSA, Trieste, Italy

Are structural order constraints existing and accessible in the cognitive systems of language learners? Is learning constrained by processes that impose structure on grammars? To answer these questions we conducted a study assessing children's and adults' performance in acquiring artificial grammars, featuring a basic distinction between function and content words. Our aim was (i) to provide an experimental framework in which a hypothesis concerning deep constraints, especially its accessibility during development, can be tested and (ii) to improve existing paradigms on AGL by introducing essential properties of natural language. We conducted two experiments with a between-subjects design. The sample consisted of 100 preschool children (Italian, Austrian and Polish) and 44 Italian adults. Participants listened to either sequences obeying a plausible rule (structural order) that each function word must follow a content word, or sequences following an implausible rule (linear order) where all strings must begin and end with a function word. In Experiment 2 sequences followed either free order or linear order rule. Our results demonstrate that children are not unconstrained learners. They showed preference for strings produced by their training grammar, but significantly more so in the case of structural order grammar. This trend was not found in adults. Our results suggest that grammars that accord to structural order, as opposed to the linear order, are easier to learn. These findings indicate the existence of a deeply-routed cognitive bias in favor of structural order. The effect this bias has on AGL is modulated by children's L1.

PB-013
The effect of communicative context on within category generalization of non-obvious properties.

Rubeena Shamsudheen, Gergely Csibra

Cognitive Development Center, Central European University, Budapest, Hungary

The theory of natural pedagogy (Csibra & Gergely, 2009) propounds that children interpret ostensively communicated object attributes as kind relevant. Previous results provide support to this claim. For example, children as young as three years are found to expect ostensively conveyed information to be generalizable to other objects of the same kind rather than about the specific object itself (Butler & Markman, 2012). However, a recent study (Chen and Rhodes, 2013) suggested that 18-month-old infants generalize knowledge from non-ostensive demonstrations, while fail to do so from ostensive demonstrations. Infants were presented with a target action, eliciting a non-obvious dispositional property, performed ostensively or non-ostensively on a novel toy. The demonstration toy was then handed over to the infants, who were also tested with two inert test toys: one that was identical to the demonstration toy and one that differed in color. Infants in non-ostensive condition were found to perform more target actions on the test toys compared to the children in the ostensive condition. Our study attempted a fairly direct replication of Chen & Rhodes (2013) with a few minor changes that helped emphasize the ostensive and non-ostensive nature of the respective experimental situations. Our results indicate that generalization to within-category objects that are differently colored is not significantly influenced by the contexts but strongly affected by negative evidence and the order in which the test toys were presented.

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PB-014
Preschoolers consider different model competences in their selective trust

Jonas Hermes, Tanya Behne, Hannes Rakoczy

Institute of Psychology & Courant Research Centre "Evolution of Social Behaviour",
 Georg-August University of Göttingen, Germany

Recent research on selective trust shows that preschoolers prefer to learn from informants previously competent over informants previously incompetent, e.g. in labeling objects (e.g. Koenig & Harris, 2005). But the cognitive foundations of such selectivity remain largely unresolved. The current study investigates whether such selectivity is

based on rational inductive inferences of a model's competences to the requirements of certain tasks or on global halo-like impression formation. A further open question is whether children prefer competent or rather avoid incompetent models.

To test these open questions, we introduced two models who both showed high competence (or both low competence), but in different domains (strength/labeling accuracy). Subsequently, we presented (i) tasks requiring strength, (ii) tasks requiring labeling accuracy and (iii) problem-solving tasks predominantly requiring one or the other competence and assessed which informant children chose for each task. In case of global impression formation, children would choose models randomly because both models were introduced positively (or both negatively). If children inferred the informants' competences rationally, model choice should be selective in accordance with the requirements of the tasks.

Four- and five-year-olds (N=48) were tested in the high competence condition. The results clearly speak against global impression formation and for rational selective learning: children chose the strong more often than the accurate model in the strength task and in the problem solving tasks that required predominantly strength, but preferred the accurate over the strong model for problems that required predominantly knowledge.

Data collection in the low competence condition is ongoing.

PB-015 Young children's understanding of the norms of distributive justice

Marlen Kaufmann, Karo Lohse, Hannes Rakoczy

Institute of Psychology & Courant Research Centre "Evolution of Social Behaviour", University of Göttingen, Göttingen, Germany

Recent research has documented that children seem to appreciate standards of fair resource distribution much earlier than previously assumed. For example, even 3-year-olds, after collaborative attainment of resources, distribute them equally (Hamann et al., 2011), or based on merit (Kanngießer & Warneken, 2012). Such findings have been interpreted as revealing children's beginning respect for norms of fairness. But the fact that children behave in accordance with certain norms of justice does not imply that they follow or even understand these norms. Whether and when children begin to grasp and follow norms of justice is thus an open question. To investigate this question, dependent measures are needed that more

directly tap normative expectations such as third party critique/protest. To this end, we confronted 3- and 5-year-olds (M=24) with a puppet distributing resources to herself and another participant in fair or unfair ways (equal/unequal) and recorded their spontaneous normative responses such as protest/critique. In one condition (1st person) the child was this other participant, in another (3rd person) it was another puppet. Preliminary results suggest that children never protested after fair distributions, but did so in 73% of the trials with unfair distributions. A 2 (age: 3/5) x 2 (condition: 1st/3rd person) ANOVA revealed only a trend for age group, with 5-year-olds protesting more (M=85%) than 3-year-olds (M=60%), $F(1,22)=4.15$, $p<.06$. These findings show that indeed preschoolers understand justice norms and are in line with other recent finding suggesting that understanding distributive justice undergoes important development from 3-5 years of age (Moore, 2009).

PB-016 Better memory for words after having said them out loud

Manuela Barona, Saloni Krishnan, Annette Karmiloff-Smith, Teodora Gliga

Birkbeck College, University of London, UK

Children are extraordinary word learners. However, word learning is not an easy process and previous studies have shown that children forget the name of an object they had learned one minute before (Munro et al. 2012). In this study, we aim to investigate what mechanisms influence children's memory of word forms. Previous studies investigating the role of working memory in language acquisition have found that word repetition skills play an important role in language acquisition (Gathercole and Baddeley, 1989). This maybe the case because producing the words helps children remembering them. To test this hypothesis we examined children's (N=25, 36 months) recollection of newly learned words over time (one and five-minute delay) either after being asked to imitate the novel word or after just listening to the word a consistent number of times. We also tested children's ability to select the correct word referent from an array of new objects after a five-minute delay. In concordance with past literature, we found that children are fantastic at referent selection but have trouble recollecting the words form, when presented with its referent, even after a one-minute delay. We also found a significant difference between conditions, with the words under the imitation condition being remembered better than those under the no imitation condition (56% vs. 18% words). These results strongly suggest that imitation is a fundamental mechanism that aids word encoding and retrieval and ultimately enhances word learning. We speculate on the role of lexical search and motor planning for word form encoding.

PB-017**Development of Understanding Zero in Preschoolers**

Petia S. Kojouharova¹, Gabor Lengyel¹, Lilla Hodossy¹, Orsolya Kis², Attila Krajcsi¹

¹ Eötvös Loránd University, Budapest, Hungary

² Budapest University of Technology and Economics, Budapest, Hungary

Zero has a special status among numbers, thus, understanding how we learn to use zero can shed some light on the mechanisms behind numerical cognition. However, only a few studies tested the understanding of zero in preschoolers [Wellman & Miller, 1986; Bialystock & Codd, 2000] revealing contradicting results. Here we investigated how the understanding of symbolic zero develops. We suggest that the concept of nothing is sufficient for preschoolers to solve the typical for their age numerical tasks involving zero. Furthermore, we argue that it is impossible to differentiate between the concept of zero and the concept of nothing in preschoolers.

We investigated 3-5-year-old children (a) whether they understand the word zero, (b) whether they can use zero value in simple numerical tasks, like comparison, addition and subtraction, and (c) whether they know that zero is a number.

The results show that preschoolers can use the concept of nothing in numerical tasks at a time when they can use the first number words (subset knowers). In contrast, preschoolers typically learn later that the word “zero” could be the synonym of “nothing” in numerical context. Finally, they are unsure whether zero is a number, potentially because they think that number is a property of a set, while zero describes the lack of a set. The latter finding might reflect an object based number representation in preschoolers.

PB-018**Infants expectations about the content of unfamiliar communication in a theory of mind task**

Tibor Tauzin, György Gergely

Cognitive Development Center, Central European University, Budapest, Hungary

Our previous results suggest that infants can attribute agency and gaze-follow the orientation change of a potential agent on the basis of variable turn-taking contingency. It is unclear, however, whether ‘will-formed’ communication is only a means to attribute agency or infants expect that communication in itself is relevant and transmit information about

something. To test this issue we designed a paradigm in which two unfamiliar agents (Hider and Observer) were present and communicated with each other in a turn-taking manner using tone triplets. In the familiarization phase one of the agents hid a ball in one of two containers then watched as it jumped into the other container or go back to its initial place. After that, Hider approached the baited container. In the test phase Hider was not present during the location change of the ball, however the Observer could see where the ball went. After Hider and Observer communicated, the former approached one of the containers as in the familiarization phase, however not necessarily the baited one. To test infants expectations we measured their looking time after the approach. Our results suggest that infants take into account that communication was relevant and it transmitted information about the location of the ball, however this expectations was modulated by the context.

PB-019**Referential expectation in infancy**

Hanna Marno¹, Teresa Farroni², Jacques Mehler¹

¹ Language, Cognition and Development Lab, SISSA, Trieste, Italy

² University of Padua, Padova, Italy

Human language is a special auditory stimulus and infants immediately after birth are equipped to acquire it in a very fast way. There is evidence that newborns are able to distinguish languages based on their rhythmical characteristics [Mehler et al., 1988; Nazzi et al., 1998; Ramus et al., 1999, 2000], to detect acoustic cues that signal word boundaries [Christophe et al., 1994], and to discriminate words based on their patterns of lexical stress [Sansavini et al., 1997]. Thus, there is great evidence that infants are born with a unique sensitivity to process language, but from when they start to understand that language is a referential symbol system and that words refer to entities in the world, is still unknown.

In the present study we addressed this questions. Thirty, 4-months old infants were shown videos of a female face, who was either talking in a normal way, or in a backward way, or she was silently moving her lips. After each movie the face disappeared and either on the left side or on the right side of the screen an object appeared. Results showed that infants' looked faster at the object in the normal speech condition than in the backward speech and silent condition. These results confirm the hypothesis that infants do not only possess great speech-processing abilities, but they also have referential expectations about language, and in the presence of speech they are ready to search for possible referents, at least from 4 months age old.

PB-020**Encoding of sequential position of syllables by newborns**

Ana Fló, Alissa Ferry, Jacques Mehler

SISSA (International School for Advanced Studies)

Numerous studies with adults demonstrate that elements at the edges of a sequence are better encoded than those in the middle of a sequence [e.g., Endress et al, 2005].

Artificial grammar learning experiments also demonstrate that infants are sensitive to different positions in a sequence, discriminating AAB patterns from ABA and ABB patterns, indicating that infants detect initial, middle, and final positional information from a sequence [e.g., Marcus et al, 1999; Gervain et al, 2008]. However, it is an open question whether these positions are merely detected or whether enhanced encoding at the edges is present from birth. To address this we tested neonates using Near Infrared Spectroscopy (NIRS).

The experiment consisted of alternating familiarization and test blocks. During familiarization a synthesized 6-syllabic word was repeated 20 times, and during test a new 6-syllabic word was played 5 times. For half of the babies the test word was created by switching the edge syllables, whereas for the other half two middle syllables were switched. Previous work with NIRS shows that novel stimuli elicit a higher activation of oxy-Hb, specifically in pre-frontal areas [Nakano et al, 2009]. Preliminary results show a larger activation mostly in left pre-frontal, frontal and temporal areas for the edge switch group (N = 5) during test than for the middle switch group (N=6). This indicates that neonates are more sensitive to changes in the edges than to changes in the middle of a sequence, and that elements at the edges of a sequence are better encoded.

PB-021**Multisensory interactions and the principle of inverse effectiveness early in development: Why threshold performance matters**Vivian Ciaramitaro ¹, Karen Dobkins ²¹ University of Massachusetts Boston, Massachusetts USA² University of California San Diego, California USA

Numerous behavioral and physiological multisensory studies have highlighted the principle of inverse effectiveness: the strength of multisensory interactions increases as individual sensory stimulus strength decreases. Thus, we expect maximal auditory influences on visual detectability near threshold. Little is known regarding the principle of inverse effectiveness early in development. Here we compare auditory influences on the visual detectability of threshold and supra-threshold visual stimuli.

We tested infants in a forced-choice-preferential-looking (FPL) and obtained contrast detection thresholds for a visual stimulus, a square (11x10, 150 left or right of monitor center). The visual stimulus fluctuated in luminance at 1 Hz, under four possible auditory conditions: [1] auditory white noise fluctuated in loudness at 1Hz, in-phase with visual modulation, [2] auditory white noise fluctuated out-of-phase, [3] no auditory stimulus was presented, or [4] a constant auditory stimulus was presented. The visual stimulus could be one of five contrasts, pseudo-randomized across trials. Threshold was the contrast yielding 75% correct performance in the FPL task. For each subject, visual thresholds were obtained for the same exact visual stimuli under two of the four possible concurrent auditory conditions.

We found that synchronized auditory information can worsen visual detectability in 3-month-olds. Infants had significantly lower thresholds for detecting the same visual stimulus if the concurrent auditory stimulus was out-of-phase versus in-phase condition. As predicted by the principle of inverse effectiveness, such effects were only seen at threshold. No significant differences in visual detectability between auditory conditions were observed when visual stimuli were supra-threshold.

PB-022**Perception of social contingency in early infancy**

Bálint Forgács¹, Ernő Téglás¹, Willem E. Frankenhuys^{1,2}, John S. Watson³, György Gergely¹

¹ Central European University, Budapest, Hungary

² Radboud University, Nijmegen, The Netherlands

³ University of California, Berkeley, USA

Contingent reactivity to infant behavior could be an important communicative cue to establish social interaction. Several studies have shown that infants are able to discriminate between fully contingent (e.g. their mirror image), and non-contingent reaction patterns from around the second month of life. However, social reactivity is highly-but-imperfectly contingent. The goal of the present experiment is to assess infants' sensitivity to stimuli that correspond to socially contingent stimulation, and specifically to determine [1] from what age infants are able to detect a high-but-imperfect level of social contingency, and [2] if they have a unique preference for socially contingent stimulation. In our experiment we tested 4-month-old infants. The procedure followed a preferential looking paradigm where infants were seated in a car seat in front of a screen that was split into two windows. In one of these windows infants saw the live video image of their own body, and on the other side they could see the image of their own body that was presented with a delay. The delay, however, varied between trials: it was between 1-3 second in 75% of the trials, and 30 seconds in 25% of the trials. With this manipulation we intended to establish the possibility of a high-but-imperfect level of social contingency. Infant's eye-gaze was recorded with an eye-tracker to measure preferential looking. Preliminary results indicate that 4-5 month old infants look longer to the condition of perfectly contingent reactivity relative to socially contingent reactivity.

PB-023**Norm Violation and Causal Attribution in Childhood**

Marina Josephs, Jana Samland, Michael Waldmann, Hannes Rakoczy

Institute of Psychology & Courant Research Centre "Evolution of Social Behaviour", University of Göttingen, Göttingen, Germany

How do we decide whether an event is a cause, a background condition, or causally irrelevant? This problem of causal selection has kept many researchers occupied for a long time. Whereas many established theories of causal judgment explain causal

selection by covariation of cause and effect, a popular recent approach argues that causes are events that deviate from norms (Hitchcock & Knobe, 2009). The nature of these norms varies from prescriptive norms like moral or legal norms to descriptive, statistical norms. Interestingly, nothing is known about whether or not children also tend to focus on the abnormality of a causal factor when they are asked to give a causal judgment. Our attempt is therefore to investigate the influence of norms on causal attribution in childhood. In our study we present 5 year old children with a new "machine" that can produce an either positive or negative effect. While a certain animal is allowed to use the machine the other is not. Regardless of this rule, both animals operate the machine so that the normative status differs between the two presented causal factors. In addition, we vary whether children get information about a possible causal mechanism before the crucial effect happens. By asking them who of the two animals caused the effect we want to find out whether children consider norms in their causality judgments. If children's causal judgments were indeed affected by their normative evaluations, then they should claim that the "abnormal" animal caused the effect. Data collection is ongoing.

PB-024**Infants' expectations of equality are specific to distributive contexts**

Denis Tatone, Gergely Csibra

Central European University, Budapest, Hungary

Recent looking-time studies revealed that, after the first year of age, infants expect that goods should be distributed equally between two recipients. The consistency of infants' looking behavior despite the variety of experimental stimuli employed (different types of agents and resources, ratios of inequality, etc.) further suggest that infants' sensitivity to distributional fairness may be a particularly robust phenomenon. However, in all these studies, the social interaction infants were familiarized with always conformed to the same relational schema, which involved a third-party distributing goods to two recipients. Thus, it is currently unknown whether infants' expectations of equality are specific to distributive contexts or follow from a general assumption of equal resource entitlement. To address this question, we ran two looking times studies in which we investigated 12- and 15-month-olds' expectations about the outcome of a third-party distribution (Study 1) and of a division of resources (brought in by the same third-party) between the two recipients (Study 2). Replicating previous studies, we found that 15- but not 12-month-olds looked reliably longer at the unequal

test event, but only when the allocation was produced by a third-party. The selectivity of infants' expectations suggests that their sociomoral sensitivity depends on specific types of social interaction, above and beyond the presence of affiliative cues between the two recipients, their mutual expression of equal interest in the resources, and the goods not being originally possessed by any of the two recipients.

PB-025 **Infants exhibit a negativity bias when interpreting others' choices**

Valentina Di Gangi¹, Teresa Farroni¹, Victoria Southgate²

¹ Department of Developmental Psychology and Socialization, University of Padova, Padova, Italy

² Centre for Brain and Cognitive Development, Birkbeck College, London, United Kingdom

Infant's tendency to expect an agent to continue to choose an object, which has been repeatedly chosen over another one, is interpreted as evidence that they attribute the goal of obtaining the chosen object. However, the same expectation would result from an attribution of avoidance: infants attribute to the agent the goal of avoiding the unchosen object. Here we pitted these two interpretations against each other. Six-to-nine-month-old infants were familiarized to a hand repeatedly grasping one object [A] over another [B]. Infants then either saw test trials in which the previously chosen object [A] was paired with a novel object [C] [Action condition], or in which the previously unchosen object [B] was paired with the novel object [C] [Omission condition]. Looking times to the hand reaching for either the previously chosen [A] or unchosen object [B] [familiar object trials], or the novel object [C] [novel object trials] were measured. In the Action condition, both younger [6-7.5 months] and older [7.5-9 months] infants looked equally at both test events, suggesting that they did not judge action on the previously chosen object to be more expected than action on the novel object. However, in the omission condition, 7.5-9-month-olds looked significantly longer when the hand reached for the previously unchosen object than when it reached for the novel object. These data suggest that older infants' action expectations may be driven more by what an agent does not do than what it does do, perhaps suggesting a negativity bias when attending to others' actions.

PB-026 **Evidence of an attentional blink in 8 month old infants**

Y. Vidal Dos Santos, J. Mehler

International School for Advanced Studies (SISSA), Trieste, Italy

Since the moment of birth infants are receptive to their surroundings and start complex learning processes. To understand better these processes is important to study the attentional mechanisms mediating them, in particular their limitations because of the implications that they have on learning.

One well known limitation of attention is the attentional blink. This is an effect found in rapid stimulus presentation paradigms that can be replicated with a variety of stimuli types. When two targets are embedded in a stream of distractors, the probability of detecting of the 2nd target is reduced if is presented between 200 and 500 ms after a first target. This effect is considered to be the result of encoding the first target and show some basic limitations of attention.

Despite the variety of studies that have replicated this effect in adults, is not known if similar limitations are present in infants. This could be in part because of the challenge that implies obtaining a report of the detection of the targets from infants.

Here we present an adaptation of the attentional paradigm to 8-months old infants. Taking advantage on the fact that infants show preference for faces over other objects we designed a paradigm that doesn't requires verbal instructions. Using eye-tracking and pupillometry we managed to obtain a behavioral index of the detectability of the 2nd target. Our preliminary results show evidence of similar attentional limitations that the ones found in adults, but in a later time window.

PB-027 **Do infants understand negation in communication?**

Eszter Szabó, Ágnes Melinda Kovács

Central European University, Budapest, Hungary

While there's a rich literature concerning how infants represent various properties of objects, we know very little about whether and how they encode representations with empty content, specifically regarding the absence of objects. In fact, earlier research suggests that 8-month-olds have difficulties in representing the absence

of objects (Wynn, Chiang, 1998; Kaufman et al., 2003). The purpose of the current series of studies is to investigate the role of language in forming such representations. We tested infants (15, 18 and 24-month-olds) with a searching paradigm in which the experimenter hides a set of objects in an opaque box then some or all of them are retrieved. Afterwards the experimental manipulation follows and the child is allowed to search. We modulated two crucial aspects of the experimental setting: the content of the box, and the verbal information about the content of the box, i.e. “It’s not [there]” (not to be – “Nincsen” in Hungarian) or “I don’t find it” (“Nem találok” in Hungarian). If infants understand “It’s not [there]” they should search less in this condition. Our results show that 15 and 18-month-olds didn’t differentiate between the two conditions. However, the older age group showed different pattern, specifically they searched longer in the “I don’t find it” than in the “It’s not [there]” (not to be) condition, suggesting that they can use linguistic negation “not to be”. Such results raise the possibility that language may enhance the encoding of empty sets, which should be confirmed by further studies using non-verbal communication.

PB-028

Do object tracking and object maintenance have distinct neural basis? A NIRS study with 6-month-old infants

Eszter Szabó, Ágnes Melinda Kovács

Central European University, Budapest, Hungary

Human adults are thought to possess a powerful object representation system that allows them to track objects through space and time and maintain their representations even in occlusion (Carey, 2009). Behavioral studies have investigated the limits and the developmental trajectory of these cognitive abilities (Piazza, 2010). However, it is still unclear whether object tracking and object maintenance are subserved by the same underlying neural structures.

The aim of this study was to investigate the neural basis of these mechanisms early in development.

Tracking an object through space and sustaining its representation when is not visible anymore both require operations on so-called ‘object-files’; and thus they may also share a common, or partly overlapping neural basis. We measured the neural correlates of object tracking and object maintenance in 6-month-olds with functional Near InfraRed Spectroscopy (fNIRS).

The results suggest that despite the apparent similarities in the mechanisms they involve, the tracking process was associated with higher temporal, while object maintained was related to higher frontal lobe activation.

PB-029

Infants compute the efficiency of joint actions

Olivier Mascaro, Gergely Csibra

Cognitive Development Center, Central European University, Budapest

Building upon infants’ recognition of shared goals (Henderson & Woodward, 2011; Henderson et al., 2013; Fawcett & Gredeback, 2013), we used looking time studies to test whether 14-month-olds go beyond computing the efficiency of individual actions, and also compute the efficiency of joint actions. During familiarization, participants saw movies in which schematic agents collaborated to displace objects from one location to another. As in previous studies (e.g. Csibra, 2008) we used agents’ path length as a proxy for their efforts.

In the test of the first experiment, infants looked significantly longer when an agent made a detour for no apparent reason than when this detour served to avoid an obstacle. Therefore, infants performed efficiency computation over individual agents’ actions when viewing our stimuli, and they expected individual agents to reduce their efforts by taking shorter path when possible. This first result validated our procedure.

In the test of the second experiment, infants looked significantly longer when agents could have taken a route that would have reduced the sum of their path length than when this shorter alternative route was not available. Crucially, this pattern of looking time would not have been observed if infants had assumed that agents aimed only at reducing their individual path length. This result suggests that infants expected agents to reduce their collective efforts when possible.

Our data indicate that infants perform computation of efficiency over joint actions by the age of 14-month-old. This capacity is crucial to predict, interpret and plan joint actions.

PB-030**Alpha-band oscillations in infants related to memory processes**Szilvia Linnert^{1,3}, Eugenio Parise¹, Brigitta Toth², Ildiko Kiraly³¹ Lancaster University, Lancaster, UK² Hungarian Academy of Sciences, Budapest, Hungary³ Eotvos Lorand University, Budapest, Hungary

Alpha-band oscillations are widely studied in adults. It was suggested that synchronization of the alpha rhythm reflects the resting state of the brain while desynchronization arise when perceptual stimuli appear. Recently, this picture became much more complex. Previous results suggested that both event-related synchronization (ERS) and desynchronization (ERD) in alpha-band to be modulated by task effects: ERS reflects inhibition processes while ERD reflects release from inhibition. In memory processes, ERDs reflects maintaining access to stored memories thus it appears following familiar stimuli while ERS inhibits retrieval. Since alpha-band oscillations show age-related differences and infants can't have the same "knowledge system" as adults it is a question what kind of processes can be reflected in ERDs and ERSs in infants.

We studied alpha oscillations in a memory-related task in babies from 10- to 12-months olds. Infants were familiarized to toy images with different presentation frequency: two images were presented in 25% of the trials [infrequent familiar], the rest were shown in 75% of the trials [frequent familiar]. In the recognition phase familiar images together with novel stimuli were presented with equal probability [33.3%] while the EEG was recorded. We measured desynchronization following novel and infrequent familiar stimuli on right central-parietal electrodes. Furthermore novel and infrequent familiar stimuli elicited stronger alpha ERD compared to frequent familiar stimuli.

This result showed evidence that alpha ERDs are related to memory processes in infants in a different way as than adults. Alpha oscillations might be a sensitive measure to study developmental changes in memory processes.

PB-031**14-month-olds attribute beliefs about numerosity**

Dora Kampis, Ágnes M. Kovács

Central European University, Budapest, Hungary

Infants' understanding of other's beliefs has been documented in a wide range of tasks. In the majority of these the belief content refers to the location of an object, and it was proposed that infants' ability to attribute mental states does not extend to identity or numerosity [Butterfill

& Apperly, 2013). In the current study we tested whether 14-month-olds show sensitivity to another person's belief regarding the number of objects in an opaque box. We used a manual search paradigm where infants search longer if they think there is still an object present (Feigenson & Carey, 2003). Infants saw a scene where two objects were put into a box by Experimenter1 (E1), witnessed by E2. Then one object was removed by E1, during which E2 was either present (True Belief) or absent (False Belief). Then E2 came back, and took out one object. After this we measured the duration of infants' search for the object. Results show significantly longer search in the condition where E2 falsely believed that there is still one object in the box. This provides support that infants' reasoning about mental states involves sophisticated representational abilities that exceed the limits of proposed simpler mindreading forms (e.g. Rakoczy, 2012), and possibly involve representing propositional attitudes.

Ongoing studies investigate whether infants can attribute to others 'negative' beliefs, namely that there is no object in the box.

PB-032**Healthy Preterm and Term Infants Differ in Responding to Joint Attention**R. G. Sperotto¹, M. Gattis¹, A. Winstanley², M. H. Bornstein³¹ Cardiff University, Cardiff, United Kingdom; ² Cambridge University, Cambridge, United Kingdom³ Eunice Kennedy Shriver National Institute of Child Health and Human Development, Bethesda, United States

The Early Social Communication Scales (ESCS; Mundy et al., 2003) is a structured observation measure used to analyze initiating (IJA) and responding to joint attention (RJA). A few studies have documented differences between preterm and term infants on the ESCS around the first birthday (De Schuymer, De Groote, Beyers, Striano, & Roeyers, 2011; Olafsen et al., 2006). However, no study has employed the ESCS with late preterm infants. We administered the ESCS to preterm (n = 26, 30<GA

Results showed a difference in RJA, with preterm infants following pointing less frequently (M = 16%) than term infants (M = 34%), U = 197.00, z = -2.26, p = .02, r = .37. The experimenter pointed at four posters: two at 90° and two at 150° from the infant's midline; the former elicited an easier head turn than the latter. Preterm (M = 29%) and term (M = 57%) infants differed in the easier trials (U = 190.00, z = -2.44, p = .02, r = .38), but not in the more difficult ones (M = 4% for preterm and 10% for term infants). No group differences were found in IJA.

We conclude that at 13 months preterm infants might not encode pointing as a deictic gesture as term infants do. These differences in RJA may have implications for the language differences found at 18 months in these groups.

PB-033

Procedural justice in children: Preschoolers accept unfair resource distributions on condition of equality of opportunity

Patricia Grocke, Federico Rossano, Michael Tomasello

Max-Planck-Institute for Evolutionary Anthropology, Leipzig, Germany

Being treated fairly is a fundamental human need. Thus justice is a cornerstone of our society. Most developmental research on justice has focused on distributive justice by investigating how children allocate resources (e.g. Sigelman & Waitzman, 1991). But there is another dimension of justice that has been mostly neglected in developmental research: procedural justice.

We confronted groups (N=20) of three 5-year-old children with an unequal distribution and offered them a spinning wheel to decide who would get which part of the share. Every group passed two warm-up trials with a fair wheel and a fair resource distribution followed by four trials with an unfair distribution. Half of the groups continued with the fair wheel. For the other half, the wheel was replaced with an unfair one. We coded for behavior showing acceptance of the procedure and the resource distribution. Besides we interviewed each child separately after the test.

All groups playing with the fair wheel kept using it to make their decisions and did not change the distribution of the resource, while 70% of the group that used the unfair wheel stopped using it and took turns getting the bigger part of the share or even redistributed the resource to an equal split. Asked to justify this change of rules 50% of those children reported that they perceived the original procedure as unfair.

Egalitarianism in resource distribution is not always possible. Our study shows that children can accept this fact, provided that a fair procedure guarantees equality of opportunity.

PB-034

I want vs. I ought: Do 3-year-olds understand the conflict between subjective desires and conventional norms

Verena Kersken and Hannes Rakoczy

Georg-Elias-Müller-Institute of Psychology Georg-August-University, Göttingen, Germany

One prominent account of theory of mind development holds that children before age 4 (when they acquire an explicit theory of mind [ToM]) do not understand desires as truly subjective, but only have an objectivist concept of the goodness of situations (Perner, 1991). Consequently they fail to understand that an agent can have desires that conflict with another agent's desires, with moral and other normative standards (as in the case of wicked desires). In the current study, we aim to investigate this account by testing whether children understand the conflict between subjective desires and normative prescriptions in conventional activities before solving standard ToM tasks. 3-year-olds see a game that required tokens to be sorted by colour into tubes where they were either retrievable or gone. Some tokens contain a sticker that is highly desirable to the child and their puppet play-partner. Stickers can be kept after the game. In the crucial test condition, the puppet receives a token with a sticker that is required to be sorted into the tube where it could not be retrieved. Before completing the move, children are asked to indicate whether the puppet would "actually like to" keep the token or put it in the tube, and which action (keep token or put in the tube) the game required them to perform. Additionally, children are asked whether the puppet needed help. Performance in this task is compared to performance in a standard false belief task. Data collection is ongoing.

PB-035

Exploring the relationship between iconic gesturing and pretend play in young children

Dermina Vasc^{1,2}, Richard Moore^{3,2}, Thea Ionescu¹, Michael Tomasello²

¹ Developmental Psychology Lab, Department of Psychology, Babes-Bolyai University, Cluj-

Napoca, Romania; ² Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany; ³ Berlin

School for Mind and Brain, Department of Philosophy, Humboldt Universität zu Berlin, Germany

Iconic gesture and pretend play reflect young children's emerging ability to use symbols to recreate actions and events, and may stem from similar socio-cognitive processes. However, little is known about the relation between the two. In this study we analyzed this relationship in 29-months-olds. In a within-subjects paradigm,

we presented each child with 9 objects in three different conditions. In one, real objects were used instrumentally [e.g. E1 watered a plant]. In two further conditions, either a wooden block was used to pretend a familiar action [e.g. pretending to eat from a bowl with a stick], or a real object was used to perform an unusual action [e.g. pretending a phone is an ice-cream]. For each set of objects, E1 first demonstrated the actions, and then, after giving the child the opportunity to use them as well, they were asked to show a puppet that did not understand German how to use the items in question. We sought to investigate the way in which children's spontaneous use of iconic gestures in their interactions with the puppet varied with the condition [pretend vs. instrumental] in which the child and E1 previously played. Data collection is ongoing, but our preliminary analysis suggests that children seemed to gesture at the same levels in the instrumental and pretend conditions. Overall, 75.9 % of children spontaneously gestured at least once, with 24,1 % gesturing in all 9 trials (N=29). This pattern of results may however change once all children are added to the analysis.

PB-036 **Do Hungarian preschoolers understand number words exactly?**

Mátyás Gerőcs, Lilla Pintér

¹ Research Institute for Linguistics of the Hungarian Academy of Sciences

² Pázmány Péter Catholic University, Budapest, Hungary

Our experiment investigated Hungarian preschoolers' interpretation of numerically modified noun phrases like 'three raspberries'. Similarly to Musolino [2004] we found in previous experiments that children prefer the upper-bounded ('exactly') reading of NumNPs to the lower-bounded ('at least') reading, even if pragmatics strongly favours the latter. We presumed [drawing on Pica&Lecomte 2008] that the 'at least' reading is not available for children because they cannot decompose sets (denoted by NumNPs) into smaller subsets. The experiment aimed to test this possibility.

The experiment involved 28 Hungarian preschoolers (5;3) divided into two groups. Both groups were told stories about Hedgehog, who needed a certain amount of items [e.g. three raspberries] and his three friends who had different amounts of the required item. In the critical trials one of Hedgehog's friends had more than he actually needed [e.g. four]. In Group 1 children were asked whether there was anyone who had three raspberries. In Group 2 the numeral was removed from the question so they were asked whether there was anyone who could help Hedgehog. By removing the numeral

we tested whether they know that having a set of x items entails having a set of x-n items without direct reference to numerosities. We found that while in Group 1 the rate of 'yes' responses was 35%, in Group 2 it was 58%, indicating that children are capable of decomposing sets into smaller units but the mapping between the meaning of numerals and the mental representation of sets (or scales) is not yet complete.

PB-037 **Individual Differences in Infant Fixation Duration relate to Attention and Behavioural Control in Childhood**

Kostas A. Papageorgiou¹, Tim J. Smith¹, Rachel Wu², Mark H. Johnson¹,
Natasha Z. Kirkham¹, Angelica Ronald¹

¹ Centre for Brain and Cognitive Development, Birkbeck University of London, London, UK

² Department of Brain and Cognitive Science, University of Rochester, Rochester, NY, USA

Individual differences in fixation duration are believed to be a reliable measure of attentional control in adults. The degree to which individual differences in fixation duration in infancy (0-12 months) relate to individual differences in temperament and behaviour in childhood is currently unknown. Given the role of the attention system in humans' self-regulation, it was hypothesized that fixation duration will be positively correlated with effortful control and negatively with surgency and hyperactivity-inattention. One hundred and twenty infants (mean age in months = 7.69, SD = 1.90) participated in an eye-tracking study. Eye-tracking data were recorded using Tobii-1750 eye-tracker. Fixation duration was detected using fixation detection algorithms in Matlab. Hand coding was performed to the results derived from the algorithms in order to clean and validate the measure. The infants' parents completed the short forms of the Early Childhood Behaviour Questionnaire and Childhood Behaviour Questionnaire, the Strengths and Difficulties Questionnaire and the Revised Rutter Parent Scale for Preschool Children questionnaire at follow up (mean age of children = 41.59, SD = 9.83). Results showed that mean fixation duration in infancy was negatively correlated with both surgency [$r = -.26$, $p = .005$] and hyperactivity-inattention [$r = -.25$, $p = .006$] and positively with effortful control [$r = .19$, $p = .04$] in childhood. These findings suggest that infants' fixation duration is linked to attentional and behavioral control in childhood and could constitute a measure of individual differences in the efficiency of young infants' ability to regulate and control their attention.

PB-038**The facilitative effect of the socially mediated representational function of pictures**

Gerda Szalai, Ágnes Pöltz, Katalin Egyed

Eötvös Loránd University, Budapest

Children aged 2-2.5 years showed sensitivity to the creator's intention when they interpreted drawings, however, their ability to use pictures as guide for action is rather limited. We assumed that picture comprehension could be facilitated by making the creator's intention available. This assumption was tested in Study 1. During the Experimental Condition (EC), the Experimenter drew four objects and the children identified the represented objects. In the Control Condition (CC), the children matched the same four objects to their replicas. In the Test phase of both conditions the children participated in a picture-based retrieval task, in which the Experimenter drew the pictures. As we predicted, children performed significantly better in EC. However, as CC did not apply pictures, the question arises whether the better performance in EC was due to the explicit representational intention or the picture-object identification. In Study-2 we applied a new CC in which the children were required to identify the referents based on the drawings; however, this time the Experimenter did not draw the pictures but discovered them. Study-2 replicated the facilitative effect. Owing to picture-drawing, the Test procedure was more similar to the Treatment of EC and that might have made it easier for children. In order to avoid this alternative explanation, in Study-3 we applied pre-drawn pictures. The preliminary data showed better performance in EC than in CC again. In sum, the results suggest that the intentional interpretation of pictures could facilitate the understanding of their representational function in a picture-based retrieval task.

PB-039**Generic grammar makes Turkish preschoolers generalize statements and tolerate exceptions**Anne Tamm¹, Leyla Roksan Caglar¹, Ayhan Aksu Koç², Gergely Csibra¹¹CEU, Budapest, Hungary ²Boğaziçi University, Istanbul, Turkey

We investigated whether grammatical generic markers lead to increased generalization of statements, and resistance to accept evidence from counterexamples, in 4- and 6-year-old Turkish children. It has been suggested that ostensive communication and generic language encourages children to generalize knowledge acquired about particulars to members of the same kind. We hypothesized that in languages

where generics are grammaticized (such as in Turkish with the marker -Dir), these grammatical forms prompt stronger generalization even when the immediate referent of the expression is a specific object.

We modeled the experiment after the study by Butler and Markman (2012), which employed non-verbal ostensive demonstration. A property (magnetism) was expressed about a novel object ("blicket") to 4- and 6-year-old children in two different ways. In one condition children were presented with an object in the context of a neutral, present indicative simple sentence ("[A] blicket is magnetic" n = 27), while the other condition applied generic grammar ("[A] blicket is magnetic+Dir", n = 32). We were interested in how these linguistic expressions guided preschoolers' exploratory play with a set of inert (non-magnetic) blickets. The time of play, the number of blickets explored and the number of occasions of trying object properties were measured.

We found that statements presented with generic markers lead to increased generalization and tolerance of exceptions. Furthermore our results suggest that Turkish 4-year-olds have already mastered the grammatical forms of generics in their native language and use them to guide their learning.

PB-040**Understanding the goal dependent nature of tool choices at 18 months of age**Fruzsina Elekes¹, Katalin Oláh^{2,1}, Ildikó Király¹¹ Department of Cognitive Psychology, Eötvös Loránd University, Budapest, Hungary² Psychobiology Research Group, Hungarian Academy of Sciences, Budapest, Hungary

Understanding the nature of a contrastive choice is imperious as it sets the borders of generalization. While some choices are preferential, subjective in nature and so generalizable along the identity of the agent, others are not. Tools are chosen in order to be used in goal-directed actions, thus, the basis of a tool choice is the tool's affordance (Gibson, 1979) or culturally determined function (Dennett, 1990). Previous research has shown (Egyed, Király, & Gergely, 2013) that 18 month old infants use a person centered learning mode when observing non-ostensively presented preferential choices.

With an active helping paradigm we are testing the assumption that infants are aware of the non-preferential nature of tool choices and thus employ a different, goal centered, generalization strategy in this domain. We expect infants to generalize the

tool choice they observed in a non-ostensive context to another agent if the goal, driving the agent's action is the same as it was during the original demonstration. On the other hand we expect random choice if 1) during the test phase no information is present regarding the goal of the agent or 2) during the demonstration the chosen tool is associated with the goal but not in a causal way. Preliminary data suggests that 18 month old infants indeed generalize non-ostensively presented tool choices along the goal that drove the choice. However, they do not generalize it to situations in which the goal is not clear.

PB-041 Neural correlates of learning and uncertainty during the acquisition of novel categories

Jellinek Sara, József Fiser

Central European University, Budapest, Hungary

In our study, we addressed the question of whether and how the learning process of a novel category and uncertainty in our knowledge about it is reflected in ERP responses and alpha-band suppression of the brain. To test these ideas, we built our experimental procedure on the oddball paradigm that is frequently used to investigate the nature of category representations in the human brain. Contrary to the majority of similar studies, we used continuous stimuli and recorded ERPs from the beginning of learning omitting any training before the actual data collection.

Obtained results suggest that participants mapped correctly the proper statistical distribution of the input both in their implicit judgments and explicit decisions about the learnt boundary between the two acquired categories.

Uncertainty followed this mapping as higher uncertainty reports were localized along the implicit category boundary.

Neural signatures of the emerging internal representations allow us to track the formation of categories.

Increased amplitude of P300 ERPs reflects the level of suddenness of an observed stimulus, and alpha-suppression corresponds to the learner's subjective confidence in their knowledge about certain exemplars of a category during learning.

These results support the ideas that ERP and alpha-suppression are reliable signals of not only the already acquired structure of concepts, but they also allow for tracking the ongoing acquisition of categories.

PB-042 Preschoolers rely on visual cues in the interpretation of doubly quantified sentences: Evidence from eye tracking

T. Zétényi^{1,2}, K. É. Kiss¹, M. Geröcs¹

¹ Research Institute for Linguistics of the Hungarian Academy of Sciences, Budapest, Hungary

² BME Budapest University of Technology and Economics, Budapest, Hungary

For Hungarian adults, the doubly quantified sentence *Három lány is két virágot locsol* 'Three girls each are watering two flowers' describes a situation involving three girls and six flowers (i.e., the scope order of quantifiers corresponds to their linear order). For preschoolers, however, this sentence can also have the inverse scope reading, describing a situation with two flowers and six girls. In the experiment to be discussed, preschoolers listened to such doubly quantified sentences, each of which was accompanied by a pair of pictures showing its two readings. In each picture pair, one of the pictures represented the members of the two sets (i.e., the girls and the flowers) mixed, whereas the other represented them chunked into identical subevents (e.g., three subevents of one girl watering two flowers). Eye tracking data were recorded under the test. The data have shown that children explored the mixed pictures more rigorously (by more fixations and for longer durations) especially during the decision period, irrespective of which picture they chose. We have found that the great majority of preschoolers matched the test sentences with the chunked pictures. The fact that the structure of the visual stimulus associated with a semantically complex sentence affects its interpretation suggests that when the processing of a linguistic expression involves excessive cognitive load, preschoolers resort to extralinguistic, visual resources. In a control experiment, adults have been found to reconstruct the situation encoded in doubly quantified sentences solely on the basis of linguistic cues.

PB-043**The role of self-generated contingent interactivity in spatial binding**

Ernő Téglás, György Gergely

Central European University, Budapest, Hungary

It is well established that the intentionality of an action changes the perception of its effects, specifically their temporal properties. For instance, if a button-press elicits a tone, the perceived time of the movement is shifted toward the tone onset. Thus, the temporal shift is a signature of a binding process that links the intentional movement to its effect. Self-generated movements may not only cause binding in time but also in space, which may play important role in social interactions potentially mediating social bonding.

Three groups of 6-year-olds were tested with an eye-tracking paradigm that explored the spatial aspects of intentional binding. Children were presented with a videogame involving a set of characters that were in a predefined relation with each other: the actions of the main character (A) predicted the actions of the second (B). In the contingent group, participants could elicit the chain of actions by holding the mouse cursor on A then 80% of A's action were followed by B. In the two non-contingent groups the game unfolded independently of the participants mouse movements, while the relation between the characters was predetermined [predictive probability of A was .8 and .5]. Children's anticipatory gaze shifts reflected spatial binding. The stronger was the relation between the characters the higher was the expectation of their proximity. This was not the case for the contingent group, where children responded with weaker spatial binding. Our results demonstrate a new aspect of intentional binding that affects spatial predictions mirroring the complexity of social relations.

PB-044**Does maternal pointing predict infant point production and point following? A longitudinal study from 8 to 12 months**Nazli Altinok^{1,2}, Ozge Savas^{1,3}, Aylin Kuntay^{1,4}, Ulf Liszkowski⁵¹ Koc University, Istanbul, Turkey² Central European University, Budapest, Hungary³ University of Michigan, Ann Arbor, USA⁴ Utrecht University, Utrecht, The Netherlands⁵ Hamburg University, Hamburg, Germany

Previous research [Callaghan, Moll, Rakoczy, Warneken, Liszkowski, Behne, & Tomasello, 2011] finds crosscultural differences in the frequency of pointing behavior of infants. Here we aim to understand input-related and socio-cognitive differences between infants who point to items around them, and those who have not yet displayed any pointing by the age of 12 months. 35 infants participated longitudinally at the ages of 8, 10 and 12 months: 20 infants with high maternal education, and 15 with low maternal education. All infants displayed index-finger pointing by 12 months except seven. There were no maternal-education-related differences in any of the time points for the frequency of infant or maternal pointing behaviors. However, binary logistic regression revealed that the mothers' number of index finger pointings at 8 months increased the probability of infant pointing at 10 months. Infants who pointed with their index fingers or whole hands at 10 months, in return, more frequently followed the points of the experimenter at 12 months than their non-pointing age-mates. We will discuss that early pointing might be contingent upon maternal pointing and its development over time successfully predicts infants' early socio-cognitive skills such as following the points of others.

PB-045**Talking to me - processing communicative cues in 6-month old infants**B. Szeplaki-Kollod¹, S. Lloyd-Fox², E. Szabo¹, A. Volein¹, G. Csibra¹¹ Cognitive Development Center, CEU, Budapest, Hungary² Centre for Brain and Cognitive Development, Birkbeck, University of London, United Kingdom

Young infants are surrounded with a great many communicative cues in their social environment. Some are addressed uniquely to them, while others are observed while they watch others interacting with one another. Which combination of communicative cues are optimal for identifying when cues are directed towards oneself in early childhood? And what brain correlates can be observed to such communicative cues as speech style, eye contact or facial expression? During two functional Near Infrared Spectroscopy (fNIRS) studies we presented infants with different cues while recording haemodynamic responses over the frontal and temporal cortices. In the first study two infants watched an experimenter while she directed children's rhymes towards each infant in turn interspersed with periods of non-communication. In the second study children's rhymes were presented either in an infant directed or adult directed manner towards one infant. Cortical activation, looking behaviour and vocalization were assessed in response to these differing communicative cues.

PB-046**Neuroimaging infant development in rural Africa**

S. Lloyd-Fox¹, D. Halliday², K. Begus¹, H. Maris¹, M. Papademetriou², L. Onsanyang³, S. Drammeh³, M. Darboe³, S. Moore^{3,4}, A. Prentice^{3,4}, C.E. Elwell²

¹ Centre for Brain and Cognitive Development, Birkbeck, University of London

² Department of Medical Physics and Bioengineering, University College London

³ MRC International Nutrition Group, Keneba Field Station, MRC Unit, The Gambia

⁴ Medical Research Council (MRC) International Nutrition Group, London School of Hygiene & Tropical Medicine, London, UK

Cortical mapping of cognitive function during infancy is poorly understood in rural, resource poor settings in low-income countries due to the limitations of available neuroimaging methods. Functional near infrared spectroscopy (fNIRS) provides an elegant solution to bridge this gap. Four-to-twenty four month olds watched videos of Gambian adults perform social movements, while haemodynamic responses were recorded using fNIRS. Trials also sometimes contained vocal (i.e. laughter/yawning) and non-vocal (i.e. water running/keys rattling) sounds. We found distinct regions of the posterior superior temporal cortex that evidenced either visual-social activation or vocally selective activation (vocal > non-vocal). The patterns of selective cortical activation in Gambian infants replicated those observed within 4 – 6 mth old infants in the UK and provided novel evidence of continued specialization to such cues over the first two years of life. These findings illuminate hitherto undocumented maps of cortical activation to social stimuli in the early developing brain of infants living in resource-poor rural communities in Africa. Furthermore they demonstrate the potential that fNIRS offers for field-based neuroimaging research.

PB-047**Newborn infants detect correspondences in the numerical structure of visual vs. auditory sets**

Julien Marie, Maria Dolores de Hevia, Aurélie Coubart, Arlette Streri, Véronique Izard

Laboratoire Psychologie de la Perception, Université Paris Descartes, Sorbonne Paris Cité, Paris France ; CNRS UMR 8158, Paris France

From the first hours of postnatal life, newborn infants can represent approximate numerosities for large sets (3 or more items); however, whether they are sensitive to the numerosity of small sets of 1 or 2 items is unclear. Given newborn infants' sensitivity to beat

in auditory rhythms, and older (5-month-old) infants' ability to extract meter from musical stimuli, we decided to use rhythmic auditory stimuli to present sets of small numerosity. Newborn infants were presented with a continuous periodic auditory stream, constructed from the repetition either of a 3-beat bar [A-B-B-A-B-B-A-B-B ...] or of a 2-beat bar [A-B-A-B-A-B ...]. Simultaneously, a visual array with either three shapes (one red circle and two white diamonds) or with two shapes (one red object and one white diamond) was presented on a screen. Newborns (age 18-98 hours) looked longer when the visual array matched the pattern of the auditory sequence. Further experiments should try and decipher the mechanisms underlying this ability: newborns may succeed because they detect the mere presence of a repeated item (B-B) across senses; or because they represent the total numerosity of the elementary cell (2 vs. 3 beats); or because they represent the structure of the elementary cell as formed of two chunks of 1+1 vs. 1+2 objects.

PB-048**Gamma-band oscillations provide evidence for perspective taking in 6-month-old infants**

Victoria Southgate, Katarina Begus

Centre for Brain and Cognitive Development, Birkbeck, University of London, London, UK

While recent work suggests that young infants are sensitive to others' beliefs, we know little about the representations and neural mechanisms that might support this sensitivity, and many authors have questioned whether infants are really able to represent the content of other minds. Here we sought neural evidence that infants form a representation of an event from the other's perspective. We measured changes in gamma-band (~40Hz) oscillatory activity in the EEG, a previously demonstrated neural correlate of object representation during occlusion, in order to investigate whether infants represent an object when it is occluded from the other. In the first condition, infants observed an object that became occluded either from the infant, or from the experimenter. Results show that infants exhibit an increase in gamma-band activity from baseline both when the object is occluded from them, and when it is occluded from the other. Two control conditions demonstrated that this increase depended on the agent having seen the object prior to the occlusion and that there is no increase in gamma-band oscillations when the object was occluded from neither infant nor experimenter. These results provide evidence that 6-month-old infants represent the content of other minds, and the presence of gamma-band activity during object occlusion irrespective of from whom the object is occluded, raise the possibility that a common mechanism is involved in representing occlusion from both perspectives.

PB-049**Comparing imitation of language and instrumental actions across cultures**

Jörn Klinger, Colin Bannard

University of Texas at Austin, USA

Children are remarkably faithful in copying even the redundant actions of others. Similar faithful (or over-) imitation has recently been found in language learning [Bannard, Klinger & Tomasello, 2013]. In order to explore how imitation of language, as a conventional cultural practice, might differ from imitation of instrumental actions, we explored whether verbal imitation follows instrumental imitation in a) increasing with age [Horner & Whiten, 2005], and b) being culturally invariant [Nielsen & Tomaselli, 2010].

29 indigenous Chatino children in Oaxaca, Mexico and 31 English-speaking children in Austin, Texas [all aged between 3 and 10] completed the following procedures:

Instrumental action: Children saw an experimenter using irrelevant actions in retrieving a ball from a box. We observed whether they subsequently copied the irrelevant actions.

Language: In a requesting game we observed whether children would imitate a novel adjective used in an experimenter's requests for objects (e.g. "the wassy shovel"). In one condition two objects were present (one plain, one modified) making the adjective necessary; in a one-object condition the adjective was redundant.

For the instrumental task, the children behaved the same regardless of culture - young children copied redundant actions and this "faithful imitation" increased with age. In the verbal task, however, while Texan children imitated the novel word significantly more often when it was required than when it was redundant, Chatino children showed no such selectivity. Neither groups' verbal imitation rate varied with age. We discuss why linguistic imitation might differ in these ways from imitation in other domains.

PB-050**Infants Detect Statistical Structure within Action Sequences**

C. Monroy, S. Gerson, S. Hunnius

Donders Centre for Cognition, Radboud University, Nijmegen, Netherlands

For infants to recognize and understand the actions of others, they must first extract information about distinct, goal-directed actions from the many diverse and fluid sequences of movements they observe. Statistical regularities within continuous environmental input is one important source of information that infants and adults use to segment continuous environmental input into discrete events. We use an eye-tracking paradigm to test whether 18-month old infants and an adult comparison group can detect statistical regularities within uninterrupted action streams, and whether this ability is facilitated by the occurrence of an action effect. Participants observed videos of action sequences with an underlying statistical structure, in which certain sequences caused an action-effect. We measured predictive eye movements to the location of the final action of each sequence, to assess whether participants could predict the next action based only on the statistical probabilities of co-occurring actions. We then investigated how this influenced action performance after observation. Adults and infants learned the action sequences and consistently anticipated the final action, or, in the case of the action-effect pair, anticipated the effect. When given the opportunity to act out the actions themselves, most adults reproduced both sequences, while infants did not. These findings suggest that infants, like adults, can learn to predict actions of others based on statistical probabilities, which may be one way they generate distinct representations of novel object-oriented actions. However, this learning does not yet influence their action execution, which may depend on additional sources of information.

PB-051**3-year-old's referring expressions balance familiarity with informativity**Colin Bannard¹, Marla Rosner², Danielle Matthews³¹ University of Texas at Austin, USA² University of California at San Diego, USA³ University of Sheffield, UK

As a general rule, frequent linguistic forms carry less information than rare ones [cf. information theory, Shannon, 1948]. For example, if we refer to someone as a young man, we are, in most contexts, giving less information about them (discriminating them

less from other men) than if we use a less frequent term [e.g. mean man]. Yet, it is well established that children are quicker to acquire, and more accurate in producing frequent forms. We here explore how 3-year-olds negotiate the tradeoff between a drive to produce easier, familiar forms and a drive to be informative (N= 23).

We paired 8 nouns with 2 different adjectives each [giving 16 unique phrases, all attested in CHILDES]. The frequency of each phrase and of the component words was varied so that one of each phrase for each noun was a familiar collocation [e.g. old woman, young man] and the other was not [e.g. kind woman, mean man]. Children were shown pictures depicting the phrases while E1 described them. They were then shown them again and asked to tell E2 what they could see. Children's descriptions were significantly less likely to include an adjective when E1's adjective had been low information [i.e., part of a collocation like young man]. However, when children did produce an adjective, they were significantly more likely to copy the exact one used by E1 if it was part of a collocation. Thus they seemed to balance a preference for familiarity with a drive to inform.

PB-052
The getting of child's attention to the act of naming as referential cue and as joint experience information

Tatyana Kotova ¹, Alexey Kotov ²

¹ Moscow State University of Psychology and Education, Russia; ² Higher School of Economics, Russia

In the natural circumstances the new word learning imply the new object demonstration, the new word pronunciation and the getting of child's attention to the act of naming [GAN] simultaneously [Baldwin, 1991]. The GAN was shown as important support for even infant word learning [Fennell, Waxman, 2010]. The goal of our experiment was to define the function of GAN by the dissociation the new object demonstration and the new word pronunciation. We have demonstrated the new artificial object to 3 year-olds in the four conditions. In the first condition we have said: "I will name this later!" and through 2-minutes-play we have pronounced the artificial label [GAN accompanied the demonstration of the new object]. To the second group we haven't gave any notification about further naming during the object demonstration and after the same play we have pronounced the artificial label within phrase: "Now I name this! It is vepa!" [GAN accompanied the new word pronunciation]. The third condition was the combination of the first and the second conditions: we have noticed the naming in our play beginning and have uttered the new word within the

phrase about naming [GAN accompanied the both]. In the control condition we have not attracted child's attention to the act of naming. The main result of our experiment was that children only in first and second groups performed mutual exclusivity task very well [used GAN as joint experience information], but they performed lexical extension task significantly worse [didn't use GAN as referential cue].

PB-053
Learning about the Structure of Probabilistic Visual Events

József Arató, József Fiser

Central European University, Budapest, Hungary

There is increasing evidence suggesting, that people encode dynamic visual information probabilistically. However, the mechanism of this phenomena is unknown. Recently Kidd et al [2012] investigated, how predictability of varying visual stimuli influences attention and learning in infants. Their main finding was, that infants maintain attention longest for stimuli, that have intermediate predictability. Such a behavior could be explained by applying an optimal learning mechanism, where attention is allocated at the most informative stimuli. However, this prediction could not be explicitly tested by Kidd et al as their method did not have a separate measure of attention and learning. To explore this prediction, we investigated how people perceive and learn about probabilistic events, and tested how accurately their behavior could be captured by a probabilistic framework.

In our set of experiments we measured how precisely people can estimate the probabilities of multiple, intertwined simple visual events. We found that increased variability, due to multiple shapes can lead to better estimation. This corroborates previous findings, that probabilistic processes are better captured by implicit than by explicit mechanisms. We also found a linear relationship between visual probabilities and participants' estimates. Moreover, the pattern of learning within and across blocks is well predicted by a probabilistic model, that includes the statistical structure of the input of the task. These results support the notion, that human learning of dynamic events is well captured by a framework that assumes probabilistic encoding.

PB-054**Exploring the Role of Theta Band Oscillations in Infants' Learning**

Katarina Begus, Teodora Gliga, Victoria Southgate

Centre for Brain and Cognitive Development, Birkbeck College, UK

Effective memory formation relies on neural activity before and during the encoding of new information (Gruber and Otten, 2010). Specifically, theta frequency oscillations have been identified as predicting the rate of recall for stimuli presented during these states in adults (Guderian et al., 2007); and were found to be elicited by expectation of novel information (as opposed to expectation of a non-informative exchange) in 11-month-old infants in our own previous study (Begus et al., 2013). In the present study we further explore theta frequency oscillations, as a potential novel marker of preparedness for learning in infants, and the role they play in infants' encoding of information.

In an ongoing study, 11-month-old infants freely explore 8 different novel objects of various complexity, while we obtain EEG data. After the exploration, infants' memory of the objects is tested by a preferential looking task, in which an image of each object, an infant had explored, is paired with an image of a very similar yet slightly different object. If theta band oscillations have the same functional role of preparedness for learning in infants' brain as they do in adults', we would expect higher amplitude of theta frequency oscillations during infants' exploration of an object to predict a novelty preference in the subsequent preferential looking time task. We will discuss the results in light of findings that interest in the to-be-encoded information has been shown to elicit the neural states that predict successful memory formation (Kang et al., 2009).

PB-055**Preschoolers conceptual flexibility as function of associative and conceptual learning**Alexey Kotov¹, Tatyana Kotova²¹ Higher School of Economics, Russia² Moscow State University of Psychology and Education, Russia

The numerous contemporary cognitive studies reveal that the children and adult category learning involve relying on different kinds of context information (Macario, 1991; Allen, Brooks, 1991). That effect was called the conceptual flexibility and became one of the central one in the fundamental learning mechanisms studying in last ten

years, because it makes new category learning very fast – the information assimilated in one context can be used in different conditions. The conceptual flexibility effect contradict the most of the classical conceptual learning models, which maintain that by increasing the knowledge about the new category the attention to the relevant features is to be increasing, and the attention to irrelevant ones are to be decreasing in accordance with the cognitive economy requirements. While trying to remove this contradictory the psychologists have found some important facts. Thus there were revealed that associative and attentional learning may give rise to conceptual flexibility effect among 4-year-olds (Sloutsky, Fisher, 2008). In our experiment we defined the conditions of conceptual flexibility development. We have made the new method (“multiple context categorization task”) for 4-year-olds and adults conceptual flexibility estimation. This task can help us to find the age and conditions which make conceptual flexibility depended on associative learning or conceptual learning. Our research has demonstrated that in those situations when subjects (both children and adults) couldn't find an appropriate cognitive scheme they increase conceptual flexibility only by the associative learning.

PB-056**Is equal always fair? Children's developing understanding of distributive justice principles.**

M. Svetlova, M. F. H. Schmidt, J. Johe, M. Tomasello

Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

In contrast with classic distributive justice literature (Damon, 1977, 1980), recent studies show that even preschoolers can allocate resources based on recipients' individual characteristics such as merit (Baumard, 2012) and need (Svetlova, 2013). However, no study has systematically compared developmental trajectories of children's abilities to use different principles of distributive justice.

In our study, 72 children aged 3, 5 and 8 interacted with pairs of puppets in four conditions. In each pair, one puppet expressed a general desire for resources (Neutral puppet) and the other had a specific reason to request resources (Target puppet): he either was hungrier (Need condition), worked more (Merit condition), was entitled to get more by a pre-existing rule (Rule condition), or simply stated that he wanted more (Subjective desire condition). Both puppets asked for toy food that the child could allocate to them (6 items per trial).

Preliminary results show that, whereas the majority of 3-year-olds distributed equally, children's tendency to give more to the Target puppets increased with age in all conditions. In addition, when comparing the older groups, more 8-year-olds than 5-year-olds tended to favor the Target puppet in the Need, Merit and Rule conditions, but not in the Subjective desire condition.

Thus, from preschool to early school age, children develop an increasingly differentiated understanding of distributive justice principles; they become able to forgo the equality principle and take into account recipients' individual characteristics; and they become better able to distinguish valid distributive justice principles from arbitrary requests.

PB-057 **Computer-based assessment of the basic cognitive components of reading**

R. M. Kiss, T. Török, Ágnes Hódi, T. Török

Graduate School of Educational Sciences, Szeged, Hungary

According to relevant literature, there are three cognitive elements, which lay the foundations of learning to read and have an important role in early reading development: phonological awareness, letter-sound correspondence and rapid automatized naming [RAN] [Csapó & Csépe, 2012]. These factors have been widely studied and measured by means of mostly paper-based standardized instruments or testing procedures assuming the presence of both the tester and the testee. However, technological development has had an impact on educational and testing practices alike. Large-scale, cross-sectional student assessment programs have already adapted their frameworks and testing practices to measuring already existing constructs in an electronic environment [e.g. OECD PISA CBAS] or new constructs [e.g. OECD PISA ERA] integrating the benefits of web.2 applications. Nevertheless, the number of research focusing on the computer-based assessment of the basic psychological components of reading is scarce. Therefore, the objectives of the present paper are to examine and exhibit the way the above mentioned cognitive components of reading can be measured by means of a computer-based assessment platform called eDia and reveal the challenges the new testing medium poses to validity issues. The findings form an integral part of a long-term overarching project that aims to assess and explore the relationship between students' reading literacy, phonological awareness, letter-speech sound processing and RAN from Grade 1 to Grade 4.

References:

Csapó B. & Csépe V. [2012]. Framework for diagnostic assessment of reading. Budapest: Nemzeti Tankönyvkiadó. Research was funded by The Developing Diagnostic Assessments project of the Social Renewal Operational Program [TÁMOP 3.1.9.11/1-2012-0001].

PB-058 **Recognising the communicative intent behind others' pointing gestures – a critical test with one-year-old infants**

Tanya Behne

University of Göttingen, Germany

In both developmental and comparative research, the so-called object-choice task has frequently been used to assess an understanding of others' communicative gestures. In this task an experimenter surreptitiously hides a prize in one of two opaque containers and then indicates its location by gazing and pointing at the baited container. Whereas non-human apes typically fail to search successfully, human one-year-olds already do so. Their successful search performance has been taken as evidence of infants' early communicative understanding [e.g., Tomasello, 2008]. However, such successful searches could also be the result of automatic orientating rather than communicative understanding [Leekam et al. 2010]. In fact, eye gaze direction shifts visual attention even in very young infants; and adults shift their visual attention in response to eye gaze and pointing, even if they know these cues to be uninformative. Thus young children may simply be searching in whatever location their attention is drawn to. To test between these two hypotheses, we confronted children with a situation in which a conspicuous, but non-communicative action was put in juxtaposition with a subtler communicative gesture. Specifically during each hiding trial the hider highlighted one potential location by a conspicuous instrumental action and indicated the actual hiding location with a comparatively subtle pointing gesture. First analyses show that one-year-olds [n=30] searched significantly more in the location that the adult had pointed at than the one that she had acted upon instrumentally, regardless of the order in which these two events had occurred – thus supporting the communicative hypothesis.

PB-059**Exploring Sleep Patterns and Cognitive Development Longitudinally: An Actigraphy and Eyetracking Study**

Manuela Pisch, Annette Karmiloff-Smith

CBCD, Birbeck College, London, UK

Purpose: Mean sleep duration during the first year drops from 14.6 hours for newborns to 13 hours for 12-month-old infants, however there are individual differences regarding aspects of sleep such as total sleep duration and fragmentation of sleep (Galland et al., 2012). In order to investigate the effect of these individual differences on cognitive development most studies have used cross-sectional designs and questionnaires instead of objective measures applied longitudinally. Research on children and adolescence as well as adults show though an association between sleep and memory (Gomez et al., 2011 for review) or sleep and attention (O'Callaghan et al., 2010). The aim of this study is to report sleep patterns longitudinally from month 4 to 10 and explore the relationship between sleep and aspects of cognitive and social development.

Methods: Actigraphy is implemented in 40 infants for one week at month 4, 6, 8, and 10. Additionally, parents fill in a sleep diary and a monthly questionnaires on sleep and cognitive/motor development. Furthermore cognitive (numerical discrimination, memory, visual attention) and social aspects of development (parent-child-interaction) are investigated using eye tracking and observation.

Results: Descriptive statistics of the longitudinal sleep development (total sleep duration, sleep onset latency, number of awakenings, sleep efficiency, longest continuous sleep period) as well as correlates to the other measures are reported.

PB-060**Sensory-perceptual experience in autism**Marietta Kékes Szabó^{1,2}, Ágnes Szokolszky¹¹ Institute of Psychology, Faculty of Arts, University of Szeged, Szeged, Hungary² Doctoral School of Educational Science, Faculty of Arts, University of Szeged, Szeged, Hungary

Professionals usually focus on Wing's triad (impaired social interactions, communicative- and imaginative skills) to understand the essential aspects of autism spectrum disorder (ASD), although these behaviours are increasingly regarded as compensatory reactions caused by some even more basic sensory- and perceptual

impairments. Atypical sensor-perceptual experience of the world may be an important background of unusual or bizarre reactions present in autism (Bogdashina, 2003). More than 90% of children with autism show specific sensory patterns (Baker et al., 2008), furthermore these peculiarities seem to be pervasive, multimodal and persistent across age and ability (Leekam et al., 2007). The purpose of our study was to explore the nature of sensory-perceptual experiences in children with and without autism. We used Bogdashina's Sensory Profile Checklist Revised (SPCR) in a sample of 24 healthy children (M=4,73, S=1,37) and 18 children diagnosed with ASD (M=4,75, S=1,46). The items of the questionnaire were rated by parents. Our results support the role of unusual patterns of sensory-perceptual experiences in ASD, as increased sensitivity in the seven sensory channel and co-existence of hipo- and hypersensitivity were found in this group compared to the typically developing group.



PRE-CONFERENCE
SESSION

Designing eye tracking experiments to measure infant and child behavior

Organizer:

Nora Laura Vezekenyi, Tobii Technology AB, Danderyd, Sweden

Instructors:

Ricardo Matos, Tobii Technology AB, Danderyd, Sweden

Irati R. Saez de Urabain, Centre for Brain & Cognitive Development, Dept. of Psychological Sciences, Birkbeck College, University of London, UK

Experimental design is a fundamental step in any type of scientific research, and experiments involving eye tracking are no exception. A well-designed experiment allows the researcher to be able to validate and answer the questions of interest, minimizing the impact of issues like poor data quality in the experimental outcomes. One of Tobii's focus points is to support researchers in designing their eye-tracking experiments in order them to reach the best data quality standards and ensuring the viability of research results. Moreover, the use of appropriate methods to retrieve and analyze our eye-tracking data can be crucial for this purpose.

Part I – Presentation

In our presentation we will give an introduction to eye-tracking and eye-tracking research with remote eye-trackers. Participants will get introduced to the main paradigms used in infant research as well as to a few experimental design issues related to eye-tracking experiments, e.g. limitations in human perception and eye physiology; type of data collected by a remote eye-tracker; and data quality and validation.

Part II – Hands On Workshop

This workshop will have hands on session where we will further focus on presenting best practices when performing eye-tracking studies with infants, and provide the opportunity for participants to try out different eye trackers, analysis tools and eye tracking setups. This part of the workshop will be run in conjunction with Irati R. Saez de Urabain from the Centre for Brain and Cognitive Development, Birkbeck, UK, that recently won the Student Software Competition at the European Conference on Eye Movements 2013, Lund, Sweden.



CONTACT
LIST

Abdi Adan adanabdi11@yahoo.com
Adam Maurits maurits.adam@uni-potsdam.de
Adrees Muhammad dr_adrees@yahoo.com
Ahmed Javid dr_adrees@yahoo.com
Althaus Nadja nadja.althaus@psy.ox.ac.uk
Altinok Nazli altinok_nazli@ceu-budapest.edu
Amrisha Vaish vaish@eva.mpg.de
Arató József arato_jozsef@ceu-budapest.edu
Armitage Emma e.armitage@lancaster.ac.uk
Bahar Koymen bahar_koymen@eva.mpg.de
Bannard Colin bannard@utexas.edu
Barona Manuela m.martinez-barona@ucl.ac.uk
Bätz Johannes johannes.baetz@psychologie.uni-heidelberg.de
Bechtel Sabrina sabrina.bechteler@psychologie.uni-heidelberg.de
Beck Sarah s.r.beck@bham.ac.uk
Begus Katarina k.begus@bbk.ac.uk
Behne Tanya tbehne@psych.uni-goettingen.de
Bekkering Harold h.bekkering@donders.ru.nl
Bernard Carline carline.bernard@gmail.com
Bohn Manuel manuel_bohn@eva.mpg.de
Boncz Ádám boncz_adam@ceu-budapest.edu
Borbély Tamás t.borbely@sussex.ac.uk
Borsos Zsófia borsos.zsofia@barczi.elte.hu
Braukmann Ricarda r.braukmann@donders.ru.nl
Bródy Gábor gaborbrody@gmail.com
Buttelmann David david.buttelmann@uni-erfurt.de
Buttelmann Frances frances.buttelmann@uni-erfurt.de
Ciaramitaro Vivian vivian.ciaramitaro@umb.edu
Cutting Nicola n.cutting@bham.ac.uk
Csákvári Judit judit.csakvari@barczi.elte.hu
Csibra Gergely csibrag@ceu.hu
De Bortoli Vizioli Aurora aurora.debortolivioli@studenti.unipd.it
De Klerk Carina c.deklerk@bbk.ac.uk
Di Gangi Valentina valentina.digangi@unipd.it
Diesendruck Gil dieseng@gmail.com
Dubey Indu lpxid1@nottingham.ac.uk
Dunham Yarrow yarrow.dunham@yale.edu
Ekramnia Milad ekramnia@sissa.it

Elekes Fruzsina elekes.fr@gmail.com
Esteve-Gibert Naria naria.esteve@upf.edu
Fiser József fiser@brandeis.edu
Fizke Ella ella.fizke@psych.uni-goettingen.de
Flom Ana anaflom@gmail.com
Forgács Bálint forgacsb@ceu.hu
Galazka Martyna martyna.galazka@psyk.uu.se
Gellén Kata kata.gellen@uni-erfurt.de
Geröcs Mátyás mgerocs@gmail.com
Gervain Judit judit.gervain@parisdescartes.fr
Glicksohn Arit arit.glicksohn@mail.huji.ac.il
Gluga Teodora t.gluga@bbk.ac.uk
Göckeritz Susanne susanne_goeckeritz@eva.mpg.de
Gönül Buse buse.gonul@metu.edu.tr
Grocke Patricia patricia_grocke@eva.mpg.de
Grossmann Tobias boettcher@cbs.mpg.de
Hanoch Ben-Yami benyamih@ceu.hu
Heintz Christophe heintzc@ceu.hu
Hermes Jonas jhermes@gwdg.de
Hernik Mikolaj HernikM@ceu.hu
Hiraki Kazuo khiraki@idea.c.u-tokyo.ac.jp
Hochmann Jean-Rémy jr.hochmann@gmail.com
Hódi Ágnes agnes.hodi@edu.u-szeged.hu
Hodossy Lilla hodossylilla@gmail.com
Hoffmann Ferdinand hoffmann@cbs.mpg.de
Horn Lisa lisa.horn@univie.ac.at
Igualada Alfonso alfonso.igualada@upf.edu
Itakura Shoji sitakura@bun.kyoto-u.ac.jp
Izard Véronique veronique.izard@parisdescartes.fr
Jasem Alkhawaj j54alkh@yahoo.com
Jellinek Sára jellinek_sara@ceu-budapest.edu
Jin Xinyi jinxinyipbs@zju.edu.cn
Josephs Marina mjoseph@gwdg.de
Kanakogi Yasuhiro yakanakogi@gmail.com
Kanngiesser Patricia kanngiesser@eva.mpg.de
Kante Nadine nadine_kante@eva.mpg.de
Kaufmann Marlen mkaufma1@gwdg.de
Kayhan Ezgi e.kayhan@donders.ru.nl

Kékes Szabó Marietta kszmarietta@gmail.com
Kelman Eva eva.kelman@gmail.com
Kersken Verena vkerske@gwdg.de
Keupp Stefanie skeupp@gwdg.de
Király Ildikó kiralyi@caesar.elte.hu
Kiss Renáta Mária kiss.renata.maria@gmail.com
Knoblich Günther knoblichg@ceu.hu
Kojouharova Petia S. p.kojouharova@gmail.com
Konieczny Christoph christoph.konieczny@psychologie.uni-heidelberg.de
Konvalinka Ivana ivana.konvalinka@gmail.com
Kotov Alexey al.kotov@gmail.com
Kotova Tatyana tkotova@gmail.com
Kovács Ágnes kovacsag@ceu.hu
Kühn Karen karen.kuehn@uni-erfurt.de
Liberman Zoe zoeliberman@uchicago.edu
Linnert Szilvia s.linnert@lancaster.ac.uk
Liszkowski Ulf ulf.liszkowski@uni-hamburg.de
Lloyd-Fox Sarah s.fox@bbk.ac.uk
Major Ágota agotamajor8@gmail.com
Marie Julien julien.marie@parisdescartes.fr
Marno Hanna hanna.marno@gmail.com
Mascaro Olivier olivier.mascaro@gmail.com
Matthews Danielle danielle.matthews@sheffield.ac.uk
Mcellin Luke lukemcellin1990@hotmail.co.uk
Michael John johnmichaelaarhus@gmail.com
Michel Christine christine.michel@psychologie.uni-heidelberg.de
Milward Sophie SJM017@bham.ac.uk
Misch Antonia misch@eva.mpg.de
Molnár András molnar_andras@ceu-budapest.edu
Monroy Claire c.monroy@donders.ru.nl
Nicoló Cesana Arlotti nicolocesanearlotti@gmail.com
Nurmsoo Erika E.Nurmsoo@kent.ac.uk
Okumura Yuko yukororo.okumura@gmail.com
Over Harriet harriet.over@york.ac.uk
Papageorgiou Konstantinos kpapag01@mail.bbk.ac.uk
Parise Eugenio eugenio@parise@tiscali.it
Park Yunhee bobbaksa@gmail.com
Peykarjou Stefanie stefanie.peykarjou@psychologie.uni-heidelberg.de

Picard Delphine delphine.picard@univ-amu.fr
Pisch Manuela m.pisch@bbk.ac.uk
Plötner Maria maria_ploetner@eva.mpg.de
Pomiechowska Barbara b.pomiechowska@bbk.ac.uk
Prieto Pilar pilar.prieto@upf.edu
R. Saez De Urabain Irati iurabain@gmail.com
Rhodes Marjorie marjorie.rhodes@nyu.edu
Rocha Sinead-Elouise s.rocha@bbk.ac.uk
Roman Feiman rfeiman@fas.harvard.edu
Rossano Federico federico_rossano@eva.mpg.de
Rutland Adam a.rutland@gold.ac.uk
S. Horst Jessica jessica@sussex.ac.uk
Schieler Andy andy.schieler@uni-erfurt.de
Schmidt Marco F. H. marco_schmidt@eva.mpg.de
Schmitz Laura Schmitz_Laura@ceu-budapest.edu
Schönebeck Maria maria.schoenebeck@uni-potsdam.de
Shamsudheen Rubeena Shamsudheen_Rubeena@ceu-budapest.edu
Sperber Dan dan.sperber@gmail.com
Sperotto Rebecca sperottorg@cardiff.ac.uk
Stapel Janny j.c.stapel@donders.ru.nl
Stein Marion Marion.Stein@uni-kassel.de
Steinbeis Nikolaus steinb@cbs.mpg.de
Stoeber Gregor gregor_stoeber@eva.mpg.de
Strid Karin karin.strid@psy.gu.se
Suhajda Virág svirag@gmail.com
Svetlova Margarita svetlova@eva.mpg.de
Szabó Eszter szaboesztertereza@gmail.com
Széplaki-Köllöd Borbala kollodb@ceu.hu
Takács Szilvia t.szilviatakacs@gmail.com
Tamm Anne tamma@ceu.hu
Tatone Denis denis.tatone@gmail.com
Téglás Ernő teglase@ceu.hu
Timbuyang Bella Nundandab Feh medicofoundation@gmail.com
Tóth Annamária TothAn@ceu.hu
Török Tímea medicne@gmail.com
Troksiarova Lenka Troksiarova_Lenka@ceu-budapest.edu
Ulber Julia ulber@eva.mpg.de
Van Schaik Johanna j.e.vanschaik@donders.ru.nl

Várnagy-Tóth Zsombor varnagy.zsombor@bacrzi.elte.hu
Vesper Cordula vesperc@ceu.hu
Viarouge Arnaud arnaud.viarouge@parisdescartes.fr
Vidal Dos Santos Yamil yvidal@sissa.it
Voelke Annik annik.voelke@psy.unibe.ch
Voinov Pavel voinov_pavel@ceu-budapest.edu
Wahl Sebastian sebastian.wahl@psychologie.uni-heidelberg.de
Wille Claudia claudia.wille@uni-kassel.de
Wissner Julia julia.wissner@psychologie.uni-heidelberg.de
Wittig Martina martina.wittig@uni-kassel.de
Wolf Thomas thomaswolf.cogsci@gmail.com
Yin Jun YinJ@ceu.hu
Zétényi Tamás zetenyi@t-online.hu
Zhou Yue whywhy0925@yahoo.co.jp
Zuberbühler Klaus klaus.zuberbuehler@unine.ch



RESTAURANTS
& MAPS

A, Conference venue
- Radisson Blu Béke Hotel
1067 Budapest, Teréz körút 43.

1. Arriba Taqueria

1067, Teréz körút 25.
www.arriba.hu
Mexican

2. Barokko Club & Lounge

1065. Liszt Ferenc tér 5.
www.barokko.hu

3. Braseiro Restaurant

1061 Teréz Krt. 23.
Brazilian

4. Broadway Garden Restaurant and Coffee

1066 Ó utca 43-49.

5. Buena Vista

Liszt Ferenc tér 4-5.
www.buena-vista.hu

6. Cactus Juice Pub & Restaurant

1061 Jókai tér 5.
www.cactusjuice.hu

7. Csirke-fogó

1065 Bajcsy Zsilinszky u. 7.
www.csirkefogo.hu
Fast food

8. Dimitrisz Restaurant

1067 Eötvös utca 25/a
www.dimitriszpub.hu
Fast food

B, 'Eiffel Ice Rink'

1062 Budapest, Teréz körút 55-57

9. Westend underground food corner

[Don Pepe pizzeria, Istanbul turkish restaurant, Thai restaurant, Chinese restaurant, Nordsee, Mediterranean Grill restaurant]
West End Shopping Center
http://www.westend.hu/hu
Fast food

10. Grappa Restaurant

1067 Teréz Krt. 25.

11. Hang Zhou Kínai Chinese Restaurant

1065 Podmaniczky u. 1-3.
Chinese

12. Horvát Restaurant

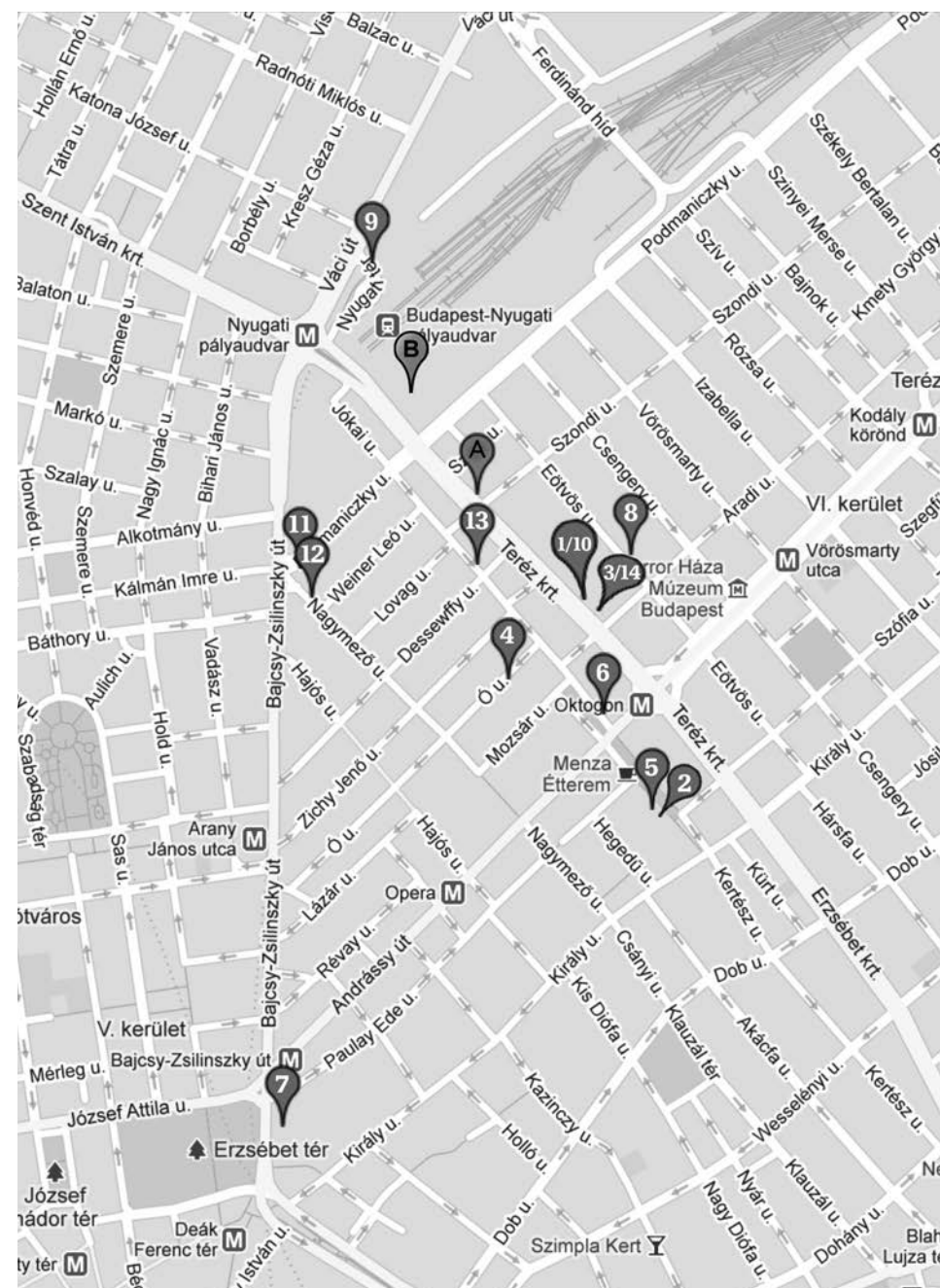
1065 Nagymező u. 49.
Hungarian

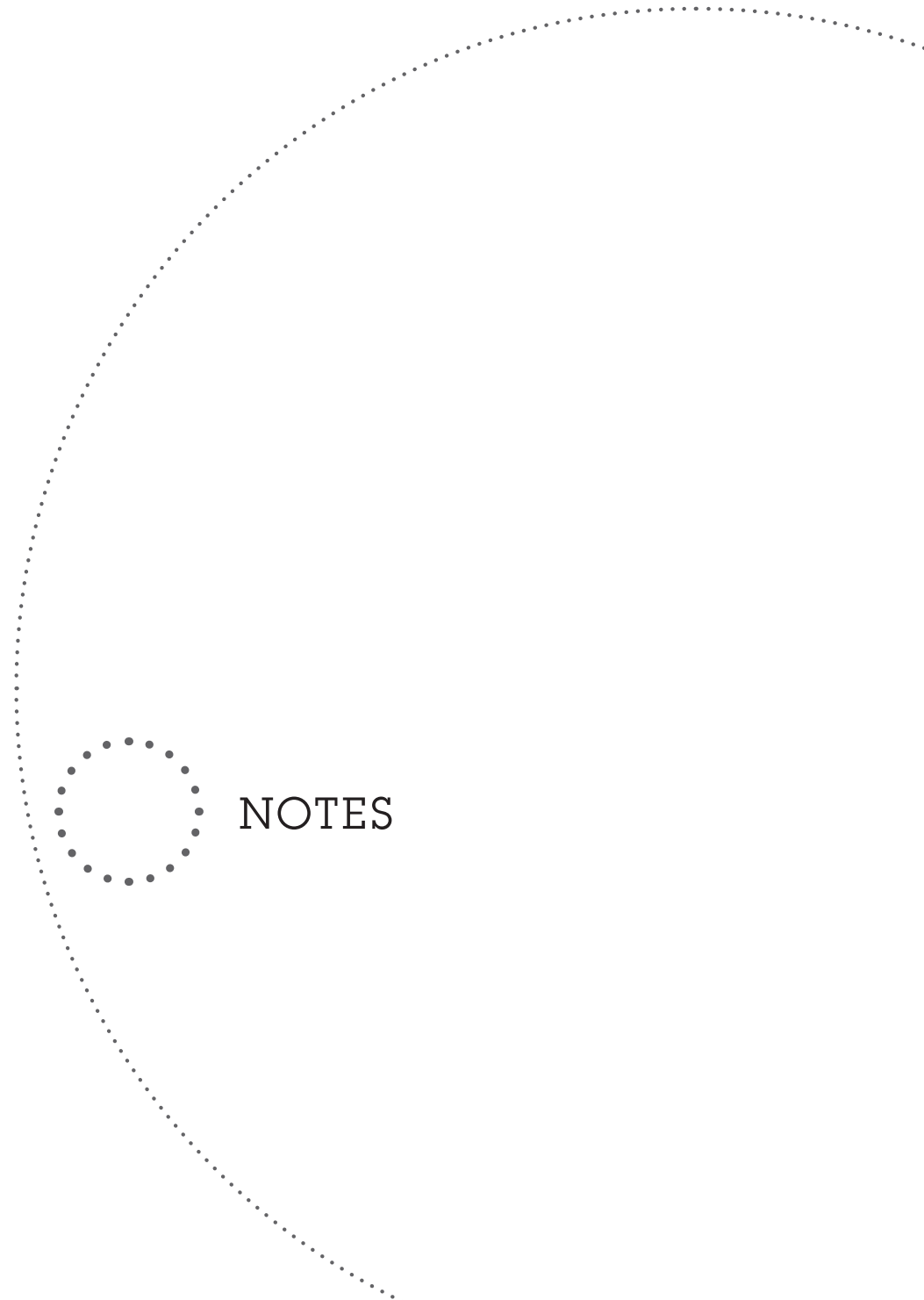
13. Indigo Restaurant

1066 Jókai u. 13.
www.indigo-restaurant.hu
Indian

14. Istanbul Turkish Restaurant

1067 Teréz Krt. 23.
www.istanbuletterem.hu
Turkish





NOTES



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