BCCD

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Program and Abstracts

Cognitive Development Center

Department of Cognitive Science

Central European University

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2013
Budapest CEU Conference on Cognitive Development

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

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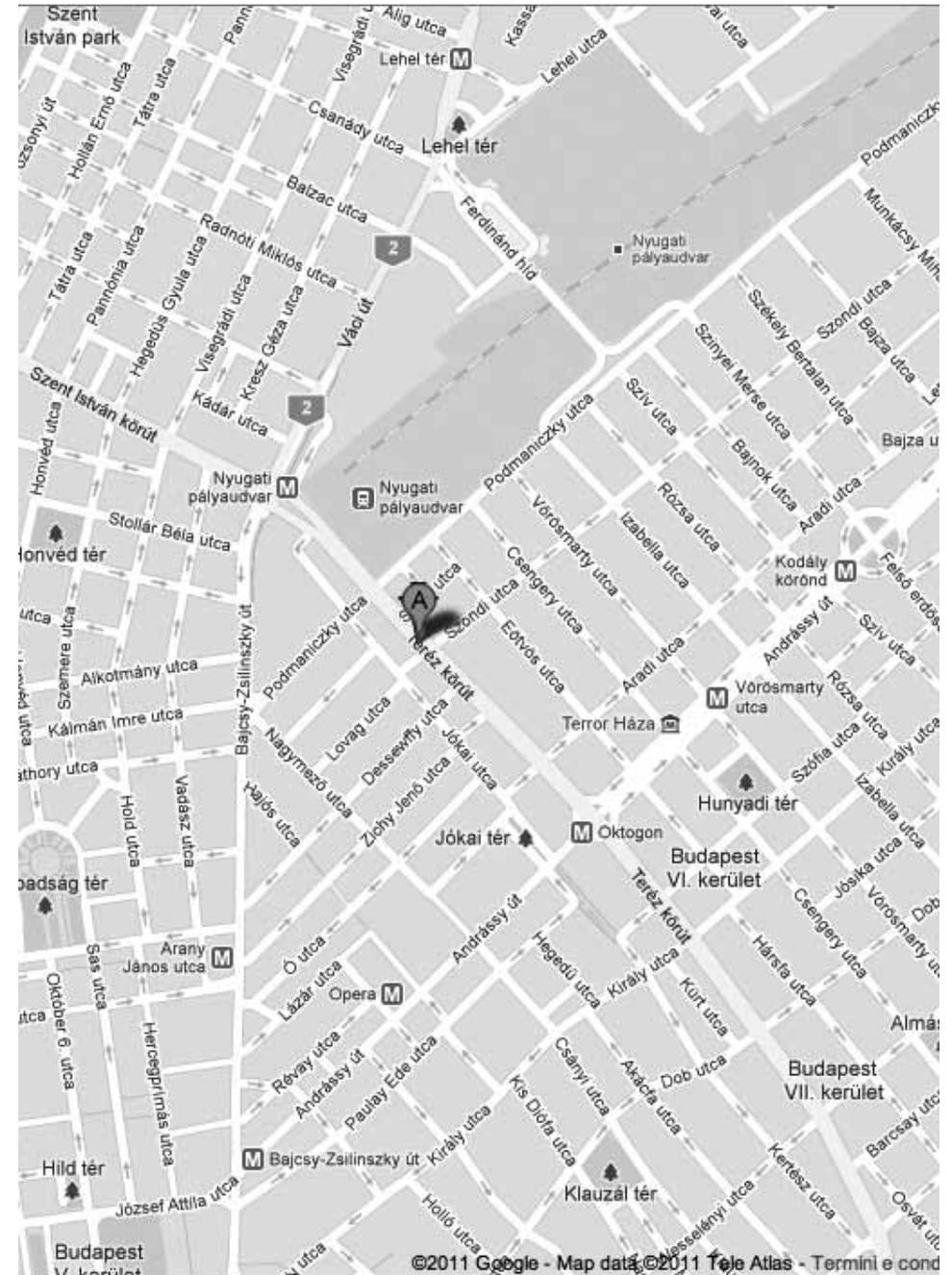
SCHEDULE

JANUARY 10, 2013 THURSDAY

08.00 - 15.00   **REGISTRATION**

09.45 - 10.00   **WELCOME**

10.00 - 12.00   **SYMPOSIUM 1**
Katharina J. Rohlfing & Angela Grimminger:
PERSPECTIVES ON THE MOTIVATION TO POINT IN YOUNG INFANTS

Ulf Liszkowski:
Imperative pointing revisited

Katarina Begus:
Infants learn through interrogative pointing

Angela Grimminger:
Maternal verbal responses to children's pointing behavior

Discussant: György Gergely

12.00 - 13.00   **LUNCH**

13.00 - 15.00   **SYMPOSIUM 2**
Erika Nurmsoo & Lucas P. Butler:
BEYOND FAITHFUL IMITATION: HOW CONTEXT SHAPES CHILDREN'S LEARNING FROM OTHERS

Meredith Gattis:
Selective and faithful imitation

Angelique Eydam:
Imitation and emulation of novel tool actions

Fruzsina Elekes:
Knowledgeability combined with ostensive cues outweigh infants' efficacy judgments in function learning

Lucas P. Butler:
Preschoolers' Ability to Navigate Pedagogical Interactions in Guiding Inductive Inferences

15.00 - 15.30   **COFFEE BREAK**

15.30 - 17.30   **SYMPOSIUM 3**
Dénes Szűcs:
TESTING THEORIES OF DEVELOPMENTAL DYSCALCULIA

Bert Reynvoet:
Numerical matching judgments in typical developing children and children with mathematical learning disabilities

Angela Heine:
Domain-general and specific functions in mathematical development and developmental dyscalculia

Dénes Szűcs:
Contrasting alternative theories of develomental dyscalculia

Discussant: Valéria Csépe

18.00   **RECEPTION**
Conference Venue, 1st floor

JANUARY 11, 2013 FRIDAY

08.30 - 10.30   **SYMPOSIUM 4**
Gerlind Grosse & Richard Moore:
OSTENSIVE CUES FROM A BROADER PERSPECTIVE

Richard Moore:
Comprehension of communicative intentions without conventions or bodily deixis in children and domestic dogs

Elena Hoicka:
Communicative and Referential Cues Distinguish Generalizable and Non-Generalizable Information

Ágnes M. Kovács:
The role of ostensive cues in category disambiguation in 12-month-olds and autistic children

Gerlind Grosse:
The role of ostensive cues in question interpretation and in hiding communicative intent

10.30 - 11.00   **COFFEE BREAK**

11.00 - 13.00   **POSTER SESSION A**

13.00 - 14.00   **LUNCH**

14.00 - 16.00   **SYMPOSIUM 5**
Anna Shusterman:
SYSTEMS AT THE INTERFACE: THE CASE OF SMALL- AND LARGE-NUMBER REPRESENTATIONS IN EARLY DEVELOPMENT

Aurélie Coubart:
Dissociation between small and large numerosities in newborn infants

Lisa Cantrell:
Signal Clarity for Infant Quantity Representation

Anna Shusterman, Emily Slusser:
Integration of Non-Verbal Number Systems with Children's Acquisition of Verbal Number

Discussants: Anna Shusterman, Veronique Izard

16.00 - 16.30   **COFFEE BREAK**

16.30 - 18.30   **SYMPOSIUM 6**
Lu Wang:
BEYOND COMPETENCE: HOW DOES BELIEF REASONING INTERACT WITH OTHER COGNITIVE ABILITIES?

You-jung Choi:
Understanding social interactions at 13 months of age

Amy Skerry:
Preverbal infants form expectations about emotions based on goal context

David Buttelmann:
Children, Like Adults, Process Beliefs and Desires Serially

Lu Wang:
False belief and working memory: can children represent two false beliefs spontaneously?

18.30 - 18.45   **COFFEE BREAK**

18.45 - 20.00   **KEYNOTE LECTURE 1**
Laurie R. Santos:
THE EVOLUTIONARY ORIGINS OF THEORY OF MIND: WHAT MONKEYS KNOW ABOUT THE BELIEFS OF OTHERS

JANUARY 12, 2013 SATURDAY

08.45 - 10.00   **KEYNOTE LECTURE 2**
Stanislas Dehaene:
ADVANCES IN UNDERSTANDING READING ACQUISITION

10.00 - 10.30   **COFFEE BREAK**

10.30 - 12.30   **SYMPOSIUM 7**
Bea R.H. Van den Bergh & Elena Kushnerenko:
ELECTROPHYSIOLOGICAL INDICES OF INFANT BRAIN DEVELOPMENT: CONNECTIVITY AND INFLUENCE OF ENVIRONMENTAL FACTORS

Bea R.H. Van den Bergh:
Prenatal exposure to anxiety and information processing in two-month-old infants: an AERP study

Elena Kushnerenko:
Individual differences in audiovisual processing in infants brain is associated with looking behaviour

Przemyslaw Tomalski:
Socio-economic status and functional brain development – associations in early infancy

Ghislaine Dehaene-Lambertz:
Maturational age and Environment, what is important to learn your native language?

12.30 - 13.30   **LUNCH**

13.30 - 15.30   **POSTER SESSION B**

15.30 - 16.00   **COFFEE BREAK**

16.00 - 18.00   **INVITED SYMPOSIUM**
Noah D. Goodman:
BAYESIAN MODELING OF COGNITIVE DEVELOPMENT

Noah D. Goodman:
The Ideal Learner: how induction depends on social context and intuitive theories

Elizabeth Bonawitz:
Exploring the "Sampling Hypothesis" in preschoolers' causal inferences

Máté Lengyel:
The sampling hypothesis: a Bayesian view on cortical development

Discussant: Stanislas Dehaene

20.00   **GALA DINNER (OPTIONAL)**
venue: see Restaurants and maps p. 187

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BUDAPEST CEU CONFERENCE ON COGNITIVE DEVELOPMENT

KEYNOTE
LECTURES

KL-001

Laurie R. Santos
Yale University, USA

**The evolutionary origins of theory of mind:
What monkeys know about the beliefs of others**

The capacity to reason about the false beliefs of others is classically considered the benchmark for a fully fledged understanding of the mental lives of others. Although much is known about the developmental origins of our understanding of others' beliefs, we still know much less about the evolutionary origins of this capacity. I'll first discuss several studies exploring whether one species of primate— the rhesus macaques– can represent the beliefs of others. I'll first discuss results suggesting that monkeys can represent the knowledge and ignorance of others, but not their beliefs. I'll then discuss some new findings demonstrating that macaques also lack the capacity to automatically represent others' beliefs in a belief contagion task. Taken together, this work will suggest that the capacity to represent beliefs may therefore be a unique hallmark of human cognition. I'll then discuss this conclusion in light of recent work on false belief understanding in human infants.

KL-002

Stanislas Dehaene
Collége de France, Paris, France

Advances in understanding reading acquisition

How is the human brain changed when we learned to read? By comparing literate and illiterate adults, as well as children before and after they learn to read, brain imaging experiments have begun to shed light on these issues. Learning to read deeply transform the ventral occipito-temporal pathway, leading to the emergence of the visual word form area. As a result, activations to faces are slightly reduced in the left fusiform and pushed towards the right-hemispheric fusiform face area. Auditory processing is also affected in the left planum temporale, suggesting a change in phonological coding. New evidence indicates that the microstructure of a specific bundle of connections that may interconnect these areas, the left posterior temporo-parietal limb of the arcuate fasciculus, is enhanced by literacy acquisition. Finally, reading expertise in alphabetic scripts also impacts on the earliest stage of retinotopic processing in the visual cortex, where activation is strongly enhanced. This research sheds light on a few mysteries of reading acquisition, such as the presence of transient mirror-reading stage in young children, and has consequences for education to literacy.

INVITED
SYMPOSIUM

IS

BAYESIAN MODELS OF DEVELOPMENT THROUGH THE LEVELS OF ANALYSIS

organizer:
   Noah D. Goodman (Stanford University, USA)
speakers:
   Noah D. Goodman (Stanford University, USA)
   Elizabeth Bonawitz (University of California, Berkeley, USA)
   Máté Lengyel (Computational and Biological Learning Lab, Department of Engineering, University of Cambridge, UK/ Department of Cognitive Science, Central European University, Budapest, Hungary)
discussant:
   Stanislas Dehaene (Collége de France, Paris, France)

Bayesian models have been widely influential in recent years, showing particular promise in solving the striking problems of induction that cognitive development presents: how do children learn so much from so little (but only sometimes)? Yet there is a puzzling relationship between Bayesian approaches and actual cognitive development: many Bayesian models explain why an induction is possible but do not attempt to explain how it is carried out by children. This apparent disconnect is not intrinsic, but is due to a top-down methodology common to Bayesian modelers. In particular, the Bayesian program suggests following Marr's levels of analysis down from computational analyses to algorithmic to neural. Most Bayesian models of development to date have been at the computational level of analysis---"what" not "how" models. Recent research has begun to fill in the levels, however, helping to fit Bayesian models into the fabric of cognitive development research. In this symposium we explore cognitive development through a Bayesian lens by following down through the levels of analysis: Noah D. Goodman will discuss computational-level models of the ideal learner, focusing on the effect that social context and rich abstract theories have on interpretation of evidence; Elizabeth Bonawitz will discuss algorithmic-level models that explain how Bayesian ideal learner computations are approximated by children, focusing on sampling algorithms used by preschoolers for causal learning; Mate Lengyel will discuss neural-level implementations of Bayesian inference and models of cortical development. The symposium will close with a discussion led by Stanislas Dehaene.

The Ideal Learner: how induction depends on social context and intuitive theories

   Noah D. Goodman
   Stanford University, USA

The Ideal Learner is a mathematical idealization of learning by making the best possible use of available evidence. Bayes' rule gives one approach to deriving an Ideal Learner, describing how to compute the probability of a hypothesis given evidence. This simple rule is the basis for a wide class of Bayesian models of learning, and gives rise to a striking effect: the value of a piece of evidence for learning is not intrinsic, but depends on the assumed context of the evidence. In this talk I will describe Ideal learner models for physical evidence, showing how abstract domain assumptions can change the value of the evidence. I will then describe an Ideal Social Learner, making best use of evidence provided by other people, and show that social evidence can be much better than physical evidence. In each case I will illustrate with empirical results from adults and/or preschoolers.

Exploring the "Sampling Hypothesis" in preschoolers' causal inferences

Elizabeth Bonawitz, Stephanie Denison, Alison Gopnik, Tom Griffiths
University of California, Berkeley, USA

In two sets of studies on preschooler's causal inferences, we have been exploring "the Sampling Hypothesis"—the idea that children might sample their responses from a distribution. The sampling hypothesis explains why we might see variability (expressed as probability matching) in children's inferences, and it also provides an account of how a learner might approximate optimal approaches (by sampling responses from the distribution).

In the first set of causal learning experiments, we explore three general tests of the Sampling Hypothesis in preschoolers. The first experiment demonstrates that the dependency between guesses decreases as a function of time between guesses. The second experiment reveals that preschool-aged children probability match (suggesting that they are sampling from a probability distribution). The third experiment shows that this is done in a manner consistent with sophisticated inferences about probability, and not merely as a naïve frequency matching technique.

The second set of experiments explores two simple sequential sampling algorithms that can be used to approximate Bayesian inference (random sampling and win-stay, lose-shift). To compare these two sampling approaches, we look at deterministic and probabilistic cases of causal learning and test preschoolers and adults. We suggest that the apparent variability in children's responses may be seen as "rational shifting" from one belief to the next; this shifting can in fact be a useful approximation to rational process and provides an account of how exact Bayesian inference can be computationally tractable.

The sampling hypothesis: a Bayesian view on cortical development

Máté Lengyel[1,2], József Fiser[2,3], Gergő Orbán[1,4], Pietro Berkes[3], Cristina Savin[1]
[1]Computational and Biological Learning Lab, Department of Engineering, University of Cambridge, UK
[2]Department of Cognitive Science, Central European University, Budapest, Hungary
[3]Volen National Center for Complex Systems, Brandeis University, USA
[4]Wigner Research Institute for Physics, Hungarian Academy of Sciences, Budapest, Hungary

Neural responses in the cortex show substantial variability, both when evoked by external stimuli and in the absence of external stimulation, during spontaneous activity. According to our theory, the sampling hypothesis, this variability reflects the stochastic dynamics of neural populations such that the distribution of neural responses matches the posterior distribution of environmental (and internal) variables that the subject needs to represent. In other words, the sampling hypothesis makes a direct link between the variability of neural responses, and the way uncertainty is represented in the brain.

Importantly, the sampling hypothesis provides a set of experimentally testable predictions about the development of sensory cortices. It predicts that evoked and spontaneous activities will represent the posterior and prior distributions, two key components of Bayesian inference. Thus, the theory predicts that the average evoked activity distribution should become increasingly similar to the distribution of spontaneous activity over development. This is because in a system that is well-adapted to the environment, inferences about the outside world should, on average, match prior expectations. We have tested and confirmed these predictions in multi-electrode recordings from the visual cortex of awake ferrets at different developmental stages of the visual system. Our results suggest that the brain adopts a sampling-based representation of uncertainty, and gradually tunes this representation based on experience with the statistics of the environment.

REGULAR
SYMPOSIA

RS-001

PERSPECTIVES ON THE MOTIVATION TO POINT IN YOUNG INFANTS

organizers:

Katharina J. Rohlfing (Bielefeld University, Germany)

Angela Grimminger (Bielefeld University, Germany)

speakers:

Ulf Liszkowski (University of Hamburg, Germany)

Katarina Begus (Centre for Brain and Cognitive Development, Birkbeck College, University of London, UK)

Angela Grimminger (Bielefeld University, Germany)

discussant:

György Gergely (Cognitive Development Center, Central European University, Budapest, Hungary)

Around 9--12 months of age, infants begin to point, and the emergence of pointing marks an important milestone in the human communicative and cognitive development. The motivation why infants point and what it tells us about their social--cognitive skills have been investigated by scholars groups with different focuses.

Tomasello, Liszkowski and their colleagues found that, from as early as 12 months of age, infants point either declaratively, i.e. to share their attention and interest in an object, person or action with an interaction partner, or informatively, i.e. to give information to another person who seems to need that information. They argue that even a 12--month old infant must have some understanding of the other's state of knowledge in order to point informatively or declaratively (see Behne, Carpenter & Tomasello, 2005; Liszkowski, Carpenter, Striano & Tomasello, 2006; Tomasello, Carpenter & Liszkowski, 2007; Liszkowski, Carpenter & Tomasello, 2008; Behne, Liszkowski, Carpenter & Tomasello, 2011).

Another theoretical point of view comes from Csibra, Southgate and colleagues who argue that infants use pointing gestures in order to receive some input from their environment and therefore gain knowledge, i.e. their pointing serves an interrogative function (see Southgate, van Maanen & Csibra, 2007; Csibra & Gergely, 2009; Kovács, Tauzin, Csibra & Gergely, 2010; Begus & Southgate, 2012).

Yet another perspective puts the gesture within an interaction loop (Ritterfeld, Rohlfing, Liszkowski, 2012): As soon as a child produces a gesture, a social partner will take it up by attributing some motives to the child (Pitsch et al., 2009; Olson and Masur, 2011). A crucial aspect is here that – no matter what kind of motives are pursued by the child – the interaction partner will react to it by providing further information. The richness of the information is helpful for the child's learning. With the interaction loop, a socio--ecological procedure for the gestural behavior is provided.

In this symposium, we present three papers on these different perspectives. Our aim is to discuss whether seemingly contrary approaches can be integrated in a "learning loop" from a social--interactional perspective.

Imperative pointing revisited

Ulf Liszkowski

University of Hamburg, Germany

Classic research focused on distinctions between imperative and declarative pointing, suggesting that imperative pointing is a simpler form of communication reflecting instrumental requests shared with non--human primates, while declarative pointing is a more complex attention--directing referential act.
I advance a unified theory which views infant pointing as part of human cooperative communication. Infant pointing is a referential act with various underlying motives, including expressive, informative, interrogative – but also imperative motives.

Little research has addressed the communicative complexities of infants' and great apes' requests. It is currently unknown whether there is a transition from more instrumental to more cooperative forms of request in human ontogeny, and whether there are phylogenetic differences in infants' and non--human primates' imperative pointing.

I present evidence from new studies which show that infant imperative pointing is a cooperative communicative act: Infants even point to request things they can easily obtain by themselves; and their pointing is embedded within common ground, for example when requesting absent objects. Great apes' imperative pointing is different: it reflects a simpler form of instrumental request, as evidenced by the finding that chimpanzees only request by making apparent their instrumental action attempts, not by directing attention from a distance. In infants, such instrumental requests are demonstrated at 8 months of age, already before infants point: infants reach for out--of--reach objects more when a social partner is present than when she is absent.

Findings enforce the idea that 12--month--olds have developed social expectations allowing for a flexible use of pointing as a cooperative communicative act.

Infants learn through interrogative pointing

Katarina Begus, Teodora Gliga, Victoria Southgate

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

Many studies have converged on the view that infants point communicatively in order to share their interest in objects and events. However, it is still an open question why infants are motivated to share their interests. With our studies, we tested a hypothesis in which the ultimate goal of pointing is not attention sharing itself (e.g. Tomasello, Carpenter & Liszkowski, 2007), but the information--laden response that infants tend to receive as a result of sharing attention.

The first study shows that infants, who interacted with a demonstrably knowledge-able adult, pointed to novel objects more than infants, who interacted with an ignorant adult. This strongly supports the idea that one of the functions of pointing in infancy is obtaining information. In the second study, we demonstrated that infants learn functions of objects better, when these are demonstrated on objects they had pointed to than on objects they had not expressed interest in. Together, these studies suggest that, not only do infants point in order to obtain information, but that responding to their expressions of interest leads to superior learning. In the third and ongoing study, we aim to explore what drives this relationship between interest (as expressed through pointing) and learning. We are investigating whether interrogative pointing is associated with the neural states identified as reflecting curiosity and preceding successful learning in adults, and exploring how these states may affect infants' learning.

Maternal verbal responses to children's pointing behavior

Angela Grimminger, Jutta Segbers, Katharina J. Rohlfing

Bielefeld University, Germany

What is the function of children's pointing within a natural interaction? Does it elicit similar responses with respect to (a) the data of different children and (b) across different ages of the children? To pursue these questions, we observed mother--child--dyads during joint book--reading when the children were 14, 18 and 24 months of age, and conducted a discourse analysis of the maternal responses. Of our interest was whether – in addition to labeling – further information were provided. Motivated by recent findings by Olson & Masur, 2011, in our analyses we considered whether infants' pointing was spontaneous or initiated by the mother. So far, our data reveal that at 18 months of age, spontaneous pointing elicits more questions, elaborations of the whole situation as well as association when compared to reactive pointing. In addition, we found correlations between the complexity of maternal responses and the vocabulary size of the children suggesting that the more extensive the reported vocabulary of the children was, the less complex the mothers responded to the child's pointing. For the discussion of our results, we suggest that the behavioral pattern of the mother following the child's gesture is a crucial aspect contributing to the production of children's pointing. We propose that the function of child's pointing cannot be viewed outside the interactional loop.

RS-002

BEYOND FAITHFUL IMITATION: HOW CONTEXT SHAPES CHILDREN'S LEARNING FROM OTHERS

organizers:

Erika Nurmsoo (University of Kent, UK)

Lucas P. Butler (Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany)

speakers:

Meredith Gattis (Cardiff University, UK)

Angelique Eydam (Klinikum rechts der Isar der Technischen Universität München, Germany)

Fruzsina Elekes (Faculty of Cognitive Psychology, University Eötvös Loránd, Budapest, Hungary)

Lucas P. Butler (Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany)

The cross-generational transmission of cultural knowledge is supported by an early ability to learn from others. Particularly important is the capacity to imitate others' intentional actions. Research investigating such early learning has primarily focused on infants' faithful imitation, in which children copy not only the goal, but the means by which it was achieved. For example, infants will copy a novel action (e.g. turning on a push-light with the forehead; Meltzoff, 1988) or the use of an inefficient tool (e.g. DiYanni & Kelemen, 2008), and will reproduce unnecessary steps in an action sequence (e.g. Brugger et al, 2007). In contrast, chimpanzees seem to be more likely to emulate, reaching the same goal using different means (Call, Carpenter & Tomasello, 2005). While both imitation and emulation can reflect learning, it is faithful imitation that allows for very precise transmission of information across generations.

In a recent theoretical proposal, Csibra and Gergely (2006; 2009) argue that faithful imitation is supported by a pedagogical stance, in which infants are particularly sensitive to cues (e.g. mutual eye gaze, using the child's name) that signal an adult is communicating information for their benefit, and use that sensitivity to learn cogni-

tively opaque knowledge. Indeed, this pedagogical stance influences not only infants' imitation, but also how strongly they generalise information learned from pedagogical demonstrations (e.g. Butler & Markman, 2012).

Importantly, children engage in behaviours other than faithful imitation, and the nature of such behaviors depends heavily on the learning context. For example, when there is a clear reason an actor used unconventional means to achieve a goal, such as turning on a light with her forehead while her hands were occupied, infants tend to "read through" that action and choose to emulate rather than faithfully copy the demonstration (Gergely, Bekkering & Kiraly, 2002). This symposium presents new research that goes beyond faithful imitation, exploring how children navigate various contextual factors in order to guide their learning and imitation.

In our first talk, Gattis and colleagues explore the relationship between faithful and selective imitation in young infants. In a longitudinal design, they investigate both the development and stability of these different types of imitative behaviours between 12 and 15 months of age.

Eydam and colleagues explore children's faithful imitation and emulation. They show that 18-month-olds differentially imitate or emulate depending on whether the target action involves a tool, even though the actions are demonstrated in the same context with the same amount of pedagogical cuing.

Elekes and Kiraly explore the other side of the problem, investigating when 18- to 24-month-olds will choose to copy the demonstrator's use of an inefficient tool over a more optimal tool. In this task, infants are not only sensitive to the presence or absence of pedagogical cues, but also to the age of the demonstrator.

In our final talk, Butler and Markman demonstrate that 3- and 4-year-olds leverage pedagogical cues to guide inferences about novel information, but that younger children's inferences are much more sensitive to the learning context.

Selective and faithful imitation

Meredith Gattis, Elena Sakkalou, Kate Ellis-Davies
Cardiff University, UK

Across numerous studies, developmental psychologists have observed that infants and children sometimes selectively imitate the actions of other people, and other times faithfully imitate, or overimitate. Most if not all of these studies report cross-sectional data however, making it difficult to compare explanatory hypotheses about these two different types of copying behavior and the relation between the two. We conducted a longitudinal, within-subjects study to investigate the relation between selective and faithful imitation, and the causes of each. Thirty-seven infants participated in three imitation tasks from 12 to 15 months. We found that 1) selective, goal-directed imitation increased with age and was stable across tasks, 2) faithful imitation also increased with age, and showed stabilities across tasks, and 3) the onset of selective, goal-directed imitation preceded the onset of faithful imitation. We will discuss several implications of these results, including the question of whether children understand the causal relations of a task and imitate faithfully anyway.

Imitation and emulation of novel tool actions

Angelique Eydam[1], Victoria Leahy[2], Erika Nurmsoo[2]
[1]Klinikum rechts der Isar der Technischen Universität München, Germany
[2]University of Kent, UK

Human beings appear to be unique in the animal kingdom by having stable representations of objects as tools, and crafting, carrying, and storing them for future use (Csibra & Gergely, 2006; Keleman, 1999). Csibra and Gergely (2006) argue that this approach towards tools may be the evolutionary root of imitation. However, research exploring early imitation has predominantly tested imitation of unusual body actions on novel objects, such as turning on a push-light with the forehead (e.g. Meltzoff, 1988). In the present work, we compared 18-month-old infants' imitation of novel tool use and novel body actions.

Thirty-two 18-month-old infants watched a model perform a target action, either using a tool (2 trials) or an unusual body action (2 trials, within subjects). The objects and actions were counterbalanced, with the same outcome (e.g. the target makes a sound) equally often produced as a tool action (using a rod) or unusual body action (using the forehead). After the demonstrations, infants' imitation and emulation behaviours were recorded during one minute of free play with each set of toys.

Infants showed a distinct preference to imitate tool-based actions. In contrast, when shown novel body actions, infants were more likely to emulate, copying the goal of the action using their own means (e.g. using a hand to press the toy). We discuss the implications of these findings for theories of early learning from others, including the theory of Natural Pedagogy.

Knowledgeability combined with ostensive cues outweigh infants' efficacy judgments in function learning

Fruzsina Elekes, Ildikó Király

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

The fact that infants readily imitate inefficient tool-use actions (Nagell, Olguin & Tomasello, 1993; Nielsen, 2006) indicates that they take intentional tool-use demonstrations of adult models as indicators of the tool's function, irrespective of the efficacy issues as long as it is possible to achieve the goal using the tool (DiYanni & Kelemen, 2008). Does this also mean that they are unable to understand which physical tool properties make a tool efficient?

We predicted that 18-24 month-old infants would imitate a less-than-optimal tool choice if it is presented by an adult model, in an ostensive referential context, but would rely on their own efficacy-judgment whenever any of the above conditions fails to be met. 76 children were randomly assigned to one of the following four conditions: ostensive adult model, ostensive child model, non-ostensive adult model, and no model baseline. Infants observed as, out of two possibilities, the model chose the less efficient tool to achieve the goal.

Although tool use increased in all modeled conditions compared to the baseline, high fidelity imitation only emerged in the ostensive adult model condition. Infants in the child model condition were more likely to choose the efficient tool than infants in the ostensive adult model condition. Additionally, outside a communicative context infants were less likely to imitate on a first attempt.

These results indicate that infants only accept an inefficient tool-function relation if the model's features indicate that she is a reliable source of information.

Preschoolers' Ability to Navigate Pedagogical Interactions in Guiding Inductive Inferences

Lucas P. Butler[1], Ellen M. Markman[2]

[1]Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany
[2]Stanford University, USA

Acquiring generic knowledge about the world is a critical developmental achievement (Gelman, 2003; Gelman & Wellman, 1991; Markman, 1989), but doing so requires making inductive inferences from limited information. Csibra and Gergely (2009) have suggested that one way children might approach this problem is by attending to whether a knowledgeable adult is deliberately demonstrating information for their pedagogical benefit, as adults may be likely to selectively manifest generic knowledge for pedagogical purposes. And indeed, recent work (Butler & Markman, 2012) suggests that 4-year-olds use such communicative cues to guide inductive inferences about whether a novel property is generalizable to a kind. However, 3-year-olds did not do so, only distinguishing between intentional or pedagogical and accidental actions in guiding their inferences.

In two experiments, we manipulated several contextual factors in order to investigate this developmental difference. We found that 4-year-olds seem to conduct a moment-by-moment analysis of whether a particular action is meant for them, while younger children only seem to distinguish between pedagogical and non-pedagogical actions when the context has been stripped of any pedagogical expectation, and thus fail to do so in a more complex, ongoing interaction. These results suggest that the developmental difference seen earlier is not the result of younger children failing to notice whether or not someone is demonstrating information for their benefit, but of a change in how children apply this distinction in an ongoing interaction.

RS-003

TESTING THEORIES OF DEVELOPMENTAL DYSCALCULIA

organizer:

    Dénes Szűcs (University of Cambridge, UK)

speakers:

    Bert Reynvoet, Emmy Defever (KU Leuven, Belgium)
    Angela Heine (Freie Universität Berlin, Germany)
    Dénes Szűcs (University of Cambridge, UK)

discussant:

    Valéria Csépe (Hungarian Academy of Sciences, Budapest, Hungary)

Developmental dyscalculia (DD) is a learning difficulty thought to be specific to mathematics. There are several theories for DD. The symposium will examine the evidence behind these theories by bringing together theory-driven studies testing various aspects of cognitive performance in DD. All studies examined whether DD is characterized by the predictions of certain theoretical proposals.

The currently dominant cognitive neuroscience and cognitive psychological theory of DD suggest that DD originates from the impairment of the magnitude representation of the human brain, residing in the interparietal sulculs (IPS), or from impaired links to this representation. Theorists debate whether DD is related to an impairment of this magnitude representation per se (representational deficit hypothesis), or to impaired connections between number symbols and the magnitude representation (access deficit hypothesis). The representational deficit hypothesis suggests that DD children's performance will be impaired on tasks requiring non-symbolic magnitude comparison. The access deficit hypothesis suggests that DD children will only be impaired on symbolic magnitude comparison tasks. In the first talk Reynvoet and colleagues addresses this question by directly contrasting the predictions of the representational and access deficit hypotheses.

The first talk focuses on the dominant magnitude representation hypothesis of DD. In contrast, the other two talks consider both the magnitude representation hypothesis and its alternatives suggested by various behavioural studies.

It is to point out that this is a major step in DD research because most studies so far have not clearly compared the predictions of the magnitude representation theory to the predictions other theories.

In the second talk Heine and colleagues will compare performance in DD children in both magnitude representation and executive function tasks by using both behavioural and electro-encephalographic measures. The study relied on screening more than 3000 children. Executive functions have been shown to be impaired in DD in various sporadic studies. However, their role has never been studied when researchers also used magnitude representation tasks.

In the third talk Szucs and colleagues will compare performance in DD and control children in very wide range of standardized tests and experimental tasks. This study relied on screening more than 1000 children and contrasted five theories of DD within the framework of a single study: the magnitude representation theory, the working memory theory, the attention theory, the spatial processing theory and the inhibition theory. The study used all available measures of the magnitude representation and each experimental task relied on a very large number of trials to assure high power. Both behavioural and electro-encephalographic measures were taken.

The three studies cover the whole of up-to-date DD research and provide a thorough insight into theoretical and practical aspects of DD.

Numerical matching judgments in typical developing children and children with mathematical learning disabilities

Bert Reynvoet, Emmy Defever

KU Leuven, Belgium

Both deficits in the innate magnitude representation (i.e. representation deficit hypothesis) and deficits in accessing the magnitude representation from symbols (i.e. access deficit hypotheses) have been proposed to cause calculation deficits. Evidence for these hypothesis has mainly been accumulated using magnitude comparison tasks. Recently, it is questioned to what extent comparison tasks reflect number-related processes. Therefore, in a first study, we examined the hypotheses in a sample typical developing children and measured their mathematical performance on a standardized test using a numerical matching task. In a second study, a group children with mathematical learning deficit was compared with controls matched on age, gender and IQ. Both pure non-symbolic (i.e. dot-arrays) and mixed (i.e. digit and dot-array) trials were included in the experiment. The results revealed that the distance effect was not affected by mathematical competence. However, children with a low score on the math test and children with MLD were slower on the mixed trials. This supports the access deficit hypothesis (Rousselle & Noël, 2007), showing that children with MLD have difficulties in linking a symbol with its quantity representation.

Domain-general and specific functions in mathematical development and developmental dyscalculia

Angela Heine, Jacqueline Wißmann, Arthur M. Jacobs

Freie Universität Berlin, Germany

We will present a range of diagnostic, behavioural and EEG data collected in the context of two research projects that aimed at investigating the relationship of basic numerical deficits, on the one hand, and domain-general deficits, on the other, with the development of mathematical disabilities in primary school children.

Starting with the collection of standardized diagnostic data by screening larger populations of children at the beginning of grades 1 and 2 (n1=1242 and n2= 1940), our projects followed the numerical and arithmetic development of matched subgroups of children from three different mathematical achievement levels, i.e. children with developmental dyscalculia, typically developing children and high achievers in the mathematical domain, during their first years of schooling. Assessing both behavioural and electrophysiological correlates of children's developing number-related and more general cognitive capacities at different time points allows for specific insights into the interplay between different processing domains.

The focus of our talk will be to discuss the results of electrophysiological studies investigating children's domain-specific, i.e. symbolic and non-symbolic numerical processing, and domain-general, i.e. executive functioning, abilities.

Contrasting alternative theories of develomental dyscalculia

Dénes Szűcs, Amy Devine, Fruzsina Soltész, Alison Nobes, Florence Gabriel
University of Cambridge, UK

Developmental dyscalculia (DD) is a learning difficulty thought to be specific to mathematics. Currently dominant cognitive neuroscience theories of DD suggest that DD originates from the impairment of the magnitude representation (MR) of the human brain, residing in the interparietal sulculs (IPS), or from impaired connections between number symbols and the MR. However, behavioural research offers several alternative theories for DD and neuroimaging also suggests that impairments in DD may be linked to disruptions of other functions of the IPS than the MR. That is, besides the MR, impairment of working memory, attention, inhibition and spatial processing were also proposed to underlie DD. Strikingly, the MR theory has never been explicitly contrasted with the range of alternatives in a systematic fashion. Here we have filled this gap by recording an extremely detailed profile of DD and directly contrasting five alternative theories of DD in 9-10 year-old primary school children. We used both behavioural and neuro-imaging tasks and used practically all available measures of the MR. Participants were carefully filtered from a pool of 1004 children and took part in 15 standardized tests and 9 experiments. DD and control participants were completely matched on reading skills, verbal and non-verbal IQ, general processing speed and socio-economic status. None of the results supported the MR theory of DD. In contrast, various domain general functions emerged as strong markers of impaired function in DD. The theoretical and practical significance of findings will be discussed.

RS-004

OSTENSIVE CUES FROM A BROADER PERSPECTIVE

organizers:

Gerlind Grosse (Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany)

Richard Moore (Max Planck Institute for Evolutionary Anthropoloy, Leipzig, Germany)

speakers:

Richard Moore (Max Planck Institue for Evolutionary Anthropology, Leipzig, Germnay)

Elena Hoicka (University of Stirling, UK)

Ágnes M. Kovács (Cognitive Development Center, Central European University, Budapest, Hungary)

Gerlind Grosse (Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany)

'Ostensive Cues' such as name calling, eye contact, eyebrow raising, smiling or conventional communicative symbols (e.g. pointing, words) occur very early in child development and are pervasive in adult-infant-interaction. Different accounts have attributed to them different roles like that of indicating communicative intent (Sperber & Wilson, 1986), soliciting attention (Fernald & Kuhl, 1987; Moore, in press), facilitating the transmission of culturally relevant knowledge (e.g. Csibra & Gergely, 2009), or as a vehicle to establish intersubjective experiences (Trevarthen, 1979).

In this symposium the presenters intend to explore the role of ostensive cues in different areas of infant and child development. What are the different roles/functions ostensive cues can take on? Under which circumstances? What are the prerequisites and where does it lead to? The symposium aims at bringing together different findings as a first step in order to shed light on the breadth of roles OC can play in pursuit to develop an integrative account.

The first presentation is about comparative findings in human infants and dogs and the differences in their interpretation of intentional/accidental and ostensive/non-ostensive acts. Tearing apart the intentional and the ostensive dimension of a communicative act informs us about their separate contribution to a successful interpretation.

The second author in this symposium presents research which directly tested the hypothesis that ostensive cues indicate information which should be learnt and generalized, i.e. is culturally relevant, by observing how parents accompany such generalizable information with ostensive cues compared to non-generalizable, humorous information. This research demonstrates the importance of researching parental cues for use in theory and experiments.

The third presentation also presents research concerned with the transmission of generalizable information. This time, researcher tested the effect of ostensive cues on infants' categorization of objects. They compared typically developing infants with autistic children, showing that an ostensively provided categorization information can override the influence of an object's surface features on the categorization.

The fourth talk takes a different perspective yet. The authors acknowledge that ostensive cues are far from uniform and investigate how specific kinds of ostensive cues combine with specific situational contexts to create meaningful responses to potentially ambiguous questions. And in another line of research, the talk informs about what happens, if ostensive cues have to be suppress in order to master a special kind of situation, i.e. that of hidden authorship.

Comprehension of communicative intentions without conventions or bodily deixis in children and domestic dogs

Richard Moore[1], B. Müller[1], Juliane Kaminski[1,2], Michael Tomasello[1]

[1]Max Planck Institue for Evolutionary Anthropology, Leipzig, Germany
[2]University of Portsmouth, UK

In this talk I present the findings of a study that compares comprehension of an unconventional, non-deictic communicative act in children of 27 months (n=60) and domestic dogs (n=56). Subjects were presented with an object choice task in which the experimenter indicated the location of a hidden object (a toy for children; food for the dogs) by pulling on one of two centrally placed ropes, which lifted and shook one of two buckets located equidistantly to her left and right. In a between subject 2x2 design, the rope was pulled in one of four conditions in which the experimenter's intention were varied. She pulled the rope either accidentally or intentionally, and with or without ostensive cues. Children found the hidden toy above chance in both intentional conditions but neither accidental condition. Whether or not the rope was pulled ostensively had no effect upon their comprehension performance. By contrast, dogs performed at chance in all conditions. However, they performed significantly better in conditions in which the experimenter acted non-ostensively.

I discuss the implications of these findings for two recently developed accounts of the role of ostension in communication: the claim defended by Gergely and Csibra (2009; Csibra, 2010) and their co-authors that ostenisve cues function to indicate communicative intent; and my own weaker claim (Moore, submitted; in press), which is that ostensive cues function only to solicit the attention of potential interlocutors. I argue that although the findings are by no means decisive, they provide some support for the weaker claim.

Communicative and Referential Cues Distinguish Generalizable and Non-Generalizable Information

Elena Hoicka

University of Stirling, UK

Pedagogy theory suggests communicative cues (e.g. Infant-directed speech, IDS) and referential cues (e.g. pointing) indicate to young children that information should be learnt and generalized (e.g. Csibra & Gergely, 2006). However, communicative cues are also theorized to grab attention (e.g. Fernald & Kuhl, 1987) and express positive emotion (e.g. Banse & Scherer, 1996), potentially increasing their use in non-generalizable situations (e.g. joking).

In Study 1, mothers enacted joke, pretend, and (positive or neutral) literal actions for their toddlers (16-20 months), each anchored to a target sentence. E.g. parents would say, „I'm having a drink" and drink water or orange drink (neutral and positive literal conditions); „drink" from an empty cup (pretend); or put a cup of water to their elbow (joke).

In Study 2, parents labeled objects for their toddlers (20-24 months). Parents would say a target sentence, e.g. „This is a shoe", and play with/show literal objects, e.g. shoe (positive or neutral literal); different objects, e.g. toy chicken (joke), or nondescript objects, e.g. block (pretend).

GORIC analyses found parents tended to express non-generalizable information (e.g. joke) with increased communicative cues (gaze to toddler, IDS, smiling), and generalizable information (i.e., literal) with increased referential cues (gazing, interacting and pointing to object). Mixed models found children's communicative responses (e.g. smiling) tended to increase in response to parents' communicative cues, and referential responses (e.g. gaze to object) tended to increase in response to parents' referential cues. This research demonstrates the importance of researching parental cues for use in theory and experiments.

The role of ostensive cues in category disambiguation in 12-month-olds and autistic children

Ágnes M. Kovács, Ernő Téglás, Gergely Csibra

Cognitive Development Center, Central European University, Budapest, Hungary

Ostensive signals indicate for the child that s/he is being addressed by a communicative partner and are hypothesized to facilitate the acquisition of kind-relevant and generalizable information (Csibra & Gergely, 2009). In four experiments, we investigated whether ostensive signals allow typically developing infants and autistic children to interpret demonstrated information about an object as kind-relevant. We employed a categorization task combined with an anticipatory eye-tracker paradigm, which included a learning-, a demonstration-, and a test-phase. In the learning-phase, participants watched movies displaying a protagonist sorting objects from two categories (cups/plates) into two locations (left/right). In the next phase, we varied the nature of the demonstration (ostensive/non-ostensive/no demo) revealing in the first two cases that, although an object looked like a plate, it was in fact a (foldable) cup. During test, participants were presented with the ambiguous object in the plate format, but no sorting was shown. Infants performed more anticipatory eye movements in the test to the cup than to the plate side when the demonstration was ostensive. However, they looked equally to the two sideds when the demonstration was non-ostensive, and looked more to the plate side when there was no demonstration. While autistic children showed significantly less anticipatory looks compared to infants, they also looked more to the cup side in case of ostensive demonstration. Together, the results suggest that ostensive communication can play a crucial role in disambiguating what kind an object belongs to, even if this requires disregarding the surface features of the object.

The role of ostensive cues in question interpretation and in hiding communicative intent

Gerlind Grosse[1], Michael Tomasello[1], Thomas C. Scott-Phillips[2]

[1]Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany
[2]Evolutionary Anthropology Research Group, Durham University, UK

Ostensive Cues are omnipresent in adult-infant interaction and have been found to serve a variety of purposes, e.g. as attention getter (Fernald & Kuhl, 1987), as signal of communicative intent (Sperber & Wilson, 1986), as indicating culturally relevant knowledge (e.g. Csibra & Gergely, 2009), or as a vehicle to establish intersubjective experiences (Trevarthen, 1979).

On the basis of the fact that ostensive cues are far from uniform, in Study 1 we looked at how the expression of different attitudes via specific kinds of ostensive cues (intonation, facial expression) interacts with different kinds of situations in creating meaningful responses to questions. We found that two-year-old children change their interpretation of a potentially ambiguous question based on the combination of the situation and attitude they perceive – they do not base their interpretation on the type of ostensive cues alone.

In study 2 we investigated how successful 3- and 5-year-old children are in suppressing their own communicative signals when trying to convey information while hiding the fact that they are doing so (hiding authorship). Both age groups were successful to some extent. The 5-year-old children were better able to fully suppress ostension. Both age groups also invented novel means to serve the attention getting function without having to resort to conventional communicative gestures. The results of this study suggest that children over time develop a more flexible command of ostensive cues and are able to separate out different functions in order to adapt to complex social requirements.

RS-005

SYSTEMS AT THE INTERFACE: THE CASE OF SMALL- AND LARGE-NUMBER REPRESENTATIONS IN EARLY DEVELOPMENT

organizer:

Anna Shusterman (Wesleyan University, USA)

speakers:

Aurélie Coubart (Université Paris Descartes, France)
Lisa Cantrell (Indiana University, USA)
Anna Shusterman (Wesleyan University, USA)

discussants:

Anna Shusterman (Wesleyan University, USA)
Veronique Izard (Université Paris Descartes, France)

How do separate representational systems communicate with one another in early cognition and how do they become integrated over development? Here we provide a case study of the early dissociation and integration of systems involved in numerical representation. Research suggests that adults have two systems available for representing quantities: an approximate number system (ANS) that maintains representations of imprecise quantities and a parallel individuation system that represents exact sets up to three or four items. A large body of evidence suggests these systems are active in infancy; however, there is an apparent dissociation between them.

This symposium explores how the two systems become integrated across development by providing data from multiple stages of development: neonates, infants, and preschoolers. The first paper documents—for the first time— a clear dissociation between the systems in neonates that has been previously observed in older infants and toddlers. Evidence for this comes from the findings that neonates successfully discriminate both small and large quantities but fail to compare values across the two systems. The second paper provides new data demonstrating that infants can successfully compare small and large numerical values, which suggests that the interaction between the ANS and the parallel individuation system may be modulated by

context and by the quality of information provided to the infant system. Finally, the third paper examines how the two systems are recruited during the acquisition of number words and suggests that number words map differently to small-number and large- number representations.

Together, these papers align with previous reports of a distinction between small and large number processing. As a group, they suggest that integration across the two systems is possible under certain conditions, such as a supportive context, or when aided by cognitive tools, such as language. The findings have implications for the development of numerical cognition from birth to adulthood. They also represent an example of the interface between two related but apparently distinct systems and help to generate hypotheses about how initially distinct systems interact over the course of development.

Dissociation between small and large numerosities in newborn infants

Aurélie Coubart[1], Elizabeth S. Spelke[2],
Arlette Streri[1], Véronique Izard[1]
[1]Université Paris Descartes, Paris, France
[2]Harvard University, USA

Infants are thought to possess two systems to represent numbers: a system for small numerosities (1-3) and another one for large numerosities (4 and more). It seems that these two systems function separately in infants. For example, 6-month-olds are able to compare two large numerosities in a visual presentation, but they fail to compare a large vs. a small numerosity. In a first series of experiments, we tested for the existence of this dissociation at birth, using a bimodal audition-vision presentation paradigm. We observed the same dissociation as in older infants: newborns succeeded with two large numerosities (4 vs. 12 and 3 vs. 9) but not with a small vs. a large numerosity (2 vs. 6). In a second series of experiments, we looked at direct evidences for the existence of a separate system for small numerosities in newborn infants. Using a crossmodal matching paradigm, we observed that newborns successfully matched the number of voices they heard to the number of faces they saw at the same time for the pair of numerosities 1 vs. 2 but not for 1 vs. 3. Taken together, our results suggest that the two systems are already in place at birth and that the limit between small and large numerosities falls between numerosities 2 and 3.

Signal Clarity for Infant Quantity Representation

Lisa Cantrell[1], Ty Boyer[2], Sara Cordes[3], Linda B. Smith[4]
[1]Indiana University, USA
[2]Georgia Southern University, USA
[3]Boston College, USA
[4]Indiana University, USA

Previous research has established that young infants discriminate large numerosities at a 1:2 ratio difference by 6 months, and sometimes show more precise comparison of small quantities (e.g. Cordes & Brannon, 2009a; Xu & Spelke, 2000); however, infants frequently fail in comparisons that cross the small and large number divide (e.g. 2 vs 4, 3 v 6). This failure has been attributed to a possible early dissociation between the systems engaged in small and large quantity processing. Here we provide new data that suggest that successful discrimination may depend on the clarity of the signal presented to the infant, which is a function of redundant stimulus dimensions (e.g. numerosity, surface area, and cumulative contour).

In two studies we tested 34 nine-month-old infants with comparisons that cross the small-large number divide and with surface area differences infants have previously failed to discriminate. Study 1 investigated infants' discrimination of 2 versus 4 items with a 2 fold surface area change; Study 2 tested infants' discrimination of 3 versus 4 with a 1.5 fold surface area change. Infants were presented with redundant correlated information across the habituation trials. Looking time measures comparing the last habituation trial to the first novel trial indicated successful discrimination, (Study 1, $t(15)=3.12$, $p<.01$; Study 2, $t(17)=2.67$, $p=.02$). These studies contribute to the limited body of research that has shown infant discrimination of differences at such small ratios (3:4) and across the small-large number divide, and support the hypothesis that increased signal clarity amplifies infants' numerical discrimination.

Integration of Non-Verbal Number Systems with Children's Acquisition of Verbal Number

Anna Shusterman[1], Emily Slusser[2]
[1]Wesleyan University, USA
[2]San Jose State University, USA

This paper explores how young children use non-verbal numerical representations as they acquire the exact meanings of individual number words. A meta-analysis of over 300 three- and four-year-olds children's performance on two measures of numerical understanding (Give-N and Fast-Cards) shows that the acquisition of individual number words corresponds to a shift in children's dominant representation of numerical quantities. This is demonstrated through the finding that children's estimates for number words they do not know are prone to systematic errors, best characterized with a coefficient of variance (CoV) around 0.3 (which is typical of human ANS representations).

In the small number range, learning the exact meaning of a number word apparently shifts the recruited representation from ANS representations exhibiting scalar variability to PI representations of precise numerosities. As children learn the meanings of individual number words, their estimates for the number words they know become more accurate, with CoV's approaching zero. For children estimating "unknown" numbers in the 1-4 range, the CoV hovered around 0.3, consistent with ANS activation. For children estimating "known" numbers, the CoV approached zero, consistent with PI activation. For larger numbers, those beyond the set-size limit of the PI system (six and higher), children continue to recruit ANS representations, with minimal change in the quality of these representations in early number learning.

Therefore, language acquisition may provide one context in which either ANS or PI representations can be recruited. The preferred representation depends on the quality of children's semantics for the specific number word.

RS-006

BEYOND COMPETENCE: HOW DOES BELIEF REASONING INTERACT WITH OTHER COGNITIVE ABILITIES?

organizer:

Lu Wang (Rutgers University, New Jersey, USA)

speakers:

You-jung Choi (Department of Psychological Sciences, University of Missouri, USA)
Amy Skerry (Harvard University, Cambridge, USA)
David Buttelmann (University of Erfurt, Germany)
Lu Wang (Rutgers University, New Jersey, USA)

The first phase of theory of mind research was marked by a near consensus, based around three-year-old's failure on the Sally and Anne task, that children younger than four years lacked competence with propositional attitude concepts, including the concept of belief. One exception to this view was ToMM theory that argued for a specific innate basis to theory of mind which included the belief and some other propositional attitude concepts. ToMM theory explained three year old failure on tests of belief reasoning as a result of various performance factors that developed relatively slowly as a result of late maturation, practice, and learning. In the last few years, several breakthroughs in experimental methods that allow versions of the Sally and Anne task to be run with preverbal infants and toddlers have provided dramatic support for early competence theories, like ToMM, and, although there are still many detractors, a new consensus is forming around that approach.

In the light of the new consensus, our symposium looks beyond the competence component to ask how theory of mind comes to interact with other social and non-social cognitive systems. Using various methodologies and age groups, the talks in this symposium explored the interactions between infants' and children's understanding of belief and their moral judgment, their understanding of emotions, desire reasoning, and theory of mind working memory capacities.

The first paper examines whether 13-month-old infants could integrate their understanding of a third party's belief status in predicting its moral evaluation. The second paper uses violation-of- expectation paradigm and investigated 8- and 10-month-old infants' ability to infer an agent's emotion after a successful or failed attempt to achieve a goal. The third paper builds on previous findings of children's belief-desire reasoning in a verbal task, and explores how in children and in adults belief might interact with desire serially or parallel to give rise to a behavioral prediction. Finally, the last paper uses eye tracking to examine 2-year-olds' working memory/attention capacity in spontaneous belief-desire reasoning while tracking two agents' false beliefs.

Together, the findings in these talks demonstrate how belief reasoning interacts with various cognitive abilities in shaping children's understanding of the social world, and point to various directions for future investigations going beyond the competence component.

Understanding social interactions at 13 months of age

You-jung Choi, Yuyan Luo

Department of Psychological Sciences, University of Missouri, USA

As adults, we constantly gather information, e.g. about others' mental states and personality, to evaluate one another and to decide how to act. Limited information may lead to false beliefs about others and erroneous evaluations. For example, most children do not want to play with a naughty child who hits others. However, if children do not see this child's transgression and are led to believe, falsely, that he is nice, then they may be friends with him.

We design a similar situation to examine infants' emergent abilities to use their "theory-of- mind" understanding to interpret social interactions. In the study, 13-month-olds are assigned to one of three conditions. In a True-Belief (TB) condition, infants first watch familiarization trials in which two puppets (A and B) play together, establishing that A and B have a positive relationship. Next, in an orientation trial, A watches B hit C. During test with only A and B, A plays with B or ignores B. Infants' responses suggest that they expect A, the third-party, to somehow "punish" B's transgression towards C; they respond with heightened interest when A still plays with B. The False-Belief condition is identical except that A is absent during orientation. Opposite results are found. Infants seem to expect A to continue playing with B based on A's false belief that B is nice. The third, Accidental condition is similar to the TB condition except that during orientation, B hits C by accident. Infants in this condition do not seem to hold any expectation.

Preverbal infants form expectations about emotions based on goal context

Amy Skerry, Elizabeth Spelke

Harvard University, Cambridge, USA

Identifying the goal of another agent's action allows an observer to make inferences not only about the outcomes the agent will pursue in the future, and the means to be deployed in a given context, but also about the emotional consequences of goal-related outcomes. While numerous studies have characterized the former abilities in infancy, inferences about emotions have gone relatively unexplored. Using a violation of expectation paradigm, we present infants with an agent who attains or fails to attain a demonstrated goal, and reacts with positive or negative affect. We find that 8 and 10 month old infants' attention to a negative emotional expression differs depending on whether it follows a failed or completed goal-directed action, consistent with the expectation that failures elicit negative emotional expressions. Control experiments suggest that infants may not form expectations about emotional responses based on other relevant contextual information, such as physical battery. The present results suggest that the representations involved in action processing in infancy are rich enough to support a relatively broad range of inferences relevant to the domain of goal-directed action. Furthermore, these data constitute a first step in characterizing the origins of abstract emotion concepts more broadly. Whereas most of the research on emotion perception in infancy focuses on perceptual discrimination and categorization of emotional stimuli, or on social referencing phenomena, the present results suggests that infants also have some knowledge of the conditions that elicit different emotional reactions in others, and that they form expectations about emotional displays based on an analysis of the goals that agents pursue.

Children, Like Adults, Process Beliefs and Desires Serially

David Buttelmann

University of Erfurt, Germany

Friedman and Leslie (2004) suggested a developmental shift in the processes that underlie belief-desire reasoning from childhood to adulthood. In their studies, participants had to indicate which of three boxes a protagonist would put her toy in when she wanted to avoid the one with a dirty frog inside. There was always a box that has never contained the frog (N), another box that actually contained it (TB), and a third one that the protagonist believed to contain the frog (FB). Identifying the protagonist's belief and desire in parallel made children prefer TB. In contrast, by serially identifying the protagonist's belief and desire adults preferred N.

However, it is possible that children were not aware of N being one of two possible options, and that adults followed a simple rule (i.e., "Choose the empty box") instead of tracking belief. We show that when N was slightly highlighted, six-year-olds, similarly to adults, chose this box over TB (Wilcoxon tests: children N=26, Z=-4.54, p<.001; adults N=23, Z=-4.71, p<.001). Results in a true belief condition revealed that neither children nor adults had a general preference for N by choosing this box and FB equally often (children Z=-.86, p=.391; adults Z=-.74, p=.460). Subjects of both age groups chose N significantly more often in the false than in the true belief condition (children Z=-3.62, p<.001; adults Z=-4.02, p<.001). These results suggest that children and adults process beliefs and desires serially, and that both age groups solve three-choice avoidance-belief-tasks based on reasoning about the protagonist's belief.

False belief and working memory: can children represent two false beliefs spontaneously?

Lu Wang, Alan M. Leslie

Rutgers University, New Jersey, USA

Latest findings suggest that infants in their second year of life reason about false belief implicitly as measured by looking time (Baillargeon, et al., 2010; Kovács, et al., 2010; Onishi & Baillargeon, 2005) and anticipatory looking (Southgate, et. al., 2007). However, little is known about the nature and properties of the early developing theory-of-mind (ToM) competence. One critical property of ToM, or belief attribution in particular, is that it is specific to individuals – the content of my belief could be the same as or different from yours, yet they need to be kept separated. To what extend could children link a belief representation to specific agents? What is the working memory capacity for tracking theory-of-mind?

The present studies explored 2-year-old children's spontaneous ability and 3- to 4-year-olds' deliberate ability to keep track of two different false beliefs. Three-year-olds were as good in tracking two false beliefs as they were in understanding a single false belief in a verbal task. Moreover, 2-year- olds were able to keep two false beliefs separated and accurately attribute each belief to the corresponding agent, as measured by their spontaneous anticipation.

Overall, the studies suggested that children could represent and link belief representations to specific agents both spontaneously and verbally. The working memory capacity could afford at least two slots for doing so, yet further research is needed to figure out whether the working memory limit applies to the number of agents or the number beliefs.

RS-007

ELECTROPHYSIOLOGICAL INDICES OF INFANT BRAIN DEVELOPMENT: CONNECTIVITY AND INFLUENCE OF ENVIRONMENTAL FACTORS

organizers:

Bea R.H. Van den Bergh (Department of Psychology, Tilburg University, Tilburg, the Netherlands)

Elena Kushnerenko (School of Psychology, University of East London, London, UK)

speakers:

Bea R.H. Van den Bergh (Department of Psychology, Tilburg University, Tilburg, the Netherlands)

Elena Kushnerenko (IRCD, University of East London, UK)

Przemyslaw Tomalski (Faculty of Psychology, University of Warsaw, Warsaw, Poland)

Ghislaine Dehaene-Lambertz (Inserm- CEA Cognitive Neuroimaging Unit, Gif-sur-Yvette Cedex, France)

This symposium focuses on inter-individual variability in functional brain development in 2 to 9 month old typically developing infants and examines possible sources of this variability.

The first and fourth speaker examine the influence of the prenatal environment. Environmental factors play a crucial role in coordinating the timing and patterning of expression of genes that mediate the basic brain histogenic events. Atypical environmental factors such as exposure to high level of maternal anxiety, viral infections, undernutrition and others, by influencing gene regulatory mechanisms, may alter gene expression. The induced change in histogenic events may impact consecutive brain development and functioning. Results from the first research team are compatible with this hypothesis; i.e., infants from highly anxious mothers were found to process sounds with low information contents differently from infants born to mothers with low and medium levels of anxiety during their pregnancy. The fourth speaker presents data indicating that preterm infants perceive and discriminate speech sounds from the onset of the cortical circuitry. However, this early experience cannot be used before a certain maturational age.

The second speaker investigates sources of interindividual variability in audiovisual speech integration. The results of this study indicate that the looking behavior of the infant is associated with the amplitude of the audiovisual mismatch response.

The third speaker found some evidence for socio-economic impact on functional brain development measured during resting state EEG. Recently graph theory has been introduced to model, at all ages, brain networks with MRI, fMRI BOLD, MEG or EEG data. Graph parameters can be calculated, namely C (a local clustering coefficient) and L (a global path length parameter). Increases in C and L reflect decrease of randomness, or increase of order. Interestingly, these graph parameters show high inter-subject variability, even in the absence of a frank psychiatric or neurological disorder. Although in most studies these measures are taken as the starting point for explaining behavioral measures, e.g. language development and impulsivity, recently, examination of the role of the environment, genes, and their interplay in shaping this variability has also started.

Together these presentations show that typically developing infants do not represent 'a monolithic group' We discuss the impact of this variability for clinical and fundamental research

Prenatal exposure to anxiety and information processing in two-month-old infants: an AERP study

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Exposure to atypical events during specific intrauterine periods may induce reprogramming of fetal brain development and lead to postnatal problems in behavior, emotions, and cognition. (Van den Bergh et al., 2005). The goal of the current study was to assess in two-month-old infants the influence of prenatal exposure to maternal anxiety on information processing related to language development. Seventy pregnant women filled out the State-Trait Anxiety Inventory between their 9th and 15th week of pregnancy. Two months after birth, we recorded auditory event-related potentials in their infants using an oddball paradigm with a standard tone and three types of deviants: inter-stimulus interval deviants, white noise, and novel sounds. The relationship between maternal state anxiety during early pregnancy and the infant's ability to process rapid auditory sequences was studied. The standard and inter-stimulus interval deviant tones elicited morphologically different auditory event-related potentials in infants whose mother reported high anxiety as opposed to infants of mothers with lower levels of anxiety during pregnancy. No similar effects were found for the white noise and novel sounds. These findings indicate that infants from highly anxious mothers process sounds with low information contents differently from infants born to mothers with low and medium levels of anxiety during their pregnancy. This difference may underlie the poorer language acquisition observed in other studies in children prenatally exposed to high levels of maternal anxiety.

Individual differences in audiovisual processing in infants brain is associated with looking behaviour

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Research on audiovisual speech integration has reported high levels of individual variability, especially among young infants. Developmental change in audiovisual processing has been demonstrated between 6 and 9 months of age with a shift of selective attention from eyes to mouths of speaking faces (Lewkowicz et al, 2012, Tomalski et al in press). This coincides in time with the increase in between subjects variability in auditory event-related responses (ERPs) (Kushnerenko et al, 2002), reflecting individual differences in brain maturation. We hypothesized therefore that developmental changes in audiovisual processing will be paralleled by changes of event-related potentials (ERPs).

We examined high-density ERPs in response to videos of audio-visually matching and mismatched syllables /ba/ and /ga/. Looking time to the mouth while watching those articulations was measured with eye-tracking. While there were no apparent age-related differences in infant ERPs, differences in looking behaviour were strongly associated with the amplitude of audiovisual mismatch ERP response. The results of the present study will have a significant impact on the understanding of individual differences in neural signatures of audiovisual processing in infants as they demonstrate that these differences are related to infants' looking preferences rather than to chronological age

Socio-economic status and functional brain development – associations in early infancy

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Socio-economic status (SES) impacts on both structural and functional brain development in childhood, but how early its effects can be demonstrated is unknown. In this study we measured resting baseline EEG activity in the gamma frequency range in awake 6-9 months-olds from areas of East London with high socio-economic deprivation. Between-subject comparisons of infants from low- and high-income families revealed significantly lower frontal gamma power in infants from low-income homes. Similar power differences were found when comparing infants according to maternal occupation, with lower occupational status groups yielding lower power. Our results show that the effects of socio-economic disparities on brain activity can already be detected in early infancy, potentially pointing to very early risk for language and attention difficulties. This is the first study to reveal region-selective differences in functional brain development associated with early infancy in low-income families.

Maturational age and Environment, what is important to learn your native language?

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During the first year of life, speech perception becomes attuned to the native language. Preterm infants receive broad speech stimulation several weeks earlier than full-terms. They hear the full frequency range of speech, which contrasts with the low-passed filtered speech fetuses hear in the womb, and experience face-to-face interactions with their caregivers, and sensorimotor and auditory feedback from their own vocalizations. However their brain is very immature and many neurons are still on their migrating way. How do preterms process speech and what is the impact of the external world on this immature brain? I will present ERP and NIRS data showing that there is an early complex organization of the perisylvian areas providing preterms with auditory discrimination capacities but that this early experience cannot be used before a certain maturational age. These results question the type of circuits which are necessary to perceive, discriminate, but also remember the external world.

POSTER
SESSION A

A-001
Generation of Ostensive Cues by Young Children

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Previous studies show that infants can recognize the communicative intention of an adult by being sensitive to the ostensive clues that specify a learning context (Senju, 2008; Csibra, 2010). However an important question remains unanswered. Do children engage in the same kind of non-verbal behaviors as adults when they want attention to communicate a specific message? In the present study we show that young children can not only detect, recognize and react to ostensive cues (Gegerly and Csibra, 2005) but furthermore, that they are capable of generating these signals when teaching. We examined kids' use of ostensive cues in games in which a rule had to be inferred before being taught to an adult. When teaching, children made use of ostensive cues, including changes in body orientation, eye-contact, eyebrow-raising and voice pitch, among others. Our results suggest that children as young as three year old are capable of using screening-off information to learn the causal structure of biological events (Schulz, 2004) and actively transmit this knowledge to others, using well-known ostensive cues to denote a pedagogical intention.

A-002
Children's Understanding of Hierarchical Conflicting Desires

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Children's understanding of hierarchical conflicting desires was examined. Three- to 7-year-olds were presented with stories in which a character has to take an action that is not desired in order to achieve an overarching goal, such as to play with another character whose preferred activity conflicts his own. Only 6-and 7-year-olds were able to predict correctly the agent would act in ways consistent with the other character's desire. In a second study, similar results were obtained with non-social situations. Six- and 7-year-olds, but not younger age groups, predicted correctly that the character would eat something he did not like to lose weight, and study rather than go to Disneyland to get good grades. The results suggest that understanding hierarchical desires is challenging for preschool children. The development of this understanding may contribute to theory of mind and metacognition, as well as have practical implications. Key words: desire understanding, theory of mind, cognitive development, social cognition

A-003
Imitation of Non-Human Agent (Dog) in 17- to 36-month-olds

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Imitation is a driving force in young children's self-discovery and provides one of the first platforms for interacting with others in the social world. Discovery of self through mimicking of the actions of others requires discrimination of actions that are relevant to the self. Self-relevance can be attributed both through the morphological as well as the behavioral features exhibited by an agent. From a young age, infants imitate the actions of human and non-human agents (e.g. orangutan puppet, robot) that are designed to appear intentional and/or contingent with the infant. The present research extended the investigation of the role of agency in infant imitation by employing a real animate agent (dog). Study 1 compared 17-, 26-, and 36-month-old's imitation of the video actions of a dog and a human, as well as the live actions of an experimenter. Although there was an increase in the level of imitation across age groups, there was no difference in the tendency to imitate dog or human actions, and there was no video deficit. To examine whether infants' would produce the actions when viewing the props moving on their own, Study 2 compared 17-, 25-, and 36-month-old's imitation in a ghost control (no agent) with infants' imitation of a human experimenter. Although 17-month-olds did not produce the actions in the ghost control, 25- and 36-month-olds did. The findings are discussed as they relate to infants' understanding of agency and their sensitivity to pedagogical cues, and the role these factors play in imitation.

A-004
Watching Minds Shape Language: The Emergence of Spatial Verb Agreement in Nicaraguan Sign Language

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With the founding of a new school for special education in Managua approximately thirty years ago, Deaf Nicaraguans came together in greater numbers than ever before. Though teaching in this school was exclusively in written Spanish, Deaf students soon began to communicate manually, giving birth to a new language: Nicaraguan Sign Language (NSL). Each year children enter the school and learn the language naturally from their older peers, eventually becoming Deaf adults who use NSL for daily communication. As succeeding gen-

erations learn NSL, the language itself grows and changes. One area that has shown striking development is the emergence of verb agreement. Mature sign languages around the world use space to indicate agreement between verbs and their subjects and objects; however, little extent work examines how this type of agreement arises. We investigated the emergence of spatial verb agreement across four groups: adult Nicaraguan homesigners (isolated deaf individuals who have not learned NSL but communicate manually though systems of their own creation) and three successive generations of Nicaraguan signers. We found that spatial agreement emergence is not monolithic: 3rd generation signers produce more verbs agreeing with multiple arguments than homesigners and 1st and 2nd generation signers, but this development is gradual. Indeed, the seeds of spatial verb agreement are present even in the adult homesigners. This illustrates the importance of human cognition and learning in shaping the form of language, but also shows that only with time and iteration can these processes give rise to mature linguistic structure.

A-005
Children´s past and future account: A study with three social groups from Buenos Aires, Argentina.
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This study analyzes the future and past talk produced by children from three social groups in Argentina: marginalized-urban neighborhoods (MU), Toba native suburban communities (TN) and middle-income families (MI). The theoretical perspective (Nelson, 2007; Hudson, 2006) maintains that a critical dimension of cognitive and linguistic development is the reconstruction of past and the prediction of future events. The concept of time is itself a social construction and it is conveyed to children through language. That is why this study explores differences in the accounts produced by the three groups of children. The data consists of 90 accounts -45 future and 45 past- produced by 45 4-year-old children, 15 from each group. The accounts were based on "The Children´s Day", a widespread celebration in Argentina. Children were asked to give a future account of their plans for that day and after the celebration they produced a past account. Analysis considered: a) the temporal frame of reference; b) the use of temporal terms. Findings showed no differences in the temporal terms used in past accounts. In future accounts differences were found. TN children included less temporal terms per elaboration (0.12) than the other two groups; MU children included less temporal terms (0.22) than MI (0.3). Differences were also found in the temporal frames of reference in the future accounts: MI children used more hypothetical frames of reference (0.11) than the other two groups (TN: 0.03; UM: 0.02). Findings were interpreted based on socio-cultural and linguistic characteristics of the groups.

A-006
Quantity, Diversity and Quality of Lexical input to young children. A study in two social groups from Buenos Aires, Argentina
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Differences in the size of children's vocabularies develop in infancy, mainly as a consequence of the opportunities offered by their environment (Nelson, 1996; Tomasello, 2003). That is why this study analyses the lexical properties of the linguistic context that 4-year-old Argentinean children from two social groups (marginalized-urban neighbourhoods, MU and middle-income families, MI) are exposed to daily in spontaneous situations. The sample included interactions recorded over a 12 hour period in the homes of 20 MI and 20 MU children. Data was analysed using the CLAN Program (MacWhinney & Snow, 1985), considering: a) quantity and diversity of words heard by the children; b) quantity of words representing non-observable phenomena. Findings show significant differences in the input children were exposed to: MI children heard a greater quantity and diversity of words than UM children (quantity: 18,650 versus 13,920; diversity: 2,512 vs. 1,899 ANOVA; quantity: $F_{(1, 35)} = 4.45$, MSE = 35131034, $p < .05$; diversity: $F_{(1,35)} = 7.45$, MSE = 453354, $p < .01$). Differences in the amount of non-observable nouns, adjectives and verbs, were found between the two groups of children. The statistical analysis suggests an association between words referencing non–observable phenomena and the social group (nouns MI: 16.57% vs MU 6.67%, $\chi^2(1) = 133.52$, $p< .001$; Adjectives, MI 39.34%; UM: 20.25%; $\chi^2(1) = 99.54$, $p< .001$; verbs, MI : 13.92% UM: 8.04% heard $\chi^2(1) = 91.74$, $p< .001$). Findings are discussed taking previous research in other cultures and languages into account

A-007
Early Theory of Mind in Deaf and Hearing Children
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During the preschool years, language plays a strong role in the development of false-belief reasoning (Milligan et al., 2007). The role of language in earlier developing aspects of social cognition remains unclear. Some have proposed that early Theory of Mind (ToM) abilities develop independent of language (Apperley & Butterfill, 2009), but recent findings comparing deaf and hearing infants on a looking-time false-belief task suggest that access to language may play a role in ToM reasoning in infancy (Meristo et al., 2011). The current study seeks to investigate the relationship between language and early ToM in deaf and hearing toddlers.

A total of 64 hearing toddlers (M_{age}=18;27) participated in Experiment 1. We measured expressive and receptive vocabulary size and assessed ToM abilities with a pointing task (Camaioni et al., 2004), a goal understanding task (Meltzoff, 1995), and knowledge inference task (Buttelmann et al., 2009). We found no significant correlation between our vocabulary measures and any of our ToM tasks (all ps>.267).

In Experiment 2 (data collection ongoing), we tested 5 deaf toddlers (Mage=21;20) born to hearing parents (matched on age and SES). Despite their lower vocabulary size the deaf children performed remarkably similarly to their hearing peers on the 3 ToM tasks.

Taken together, the findings support the argument that early ToM capacities develop independently of language, as measured by vocabulary size. We suggest that the impact of language on ToM development may be specific to the uniquely human capacity to reason about false beliefs.

A-008
Indirect reciprocity and fairness in 10-month-old infants
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The principles of reciprocity and fairness are fundamental building blocks of complex cooperation among human adults. Little is known, however, about the developmental origins of reciprocity and fairness reasoning in human infancy. In Experiment 1, we assessed whether infants generate expectations of indirect reciprocity in a scenario involving helping or hindering actions. Sixteen 10-m-old infants were shown four familiarization events followed by one test event. Familiarization events involved helping and hindering actions performed by two agents. In the test event, a hand delivered a strawberry either to the Helper or the Hinderer. Half of the infants were randomly assigned to witness the Expected Reciprocity test event in which the strawberry was given to the Helper, while the other half saw the Unexpected Reciprocity test event in which the strawberry was given to the Hinderer. Infants who saw the Hinderer being rewarded looked reliably longer (M = 15.4 s) at the test event than infants who saw the Helper being rewarded (M = 4.6 s), p = .012. In Experiments 2-4 familiarization events involved equal and unequal distribution of resources, while test events were similar to those used in Experiment 1. Looking times revealed that infants expected agents to make egalitarian distributions and expected third parties to act more positively towards fair agents than unfair agents. Overall, these results suggest that infants may display very early tacit knowledge of the principles of fairness and indirect reciprocity and that such competence does not appear to depend on explicit teaching or verbal reasoning.

A-009
Observation of human and non-human touch in young children: EEG study
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Recent functional magnetic resonance imaging studies have reported activation of primary and secondary somatosensory cortices when participants experienced touch as well as when they observed another person or object being touched (Keysers et al, 2004; Ebisch et al., 2008; Schaefer et al. 2010). However, little is known about the time-course and brain mechanisms underlying the development of this activity in children.

We used event-related potentials (ERPs) to examine the time-course of the neural mechanisms underlying the observation of human and object touch in 4- to 5-year old children. One participant group was presented with video clips of an arm being touched by object (touch trials) or object moving in front of the arm (non-touch trials). Another group of children was presented with videos of cylindric objects being touched by object or object moving in front of cylinders. After the ERP assessment, child's arm was touched with the same objects used in the videos.

ERP component differences were observed over midline central electrodes between 400 and 700 ms after stimulus onset. Statistical analysis of the mean ERP amplitude revealed a main effect of touch in the group presented with human touch, but this effect was absent in the group presented with object touch. These findings suggest that the observation of human touch is associated with specific neural mechanisms in 4- to 5-year olds, which are activated at relatively late cognitive stage of neural processing. Time-frequency analyses will be conducted, in order to examine neural mechanisms underlying the experience of touch in children.

A-010
Can Implicit Sequence Learning Deficits Be Accounted for Reading Disabilities?

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There is a growing body of evidence that implicit sequence learning is crucial for language skills. Impairments in this type of learning have been suggested to be responsible for reading difficulties in developmental dyslexia. Previous studies, however, showed mixed results regarding this question. The aim of our study was to investigate two variables which can influence the relationship between implicit sequence learning and dyslexia: the type of learning (sequence-specific versus general skill) and the age of participants (children versus adults). We used the Alternating Serial Reaction Time (ASRT) task to assess the implicit probabilistic sequence learning in two age groups: 10-12-year-old dyslexic and typically developing children, and 18-20-year-old dyslexic and control adults. We found that both dyslexic children and adults showed general skill learning and implicit learning of probabilistic sequences similar to that of typical controls. The only significant difference between groups was that dyslexic children were generally slower compared to the typically developing controls, but this difference disappeared in the adult groups. We suggest that previous reports with mixed results of implicit learning in dyslexia can be accounted for the type of the sequence, the explicitness of the stimuli, and the nature of the task demands.

A-011
Children reciprocate differently after having gummy bears given to them or taken from them

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Little is known about young children's tendencies toward reciprocity in distributing resources. In the current study, as a result of a partner's behavior, three- and five-year-olds ended up with either 3, 5, or 7 candies out of a total of 10 available. But in each case this result was produced either by the partner giving or by the partner taking (i.e., giving 5 or taking 5 out of 10; giving 3 or taking 7 out of 10; giving 7 or taking 3 out of 10). When children were then provided the opportunity to reciprocate, two effects emerged. First, in both age groups, the more candies children ended up with as a result of the partner's behavior, the more candies they reciprocated with in return. Second, in both age groups, children were more generous to the partner when she had previously transferred candies by giving rather than by taking, presumably reflecting their assessment of her intentions. Five-year-olds, but not three-year-olds, showed some tendency towards equalizing resources as well. Additionally, we presented children with conditions in which an amount of gummy bears given to or taken from them was determined by drawing a number to rule out that their responses reflected loss aversion instead of reciprocity.

A-012
Novel Human Communicative Signals Facilitate Categorization in Infants

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Converging evidence suggests that human communication supports kind-relevant cognition in infants (Csibra & Gergely, 2009). For example, in one study, infants who saw an actor point ostensively toward an object detected a change in kind, but infants who saw a non-communicative grasping gesture did not (Yoon et al., 2008). Likewise, human language appears to support object individuation by kind (Xu, 2002) and the formation of object categories (Ferry et al., 2010). The contribution of language in these studies is clear - infants listening to other signals (e.g. sine-wave tones, backward speech) fail to form categories. We ask whether these effects are unique to speech, or whether other signals might also support categorization if infants perceive them as communicative. We put this to a strong test with sine-wave tones, a sound that has never facilitated categorization at any age. We presented infants with a video-recorded conversation between an English speaker and a "beeper" who responded in tones (dubbed over her mouth movements). This was followed by an object categorization task: participants saw 8 exemplars of a novel object category paired with a unique tone sequence. The evidence that tones are communicative had a significant impact on their ability to facilitate object category formation: tones now facilitated categorization for 6-month-olds (p < .02), but not 12-month-olds. We interpret these results within a developmental framework.

A-013
Statistically optimal effects of uncertainty in scene segmentation on human learning

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In contrast with the traditional deterministic view of perception, a number of recent studies have argued that it is best captured by probabilistic computations. A crucial aspect of real-world scenes is that conflicting cues render stimuli ambiguous which results in multiple hypotheses being compatible with the stimuli. Although the effects of perceptual uncertainty have been well-characterized on perceptual decisions, the effects on learning have not been studied. Statistically optimal learning requires combining evidence from all alternative hypotheses weighted by their respective certainties, not only from the most probable interpretation. We tested whether human observers can learn about and make inferences in such situations. We used an unsupervised visual learning paradigm, in which ecologically relevant but conflicting cues gave rise to alternative hypotheses as to how unknown complex multi-shape visual scenes should be segmented. The strength of conflicting segmentation cues, "high-level" statistically learned and "low-level" grouping features of the input, were systematically manipulated in a series of experiments, and human performance was compared to Bayesian model averaging. We found that humans weighted and combined alternative hypotheses of scene description according to their reliability, demonstrating an optimal treatment of uncertainty in learning. These results capture not only the way adults learn to segment new visual scenes, but also the qualitative shift in learning performance from 8-month-old infants to adults. Our results suggest that models of perceptual learning that evaluate a single hypothesis with the "best explanatory power" instead of model averaging, are not sufficient for characterizing human visual learning.

A-014
Do monkeys automatically calculate beliefs?

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Young infants represent the false beliefs of others when tested using looking-time tasks (Luo, 2011), suggesting that there may be an early-emerging core knowledge system for belief understanding. One way to investigate this claim is to examine belief understanding in other primates. Monkeys fail looking-time false belief tasks (Marticorena et al., 2011), perhaps due to a difficulty in simultaneously representing a false belief and predicting behavior. We modify an automatic belief representation task from Kovacs et al., 2010 to examine whether rhesus monkeys might be influenced by an agent's beliefs when there is no need to predict behavior.

Study 1 replicated the "true belief" result from Marticorena et al. (2011). When an experimenter saw an apple move into one box, monkeys looked longer when the experimenter searched for the apple in an incorrect box. Study 2 examined whether monkeys were influenced by the experimenter's beliefs when tracking the apple's location. Monkeys watched the apple move between two boxes and an outcome in which one box was revealed to be empty. By occluding segments of the apple's movement from either the monkey or the experimenter, we manipulated the monkey's belief (true or false) and agent's belief (true or false) about the final location of the apple.

Monkeys looked longer when their own beliefs were violated than when their beliefs were confirmed. In contrast to human infants, however, monkey's expectations were not influenced by another agent's beliefs, suggesting that belief representation may be an aspect of core knowledge unique to humans.

A-015
Essentialism prompts children's negative attitudes towards ethnicity

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Children have been found to essentialize various social categories, such as race, gender, and ethnicity. Studies on adults have shown positive correlations between essentialism and negative attitudes towards social categories. We investigated whether such relations are found in young children. Sixty-seven 6-year-old and 70 9-year-old Jewish Israeli secular children participated in one of four story-conditions. The critical, "ethnic essentialism" story, described the lives of a Jewish and an Arab boy while emphasizing a number of essentialist components: e.g. that the boys lived in cities with people exclusively of their own ethnicity and who had similar customs, that the boys' parents were of that ethnicity, and that the boys would grow-up to be adults of that ethnicity and have children of that ethnicity. The other three conditions included control stories for the frequency of mentions of ethnicity and for essentialism about a non-social category. After listening to their assigned story, children completed a drawing task, in which they were asked to draw a Jew and an Arab; and an Implicit-Association-Task (IAT). The main finding in the drawing task was that children in the "ethnic essentialism" condition drew the Jewish and Arab characters farther apart from each other than children in the

other three conditions. The main finding from the IAT task was that 6-year-old boys in the "ethnic essentialism" condition responded faster to stereotype-consistent than inconsistent pairings. These findings indicate that already at a young age, prompting children's essentialist thinking about ethnicity influences their attitudes towards ethnicity.

A-016
The effect of recall condition on children's memory performance
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The part of the eyewitness memory research, which specifically deals with child-related crimes is called "forensic or judicial" developmental psychology in the literature. The present study focuses on how children's memory performance is affected by the manipulation of presenting and recalling stimuli. Two short cartoon clips were presented to 10-year-old primary school pupils (24 boys and 20 girls). Before presentation of the second clip, instruction to remember or to forget the first story was given to the subjects according to the classical directed forgetting paradigm. Later recall was manipulated by contextual reinstatement – a memory enhancing technique of the cognitive interview. Children's memory performance was measured by the number of recalled story elements. Results showed that performance was affected by both the instruction at presentation (to remember vs. to forget) and the recall technique (context-reinstated vs. free). Significant directed forgetting effect was found in the recall performance of the first story: the 'forget' group was able to recall fewer story elements than the 'remember' group. However, memory performance of the 'forget' group was lower in the context-reinstated, than in the free recall condition. These findings suggest that the contextual reinstatement technique of the cognitive interview may be counter-productive in criminal investigation when the victim (or witness) has been called to oblivion.

A-017
A Large Scale Adaptive Training System for Children's Logical Reasoning (and Beyond).
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Logical, abstract reasoning is a cognitive domain that gets little attention in formal education at primary school. We developed a deductive reasoning task in the adaptive train and game

environment of mathsgarden.com (rekentuin.nl; Klinkenberg et al., 2011), flower code. Flower code, known in the literature as deductive mastermind (Koyama, 1993), has been played by a large number of children (N = 28,247), from preschoolers to grade 8. Playing the game in the adaptive environment results in an empirical rating of the item difficulties and of the person ability parameters. The aim of the study is to understand children's reasoning strategies while playing this task and the relation to executive functions, such as working memory.

We find a relation between age and player ability, but the individual differences within age groups are large. In addition to age, reasoning in arithmetic domains, and another complex reasoning domain, working memory explains an important part of the individual differences in nonverbal deductive reasoning ($F(6,7085) = 572.3$, p<.0001; $R^2 = .33$; Working memory: $\beta = .28$, p < .0001).

By logical analysis of the domain we get a better insight in the strategies that children follow for solving items. We developed a formalization of strategies based on the tableau method (Beth, 1955). Strategies need more or less resources dependent on the efficiency of selecting the relevant information. Important aspects of item difficulty are explained by the number of necessary reasoning steps derived from the formal logical analyses ($F(6,93) = 33$, p<.0001; $R^2 = .66$).

A-018
Preschoolers' visual attention and vocabulary learning as a function of temporal contiguity between the pictures and the oral text of storybooks
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In line with the dual-coding (Paivio, 2007) and the multimedia learning (Mayer, 2003) theories, it was hypothesized that children make stronger connections between the pictures and the text of storybooks when those are presented at the same time as compared to after each other during storybook reading sessions. In Study 1, eye movements during the reading of one page of a book were recorded in 3 conditions in a between-subject design: the picture and the oral text presented simultaneously, presenting the picture first and then the oral text, and presenting the text first. In Study 2, looking behavior was monitored during 2 reading sessions of 3 storybooks in 3 conditions in a within-subject design: simultaneous presentation of pictures and text, text-first and a control condition. Additionally, word learning from the books was measured at various levels of word knowledge. It was found in both studies that children in the simultaneous condition fixated longer in total at the parts of the picture that was highlighted in the text as compared to the text-irrelevant

parts of the picture, which was not true for the non-simultaneous conditions. Moreover, children in the simultaneous condition fixated more times at the text-relevant parts of the picture as compared to the other conditions. A mediation model will also be tested in Study 2 with visual attention (partially) mediating the relationship between the pretest and the posttest vocabulary scores. Implications for the role of pictures in storybooks and the integration of visual and verbal information are discussed.

A-019
Look here! No, here! Infants' selective attention to reliable visual cues in the presence of salient distracters
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By 8 months of age, infants are proficient in detecting spatio-temporal contingencies among visual events and using reliable cues to orient attention (Wentworth, Haith, & Hood, 2002; Kirkham, et al., 2007; Wu & Kirkham, 2010). However, outside the laboratory, many potential cues compete for infants' attention and they must discover which features are reliable within a noisy environment. How do infants select and learn related events when more salient distracting items are present? In an eye-tracking study, we showed infants two shapes, one that always triggered an exciting cartoon when they fixated it (a reliable contingency), and the other that did not trigger a reward (a distracter). In Experiment 1, we tested whether 6- and 8-month-olds would learn the relationship between cue and reward when the distracter was more visually salient than the cue. Only 8-month-olds demonstrated increased preferential looking and decreased latencies to the contingent cue, suggesting that they learned its predictive value. In Experiment 2, we removed the contingency between cue and reward to control for the possibility that 8-month-olds had simply habituated to the salient distracter. In Experiment 3, we presented 6-month-olds with equally salient cues and distracters, and found that 6-month-olds could successfully shift attention to the contingent cue when the distracter was not more engaging. Taken together, these experiments suggest that visual learning in infancy is highly dependent on the relative weightings of top-down and bottom-up features (e.g. salience, reliability), which may differ across contexts and developmental time.

A-020
What do 3-year-olds remember from their past?
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Recent research on infant's long-term memory indicates that memories of children younger than 3 years are less detailed and more fragmentary than long-term episodic memories in older children. In a longitudinal research project we investigated whether 3-year-olds who were involved in a deferred imitation task in our lab when they were 9- (young age) respective 18 (older age group) months old are able to retrieve person-, object- and activity-related items from the former study. In a picture-choice-task memory for the model/person as well as for the action-related objects was assessed. In addition, target objects were presented and realization of target actions was analyzed. Memory tests were also done with same-aged control subjects not being involved in longitudinal research. 3-year-olds performed a significant number of actions of the former deferred imitation study which was 27 months ago. In the picture choice-task, however, children from the young age group did not show many person- or object-related recognitions. Person- as well as object-related items were recognized in the picture-choice task from children of the older age group, typically. Besides the finding that long-term memory improves with age our study indicates that activities seem to be retained in young infant's long-term memory. These findings are in line with the theoretical memory view that a form of implicit, action-based memory develops before a more explicit, visual memory. This early implicit memory system allows to retain activities in long-term memory from early on while this is not the case for visual information.

A-021
I have just felt a face: the role of intermodal stimulation and contingency detection in the development of a body image in newborns
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Rochat's theory of self-consciousness development claims that infants are aware of their presence in the world from the moment they are born. Infants for example recognize that there is a perfect contingency between seen and felt movement when looking at their specular image which is thought to allow them to differentiate between their own body and other entities (Rochat, 1997).

With the present study we aim to test whether newborns are sensitive to contingencies in visual-tactile perception when they are not performing actions and therefore cannot control the sensory feedback they receive (Zmyj, 2011). We used a modified version of the Rubber Hand Illusion paradigm during which twenty newborns were presented with a video of an infant's face being stroked on the cheek with a paintbrush, while the neonate's corresponding cheek was either stroked at the same time (synchronous condition), or after a delay (asynchronous condition). We found that the newborns preferred to look at the contingent phase compared to the non-contingent phase (t(19)= 2.76, p<.05, r=.54).

To investigate whether newborns prefer a perfect contingency only in relation to stimuli they can attribute to themselves, we repeated the study with a different group of newborns using inverted faces. We did not find any significant differences between the two conditions, demonstrating that the preference for a perfect matching between visual and tactile stimulation is specific to biological stimuli. These findings suggest that newborns possibly use visual-tactile information as a key mechanism to develop the body image.

A-022
Dogs follow human's voice direction like children do
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Rossano, Carpenter and Tomasello (in press) investigated if children and chimpanzees are able to follow a human's voice direction without any visual cues. In their study, an experimenter squatted behind a huge barrier (out of subjects' sight) and vocalized excitement towards one of two boxes. The children followed this acoustic cue. In contrast, chimpanzees tested with the same set up were not able to follow the human's voice direction in order to find a piece of hidden food in one of two boxes. In the current study, we presented dogs with this communicative cue in the same set up. Dogs are known to outperform other species, especially great apes in their ability to follow humans' visual communicative cues such as pointing. However, the current literature suggests that the dogs need humans' eye contact to be able to use these communicative cues (e.g. Kaminski et al. 2012). The dogs were tested in 12 consecutive trials and the side towards which the experimenter would vocalize was counterbalanced. Our results show that, over all trials, the dogs easily follow the experimenter's voice direction without having eye contact or other visual cues (Wilcoxon test: T+ = 86.0, N = 19, P < 0.001). Like 16-month-old and 12-month-old children in the previous study, dogs were able to use this cue within the first four trials (T+ = 130.0, N = 16, P < 0.001). These findings suggest that dogs' ability in understanding humans' communicative cues might be more flexible than previously supposed.

A-023
Tracking the independent processing of stress and phonemes in the first year of life
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Perceptual narrowing and language-specific learning for word-level stress has been shown in infants younger than six months. It occurs even before infants figure out the typical phonemes of the maternal language. Here we investigated neural underpinnings of stress and phoneme processing in the first year of life. In a priming paradigm, spoken word onset syllables (primes) preceded spoken words (targets). We varied phoneme and stress overlap between primes and targets in four conditions: (i) "phoneme-match, stress-match" (e.g. PUP-PUPpe, Engl. puppet [capitals indicate stressed syllables]); (ii) "phoneme-match, stress-mismatch" (e.g. pup-PUPpe); (iii) "phoneme-mismatch, stress-match" (e.g. FE-PUPpe); (iiii) "phoneme-mismatch, stress-mismatch" (e.g. fe-PUPpe). Event-Related Potentials (ERPs) of thirty 3-month-olds, thirty 6-month-olds and thirty 9-month-olds from German speaking environments were analyzed. A group of thirty adults served as control group. In the ERPs, an early phoneme effect starting at around 100 ms after target onset was present for all groups. A stress effect, starting at around 300 ms, was seen only in the 3-month-olds and in the 9-month-olds. For them, no interaction of phoneme and stress priming was seen suggesting independent processing of both types of information from the speech signal. While 3-month-olds and 9-month-olds seem to use both word stress and phonology, language processing in the 6-month-olds appears to focus on phoneme processing.

A-024
Infants Favor Functional Information in an Ostensive Learning Context
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What kind of information do one-year-old infants generalize within a natural pedagogy learning context? The experimental procedure consisted of a learning phase with a person demonstrating preference for one of two objects and a test phase where one of the objects was grasped. Objects that have been proven to differentiate between function and color were utilized (Träuble & Pauen, 2007). The function-color combination of the objects was swapped between the learning and testing phase, compelling the infants to focus on one or the other characteristic as estimated content of the learning phase. Within a series of three experiments (N = 48), generalization performance of 12-month-old infants was tested by substituting the

ostensively communicating agent with another person in the test phase. Within the rationale of a violation of expectation experiment, looking time analyses suggest that infants generalized object preferences according to functional features and not to color. However, this was not the case when the same preferences were presented in a non-ostensive manner. Taken together, the results suggest that within a forced choice situation, infants are more likely to ascribe generic information status to functional relevant features compared to color features.

A-025
The Role of Agent Action for Causal Reasoning in Infancy
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Causal reasoning is one of the core features of human cognition. Understanding causal relations allows us to predict future events and to effectively intervene on our environment. Research with toddlers suggests that young childrens' ability to infer effective interventions from observations critically depends upon supplemental information like unmediated contact between objects, causal language, or another agent's action (Bonawitz et al., 2010). In the present study, 15-month-olds passively observed three different visual stimuli (L1, L2, and L3) either interrelated in a causal chain (L1, L2, L3 activate in sequence) or in a common cause structure (L2 activates L1 and L3). Prior to this presentation, they had learned to activate L1 using a button. In Experiment 1 (n = 48), the button's function was demonstrated by the experimenter (i.e., a dispositional agent), in Experiment 2, infants discovered it themselves. At test, infants in the causal chain condition pressed the button significantly more often than infants in the common cause condition. The results suggest that they expected L3 to activate as an effect of L1. This interpretation was further supported by an analysis of infants' looking behavior. Infants seem able to infer correct predictions of intervention outcomes from observational data without supplemental information from unmediated contact events or causal language. Preliminary data of Experiment 2 further suggest that this effect persists when the presentation does not involve another agent's action.

A-026
Seeing it your way: Chimpanzees' and preschoolers' performance in a nonverbal level 2 perspective-taking task
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We compared the performance of chimpanzees (N=16) and 6-year-old children (N=16) in a nonverbal level 2 perspective-taking task. Subjects were sitting opposite a conspecific competitor and a vertical board could be slid back and forth between them. Two bread sticks of the same size were attached to the board on the subject's side on different heights such that the subject could fully see them, while to the competitor one stick looked bigger than the other. The competitor chose first in private, and the subject chose thereafter, without knowing which stick was gone. We predicted that if subjects understood the competitor's perspective, they would avoid the location with the stick that looked bigger to the competitor. We compared their behavior to a nonsocial control condition.

We found that both children and chimpanzees chose the bread stick that looked bigger from the other side significantly less often when the competitor was present than when she was absent. Children significantly avoided the stick that looked bigger to the competitor in the social condition, but chose randomly in the control condition. In contrast, chimpanzees significantly preferred the stick that looked bigger from the other side in the control condition; this preference was reduced to chance level in the social condition.

Our results suggest that not only humans, but also chimpanzees understand how objects appear to others. Chimpanzees might also have solved the task by projecting their own preference to the competitor. Both interpretations support recent evidence for a chimpanzee Theory of Mind.

A-027
Neural Correlates of inspection time task performance: a developmental study
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Inspection Time Task (ITT) is used as an index of individual differences in perceptual discrimination speed and it has been proven a reliable predictor of the relationship between processing speed and psychometric intelligence. Converging lines of research have shown that subjects with higher IQ can correctly identify a briefly presented stimulus more quickly and with greater accuracy than those of a lower IQ. The present study used two age-matched samples of children aged 7 through 18 years, selected on the basis of their scores on Wechsler Abbreviated Scales of Intelligence. Children performed the ITT while their electro-cortical activity was registered using a high-density 128-channel electroencephalography acquisition system. General differences were found in the amplitude course of event-related potentials (ERPs) between the high and low IQ groups that are consistent with their differences in inspection time. The high IQ group showed faster response times, made significantly fewer errors and exhibited a significantly larger N1 response. N1 latency and other ERP components did not distinguish the two IQ groups. Given the specificity of ERP group differences to the N1, the results of the present study show that the 'low IQ' group faces difficulties related to the allocation of attentional resources.

A-028
Numerical Abilities and Spatial Cognition In Preschool Children
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A large body of evidence indicates the association between the representations of space and numerical abilities in healthy and brain-damaged adults. Most of the results derived from those studies, investigating the representation of mental number line (the numbers are initially represented on a continuous left-to-right-oriented line). But only few developmental studies investigated how numerosity is extracted from a visual-spatial display in early ages. The aim of present study was to investigate the development of spatial-numeric associations before children begin school. We examined the directional biases in how children (3-, 4- and 5-year olds) used numeric information on a spatial task before formal reading practice and schooling. Using manual non-directional bisection paradigm children were asked to indicate the midpoint of a horizontally displayed line flanked by two dot

arrays differing in numerosity. The visuo-spatial properties of the flanker varied across the four conditions (equal total surface, different total surface, well-defined contour, structured arrays of the dots). The results showed that children in each age group displayed bias in their line bisection, choosing a midpoint that is closer to the larger numerosity. However, children tend to show bias toward the larger numerosity in those conditions where the total surface of the flanker was equal. The results indicate that spatial-numeric associations emerge long before children begin reading. This ability might be modulated by embodied visuo-motor activity such as counting routine with fingers.

Keywords: spatial cognition, numerical abilities, mental line bisection, non-numerical properties of visual display

A-029
You and me as we: The effects of cooperation and minimal group membership on children's affiliation, prosocial behavior, and trust
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In our everyday lives, we feel connected to other people in various ways. Even with strangers, we are able to experience being a 'we' in at least two ways, either by collaborating with them to achieve a shared goal or by belonging to the same social group. Tomasello and colleagues (2012) recently discussed the evolutionary emergence of these two mechanisms, but the developmental pattern remains unclear. Therefore, this study investigates the effects of collaboration and minimal group membership on the developmental emergence of feelings of being a 'we'. In the first, the collaboration experiment, children collaborated with one puppet while another puppet was said to collaborate with someone else. In the other, minimal group experiment children were assigned a color group and later presented with a minimal in-group (same color) and a minimal out-group member (other color) puppet. In both experiments, children then had to choose between the puppets in five forced-choice tasks (helping, resource allocation, trust, liking and a goodbye hug). Five-year olds (N=72) showed significant preferences for both collaborators and minimal in-group members. In a follow-up study we are investigating the developmental emergence of these preferences with 3-year-olds; testing is currently in progress. These findings suggest that both directly collaborating with a partner and being members of the same minimal group are enough to increase 5-year-olds' prosocial behavior and affiliation. Comparing these results with the performance of 3-year-olds will help shed light on the development of feelings of group membership - being a 'we' - in young children.

A-030
Infants Preparing to Learn – Increase in Theta Band Activation in Expectation of Novel Information

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An important recent development in our understanding of mechanisms that enable efficient learning is that effective memory formation relies on neural activity just before new information is received. Importantly, while the rate of learning varies over time for any individual partly due to random fluctuation of brain state (Yoo et al., 2011), neural states that predict successful memory formation were also found to be elicited by motivation (Gruber and Otten, 2010), and by heightened interest or curiosity (Kang et al., 2009), reflecting a strategic preparatory state in anticipation of receiving desired information.

In our study, we explored this mechanism in infants, by familiarizing them with two adults, one of whom is informative and provides them with labels of novel objects, whereas the other is equally engaging, but provides no information. We obtained EEG data during the period of anticipation (of information or a non-informative interaction) and examined theta oscillations, an increase in amplitude of which was shown to directly correlate and predict the rate of recall for stimuli presented during these states in adults (Guderian et al., 2007). We observed increased activity in the theta frequency band, when infants faced the informative as compared to when they faced the non-informative person, in right temporal area (t=4.365, p=0.001), suggesting this frequency band might have the same functional role of preparedness for learning in infants' brain as it does in adults. We hope make use of this measure in future studies exploring the relationship between interest and learning in infants.

A-031
Cycles in Speed-Working Memory-G Relations: Towards a Developmental-Differential Theory of the Mind

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This presentation summarizes four studies, two of them longitudinal and one intervention, which investigated the relations between age, processing speed, working memory (WM), and fluid intelligence (gf) from 4 to 16 years of age. Structural equations modeling showed that speed was a powerful covariate of age (~-.6 to -.7) from 4 to 13 years, declining thereafter (to ~-.2). WM was stably related to speed through the whole age-span studied (~-.4-.5). A large part (59%) of age-related changes in gf (83%) from 4-7 years and a lower but significant part later on, especially in adolescence (~10-20% out of ~40-50%), were mediated by WM. However, with speed and age controlled, WM was almost fully commensurate with gf (~.9), from about the age of 8-9 years onwards. Hierarchical modeling indicated that a three-level architecture (specialized processes, general functions, i.e. speed, WM, and gf, and G, is stable in development. Analysis of change in residual covariances in each of these levels revealed that change over time originated from within the processes themselves and G. The size of G-driven change was higher in phases of intense reconstruction of gf processes. Overall, speed signified age-associated changes in processing capabilities, directly expressed in WM expansions which contributed to gf reconstructions. However, gf reconstructions were extensively self-reliant, with a pace of implementation somewhat faster if WM was high. An overarching model is proposed and implications are discussed.

A-032
The interrelation of overt and covert orienting in 12-month-olds

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Anticipating other peoples' action goals results in goal-directed, overt eye movements in 12-month-olds (Falck-Ytter, Gredebäck & von Hofsten, 2006). Covert attentional shifts toward the location of a potential action goal occur when observing incomplete actions (Daum & Gredebäck, 2011). We investigated how these two processes are related in 12-month-olds. Infants viewed complete (overt-attention) or incomplete (covert-attention) actions on an eye tracker. In overt-attention actions, a hand grasped one of two toys (goal and non-goal). Gaze shift latencies toward the toys were assessed. In the covert-attention actions, the same movement was shown without the toys. The hand stopped at a central location, disappeared and a target was presented randomly at a location congruent or incongruent to the grasping direction. Saccadic reaction times (SRT) upon target appearance were measured. In the covert-attention task, eleven infants showed a congruence effect (C-group) and fifteen infants showed no congruence effect (NC-group). No overall congruence effect was observed, but separate group analyses revealed different behavior in overt-attention actions. The C-Group showed predictive gaze shifts above chance and a more anticipatory than reactive first gaze shifts toward the goal. Latencies toward the goal were shorter than toward the non-goal. In the NC-Group, prediction rate was not above chance and first gaze shifts toward the goal were not more often predictive than reactive. No difference occurred between latencies toward the goal and toward the non-goal. These findings suggest that the abilities to orient covert and overt attention in a goal-directed manner are related in 12-month-olds.

A-033
What drives set-size effects? Investigating the role of rule representation in the development of cognitive flexibility

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When switching between two conflicting tasks, such as matching stimuli by colour or by shape, switch trials are often slower and less accurate than no-switch trials. Children and adults have reduced switch costs when the tasks have a larger set-size (i.e. when there are many exemplars of a particular dimension), compared to when tasks have a smaller set-size (Kray et al., 2012). The current study tests a possible explanation of these findings: that larger set-sizes lead to more abstract and flexible rule representation. A two-by-two design was used to separate set-size effects on initial rule representation from set-size effects that occur on later trials. 252 children between 5 and 11 years completed one of four versions of the Switching, Inhibition and Flexibility Task (SwIFT, Carroll et al. 2012). There were two levels of set-size: either two or nine exemplars of colour and shape. The set-size was either consistent across the two blocks, or changed between the blocks. Consistent with previous findings, there were RT switch costs with a smaller set-size (ps < 0.001), but none with a larger set-size (ps > 0.05). Switch costs during the second block were determined by set-size in the second block but not set-size in the first block. These findings suggest that children's initial rule-representation does not affect later switch costs. If the larger set-size did lead to more flexible rule representation in the first block, these flexible representations did not carry over to trials with a smaller set-size in the second block.

A-034
What type of cues do children use while selecting pictures for other people?

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Children use different cues such as shape, size, orientation, and artist's intention to determine the label for pictures. During the years of critical language learning, children become flexible in their labeling of images (they understand that a single picture can be used to represent more than one entity). This study aims to determine the flexibility with which children select pictorial representations. Furthermore, it attempts to determine the cues which they use while selecting images for individuals with no prior knowledge of the objects that these images represent. In a series of experiments, 22 typically developing children between the ages of 3 and 5 years were asked to select line drawings with pre-established

labels for another child with no prior knowledge about the target objects. The results showed that when the drawings resembled the target objects, the older children were relatively flexible in accepting different labels for drawings with pre-established labels. On the contrary, both older and younger children failed to show clear representational flexibility when the drawings had no resemblance with the target objects. Finally, we wanted to determine if children accepted scribbles as representing real objects. Although children readily accepted "scribble" as representing a "house" when shown in isolation, they were hesitant to select it when it had to be shown to someone with no prior knowledge. Children perhaps have an understanding that scribbles are difficult to interpret and may not be useful to others. These findings suggest that children use theory of mind reasoning while interpreting pictures.

A-035
18-month-olds comprehend indirect communicative acts

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Most human communication works by the communicator referring the recipient's attention to something, and then the recipient uses this referential act – and perhaps other information – to infer what the communicator is intending to communicate. The referential act can be conceptually closer or farther from the communicator's overall communicative intention.

Previous studies of infants' understanding of communicative intentions have used referential acts very close to that intention. Thus, Behne et al. (2005) pointed to one of two cups for 18-month-old infants. The infants understood that this referential act was intended to inform them of the location of a sought-for toy.

In the current study we wanted to know if infants this young would be able to infer an adult's communicative intention if it was related to the referential act more indirectly. Children were shown a chest containing toys that were needed for a game and a key that opened the chest. When the child needed another toy to complete the game, the adult either showed her the key (Ostensive Condition) or inadvertently moved the key in the direction of the child so that she noticed it (Accidental Condition).

Children of both 18 and 26 months of age identified the ostensive showing of the key as an indirect request to go open the chest and retrieve the toy, whereas they did not try to do so in the Accidental Condition (18-month-olds: χ^2=8.023, p=.015; 26-month-olds: χ^2=8.640, p=.008).

Young children thus are able to infer a communicative intention from rather indirect referential acts.

A-036
Young Children Value Loyalty to the Group
A. Misch, H. Over, M. Carpenter
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As adults, loyalty to the group is very important to us. We stick with our group even when it costs us and often punish individuals who leave harshly. Developmental research on loyalty is scarce. Therefore, in this study, 4- and 5-year-old children (n=49 at each age; means = 4;7 and 5;5) were shown a video in which two groups competed in a tower-building contest. Two members of the losing group were brought into focus. One of them, the disloyal individual, stated that she would like to win too and therefore would leave her group to join the other group. The loyal individual, in contrast, stated that she too would like to win, but that she would stay with her group. Following the video, children were asked five forced-choice questions about these two individuals. Binomial tests for the 5-year-olds revealed that children judged the loyal person as nicer (p=.019) and more trustworthy (p=.04). They thought that she did the right thing (p=.004), and tended to reward her more (p=.085). Furthermore, they judged that the other group members would now dislike the disloyal person (p=.01). Four-year-olds also responded in the hypothesized direction for each question, but their results were all only marginally significant. Upon being asked to justify their answers, 71% of the 5-year-olds and 40% of the 4-year-olds justified their decision with a reference to loyalty. These results show that young children value loyalty to groups and have some understanding of the norms and commitments that are associated with group membership.

A-037
Contingency Analysis and Life-History Development
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Recent empirical work shows that early-life harshness and unpredictability are independently associated with long-term developmental outcomes. These studies suppose that environmental stressors affect parental investment (e.g. responsiveness), which then shapes child development (e.g. onset of puberty). This work has detailed mediating physiological pathways, but it has not specified how children transform experiences with their parents' and others' responsiveness into cognitive estimates about environmental harshness or unpredictability. Here, we analyze this estimation process drawing on the study of contingency analysis. We propose that harshness and unpredictability produce distinct contingency profiles, and that children use these profiles to separately estimate each dimension. We conclude by discussing six empirical predictions.

A-038
Children's spontaneous responses to moral and conventional transgressions: An experimental approach
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A wide array of research in the tradition of social domain theory (Turiel, 1983) has accumulated extensive evidence that young children are able to distinguish between conventional and moral norms. However, most of this work has relied on interview methods and naturalistic observations of prototypical events leaving open the question of how children respond to unfamiliar events in a controlled setting. For the present study, we conducted an experiment during which we confronted 5-year-olds with moral and conventional transgressions and coded their spontaneous normative utterances and behavioral responses. We tested 16 same-sex dyads who had participated in a prior experiment during which they autonomously created their own rules of playing with a marble run and won rewards depending on how many marbles they retrieved. For the present experiment, the same marble run was used and the dyads played together with a naïve puppet who performed a conventional and a moral mistake (2 trials each; within-subjects; order counterbalanced) by putting marbles in a box where they were either retrievable (conventional) or lost (moral). Results revealed that children used the same proportion and forms of normative utterances in both conditions ($\chi^2 = 0.11$, df=1, p=.74). However, children showed significantly higher emotional agitation (t(15)=4.68, p<.01), more tattling, and preventive measures towards the puppet following moral transgressions as compared to conventional transgressions (McNemar's tests, ps<.05). These findings suggest that while children do understand both types of mistakes differently as expressed in their behavior, they linguistically apply the same normative force to both types of transgressions.

A-039
The influence of visual emotional input properties on the acquisition of verb meanings in 24-month-old monolingual German learning children

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There is evidence that emotional properties of the input, like, happy or angry intonation or facial expressions of a speaker referring to an object or action (e.g. Mumme & Fernald, 2003), influence the learning and memory of words for these referents. These properties we call extrinsic emotional properties.

The present study focuses on the still disregarded question, whether we will find similar influences on word learning and memory when these emotional properties are features of the referents of the words to be acquired, like the happy or angry facial expression of an actor who is acting on an object, which we call intrinsic emotional properties.

We tested 24-month-old monolingual German learning children (n = 36), using a variant of the intermodal preferential looking paradigm (Waxman et al., 2009). In a training session children were presented novel verbs while watching short actions, resembling natural situations of word learning, with either a negative or neutral facial expression of the actor; a positive condition is also planned. Successful learning and memory was assessed by tests immediately after training and seven days later.

Preliminary results revealed a positive effect of the negative internal emotional input property on verb learning immediately after training, which disappeared after seven days.

We will discuss our results in the light of the results of studies with external emotional properties.

We plan further studies with the same design with 14- and 36-month-olds in order to clarify the interaction of emotional, cognitive, and linguistic development, which is still only partially understood.

A-040
The development of the mental representation of fraction magnitude

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We investigated the development of mental representations of the global magnitude of fractions during the initial stages of fraction learning in Grade 5, 6 and 7 children as well as in adults. We examined the activation of global fraction magnitude in a numerical comparison task and a matching task. There were global distance effects in the comparison task but not in the matching task. This suggests that the activation of the global magnitude representation of fractions is not necessary in all tasks involving magnitude judgments. The slope of the global distance effect increased during early fraction learning and declined by adulthood, demonstrating that the development of the fraction global distance effect differs from that of the integer distance effect.

A-041
Investigating the flexibility of 14-month-olds' rational imitation

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Previous studies have demonstrated the capability of preverbal infants to imitate rationally (Gergely, Bekkering, & Király, 2002). While researchers have investigated the flexibility of such a skill by employing tasks other than the classical head-touch task (Schwier, van Maanen, Carpenter, & Tomasello, 2006), there has been only one study until now (Buttelmann, Carpenter, Call, & Tomasello, 2008) that has examined infants' ability to alter their imitative behaviour across conditions that entailed different constraints for the model. Whereas Buttelmann et al.'s (2008) study has focused on rational tool use; the present research project applied the same design to body part imitation. In a within-subjects design, children were presented with a model executing two unfamiliar actions (head- and sit-touch) in two conditions (hands-free and hands-occupied) in order to turn on two apparatuses (two modalities: light and sound). The novelty of the study is, therefore, that it could yield strong evidence for the flexibility of preverbal infants' rational imitation skills, not only across conditions, but also across tasks and apparatuses with different modalities. Preliminary results implied a tendency for infants to alter their imitative behaviour across conditions, as they were more likely to imitate the head- or the sit-touch in the hands-free than in the hands-occupied condition (Z = -1.684, p = .092). Data collection is still in progress but will be finished in the following weeks.

A-042
Detailed phonological representations in three-month-olds

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Previous studies with adults demonstrated phonological processing that is gradually sensitive to mismatch between word form representations and the speech signal. Here we investigated phonological processing in three-month-olds. We recorded event-related potentials (ERPs) in unimodal auditory word onset-priming. Infants listened to initial syllables of German words (primes) which were followed by complete German words (targets). Common words, frequently used in caregiver-infant interactions, were chosen from an early words screening inventory (German version of the McArthur Communicative Development Inventories). In an identity condition, the primes were the onsets of the target words (e.g. Ma – Mama). In a variation condition, the primes differed from the targets only in the initial place of articulation (e.g. Na – Mama). In a control condition there was no overlap between prime and target (e.g. Pup – Mama). We tested 30 three-month-olds (16 girls) from German speaking parents. Starting 450 ms after target word onset, ERPs differentiated the identical and the control condition as well as the variation condition and the identical condition. This is evidence for phonological processing that does not tolerate any mismatch in the speech signal. In the time window of 950ms – 1150ms, a difference between the identical and the control condition as well as between the variation and the control condition was observable. This is evidence for processing that gradually weights mismatch in the speech signal. Our results indicate that the activation of early phonological representations in three-month-olds is sensitive to variation in a single phonetic feature, namely place of articulation.

A-043
Action Production Enhances Verb Learning in Toddlers

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Recent findings suggest that learning a novel word is enriched by enactment (Macedonia & Knösche, 2011). This finding supports the notion that action can enhance the acquisition of novel words. We examined this effect in first language acquisition from a developmental perspective. In a word-learning study 24-, 30- and 36-month-old children learned the labels of object actions (i.e. actions differing in object appearances but not in movement) and motion actions (i.e. actions differing in object appearances and movement). These actions were presented in two conditions: in the passive condition children observed the experimenter executing the action; in the active condition children were asked to execute the action themselves after observing the experimenter. One of the three actions was labelled by a novel verb while the others were introduced by neutral language. We coded whether children chose the correct object and the correct action in the test phase. In the object actions, analyses showed no differences at verb learning between the two conditions. Children in both conditions were able to acquire the novel verb. In contrast, verb learning was enhanced in the active condition of the motion actions in the 24- and 30-month-old children as indicated by the learning pattern. At the age of 36 months these differences then diminished. Accordingly, the results support the idea that enactment is beneficial for the acquisition of verbs if the action information is relevant. The beneficial effect is present at the beginning of the verb acquisition phase and later diminishes.

A-044
Relationship-specific attachment and intraindividual variability in social cognition

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The capacity to mentalize, i.e. a form of social cognition that enables to perceive and interpret human behaviour in terms of intentional mental states (Frith & Frith, 2003), seems to emerge in early childhood and seems to require social interaction to develop adequately (e.g. Meins et al., 2001). Thus, there is an increasing interest in understanding how relationships promote mentalization. Particularly, the attachment relationships (Bowlby, 1969) offer a natural context of learning about minds and extant research have reported positive associations between secure attachment and mentalizing ability (Fonagy, Bateman, Luyten, 2011). However, these studies have typically overlooked the findings that people posses multiple attachment relationships which, in addition, may vary in quality across relational contexts (e.g. Fraley, 1997). A key question in this study is whether the ability and motivation to infer about others' mental states is a general trait disregarding a relationship context or, alternatively, we can observe an intraindividual variability in mentalization due to its relationship-specificity. 115 participants (mean age 21.13, SD = 3.48) report both their relationship-specific and global attachment styles (Fraley et al., 2011) as well as a tendency for a perspective-taking ability (Davis, 1983) in four kinds of relationships: with mother, father, romantic partners, and best friends. Reading the Mind in the Eyes Task (Baron-Cohen et al., 2001) has been used as a proxy for more general characteristics of mentalization. The results indicate that a tendency to infer about others' mental states is embedded within specific attachment relationships and is related to its avoidance dimension.

A-045
Primitives of logical reasoning: disjunction

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Representing alternative hypotheses is a fundamental mode of common and scientific reasoning. The logical operator of disjunction allows to represent hypotheses as collectively exhaustive and to trim the hypothesis space by eliminating some of them via disjunctive syllogism (H1 or H2; not H1; therefore, H2). Here we ask if prelinguistic infants possess the representational resources to reason by disjunctive syllogism. We address this question with three experiments based on an "event mapping" task. We present infants with videos containing two objects that belong to different categories but look identical under partial occlusion. In a part of the scene, one object is fully hidden whereas another object is partially hidden by a container, so that only its ambiguous part is shown. Infants might represent the partially hidden object disjunctively, as an object belonging to either category A or category B. Finally, the scene ends with a possible or an impossible outcome. Infants can detect the possibility/impossibility of the outcome by performing a disjunctive syllogism. In Experiment1, 19-month-olds succeed in detecting the impossible outcome. In Experiment2, 12-month-olds fail to detect the difference between the two outcomes. In Experiment3, we simplify the scenes and found that 12-month-olds succeed, but only with couples containing a strong category contrast. Such interaction suggests that the ability to perform disjunctive syllogism might be present in prelinguistic infants, but the ability to deploy this reasoning strategy depends on how well they encode the categories of the objects present in the scene.

A-046
Oscillatory brain activity of joint attention in infancy

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The ability to engage in triadic interactions plays a crucial role for learning processes in the first year of life (Striano & Reid, 2006). The influence of a joint attention (JA) interaction on object processing was investigated in 9-month-old infants using a live joint attention paradigm.

Novel objects were presented to the infants in two conditions while measuring EEG: in the JA condition the experimenter made eye contact with the infant and then turned to a computer screen where a novel object was presented for 1000 ms. In the no-JA condition the experimenter gazed only at the object without making eye contact before.

Analyzing event-related potentials, a greater Nc amplitude was found in reaction to objects presented in the JA condition in comparison to objects presented in the no-JA condition (Striano, Reid, & Hoehl, 2006) suggesting that eye contact lead to greater allocation of attention towards the objects presented afterwards.

These data were reanalyzed with regard to oscillatory brain activity conducting a Fast Fourier Transformation over the time segment in which the novel object appeared on screen. 27 infants were included into the final sample. The mean signal power on the frequency band 2.9-4.9 Hz was used as the dependent variable. A main effect of condition (JA vs. no-JA) was found: mean signal power was reduced in the JA compared to the no-JA condition, $F(1,26)=7,605$, $p<0.05$. Additional time-frequency analyses are underway.

Results will be discussed in terms of functional development of oscillatory brain activity and social cognitive development.

A-047
Cognitive attraction and cultural evolution: How portraits turned their eyes upon us

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It has often been suggested that innate features of the human mind could make some cultural forms more successful than others. Little is known, however, about the specific workings of this « cognitive attraction » and its developmental underpinnings. This poster presents a simple example of cognitive attraction, and a mechanism that could explain it. In two traditions (Korean paintings and European Renaissance paintings) portraits are shown to shift from a stage where most portraits do not stare at the viewer, to a state where most portraits do. This is consistent with studies showing that direct eye-gaze catches the attention of adults, children, and newborns. It is proposed that direct eye-gaze portraits prevailed because they were more likely to become famous, and because young painters learnt portraiture by copying famous portraits. Consistent with this view, direct eye-gaze portraits from both traditions

are more likely to be featured in art books (as opposed to less selective museum catalogues). An analysis of the demographic dynamic underlying the European shift shows that it was due to the arrival of new generations of painters. Those artists show a preference for direct eye-gaze portraits as soon as they start painting, suggesting that they acquired the new style in the years of their apprenticeship. These results suggest that cognitive attraction influences not just the production of cultural forms, but also their selection and evolution. Like some cases of language evolution, cognitive attraction might depend on new generations of learners.

A-048
Categorizing prosodic phrases: A Bayesian model relying on function words and prosodic boundaries

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In this study, we focus on the beginning of language acquisition and simulate how infants start to acquire rudiments of syntax. Christophe et al (2008) proposed that function words and phrasal prosody may allow young children to build a first approximation of the syntactic tree, the syntactic skeleton, where prosodic boundaries correspond to syntactic constituent boundaries, and function words label these units (Noun Phrase, Verb Phrase). Such a representation would help the child to gain insight into the syntactic structure of her language, and in particular, enable her to infer the category of unknown content words: an NP should contain a noun (referring to an object) while a VP should contain a verb (referring to an action).

To computationally evaluate the cognitive plausibility of such a model, we implemented two variants of the Naïve Bayes Expectation-Maximisation algorithm operating on a prosodically-annotated corpus of child-directed speech: an unsupervised model relying on frequent function words, and a semi-supervised model relying on initial knowledge of some common content words. The first model clusters together similar prosodic phrases, while the second labels prosodic phrases either as NPs or VPs. Both models corroborate the syntactic skeleton hypothesis. With as little initial knowledge as 2% of the corpus, our second model managed to construct highly precise VP and NP clusters (purity above 80%), which span 40% of these categories. We conclude that such a partial syntactic representation based on the speech signal can be learnt via minimally supervised clustering and would be useful for syntactic categorization.

A-049
The Effect of Mothers' Self-Construal on Memory Characteristics of Iranian Mother-Child Conversations

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This study aims to explore, a) memory characteristics of mother-child conversations from Iran, and b) how mothers' self-construals affect their conversations with their children, and child outcomes. Twenty-five Iranian mother-child pairs were asked to draw a picture, and then play with a puzzle together. All conversations were audio-recorded and transcribed verbatim. A native speaker coded both conversations for memory characteristics. We coded for the total number of words and sentences, self-, other- and we-related words, mothers' context statements, their evaluations, repetitions of both context statements (Kents and evaluations, in addition to yes-no and open-ended questions, and their repetitions. Mothers filled out a questionnaire including demographic questions, and the Balanced Integration-Differentiation Scale, which measures self-construals formed by individuation and relatedness orientations.

Preliminary results showed that, in the first conversation, as mothers' relatedness increases, and individuation and actual age decreases; number of children's we-related words showed a significant (b = 1.553, t(4) = 13.959, p=.046), and number of children's elaborative questions showed a marginally significant (b = -.605, t(4) = -7.69, p=.082) increase. Furthermore, as mothers' individuation increases, their use of self-related words showed a marginally significant increase (b = .908, t(4) = 3.386, p=.077).

In the second conversation, as mothers' relatedness and age increase and individuation decreases; their children's yes-no questions (b=.905, t(4)=23.524, p=.027), mothers' yes-no question repetitions (b=1.363, t(4)=23.847, p=.027) showed a significant, and mothers' self-related words (b=.690, t(4)=11.684, p=.054) and children's we-related words (b=1.021, t(4)=6.834, p=.092) showed a marginally significant increase. As codings are completed, results will be discussed.

A-050
The interference phenomenon in deaf children solving operations.

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Objective: Seven deaf from birth adolescents (aged 12:04 and 15:11) solved by couples addition and subtraction operations. We analyze the phenomenon of interference between using fingers to keep track of counting and using fingers to sign numerals in the solving process, to participate with our own data in a discussion settled by previous studies (Secada, 1981; Frostad, 1999).
Background: Secada (1981) observed that when deaf children had to coordinate counting in sign on one hand with keeping track of the counting process on the other hand, this procedure caused interference. On the contrary, Frostad (1999) found that the deaf children in his study had no problem in attending to two messages in the same modality.
Methodology: Each member of the couple posed the operation and problem to the other student, this student solved the operation and then the companion corrected the exercise. We made a microanalysis of two fragments where two students explain to their companion the mistake he/she has committed to observe whether interference appeared or not.
Results: Our results show that these students seem to be able to combine keeping track of counting and signing numerals at the same time without problem in the process of explaining the operation to their classmates. As programs of bilingual education are being implemented in Spain and other countries, phenomena as interference deserve study because this subject should be taken into account to assess the gains and pitfalls of mathematics education in sign.
Keywords: deafness- learning mathematics- solving strategies-interference

A-051
Do Japanese and Hungarian 3- to 5-year-olds exhibit response biases to incomprehensible yes-no questions?

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Our previous studies indicated that younger preschoolers exhibit a yes bias due to underdeveloped cognitive abilities, whereas older preschoolers have good command of "yes" and "no" usage. The present study investigated whether Japanese and Hungarian 3- to 5-year-olds exhibit response biases to comprehensible (e.g. "Is this green?") and incomprehensible questions (e.g. "Is this reneg?") pertaining to familiar and unfamiliar objects. We also examined whether the children spontaneously say "I don't know" to the questions.

Japanese 3-year-olds exhibited a yes bias in all conditions, but Hungarian 3-year-olds exhibited a nay-saying bias to incomprehensible-familiar condition. Japanese 4-year-olds exhibited a yes bias to both comprehensible conditions, and Hungarian 4-year-olds exhibited a nay-saying bias to both incomprehensible conditions. Older children's tendencies in the two countries were similar. Both Japanese and Hungarian 5-year-olds exhibited a nay-saying bias to both incomprehensible conditions. Japanese 6-year-olds exhibited a nay-saying bias except comprehensible-unfamiliar condition, and Hungarian 6-year-olds exhibited a nay-saying bias except comprehensible-familiar condition. "I don't know" response was observed most often in incomprehensible-unfamiliar condition.

The data shows different patterns for Hungarian and Japanese 3-year-olds with a more pertinent yes bias for the Japanese sample.However, we found that Japanese and Hungarian 5- and 6-year-olds exhibited a nay-saying bias to incomprehensible questions similarly. Children's "no" response can include disagreement with the incomprehensible questions (Waterman, Blades, & Spencer, 2001). If this is the case, our results may indicate that older preschoolers try to understand questioners' intentional meanings with saying "no" or "I don't know".

A-052
What helps children to acquire "the language of ToM"?

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The report contains the analysed results which revealed a correlation between the semantic type of caregiver questions and the cognitive / linguistic development of the child. This typology is founded on the distinction between questions to dictum (dictum proposition) and to modus (modus proposition) (Bally). The study was based on the longitudinal diaries and recordings data of Russian children.

Our results have shown that adult modus questions (MQ) appeal to the mental, emotional or perceptual state of a child: What do you think …? How did you find out that …? Why does he think that…? Mental modus containing spheres of 'knowledge', 'opinion', 'thinking' etc. better demonstrates connections between judgment and its subject, and thus contributes to the emergence of MQ. MQ are aimed at the development of the child's introspective

abilities to speculate on its/other mental states, and help children to form initial beliefs about themselves as intellectual human beings. MQ trigger a new – internal/'subjective' – sphere of mental advancement, which is characterized by the developing invariant concepts of reality, and reflection on various viewpoints.

Despite the fact that MQ are important for child cognitive development, due to making a contribution to forming ToM and overcoming the egocentric thinking, their use represents a feature of adult communicative behavior. The first adult MQ appear as pseudo- and meta-interrogative ones after dictum questions have evoked a perception of the exterior/'physical' world, and have contributed to initial categorization of realities referring to the denotative situation: Who is it? What is Dad doing? etc.

A-053
Stress and phonemes processing in word comprehension in pre-reading preschoolers to beginning readers

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Formerly, we have shown that the processing of phoneme information in spoken words is modulated by reading experience in monolingual German children (Schild, Röder, & Friedrich, 2011). We related this effect to grapheme-phoneme mapping that is needed for accurate reading. Here we tested how information that is not encoded in the written signal in German, namely syllable stress, is processed by pre-reading and reading children. In a priming paradigm, spoken word onset syllables (primes) preceded spoken words (targets). We varied phoneme and stress overlap between primes and targets in four conditions: (i) "phoneme-match, stress-match" (e.g. DO-DOse, Engl. can [capitals indicate stressed syllables]); (ii) "phoneme-match, stress-mismatch" (e.g. do-DOse); (iii) "phoneme-mismatch, stress-match" (e.g. BA-DOse); (iiii) "phoneme-mismatch, stress-mismatch" (e.g. ba-DOse). Lexical decisions and Event-Related Potentials (ERPs) for the targets were obtained from 23 non-reading preschoolers, 10 reading preschoolers and 24 beginning readers. In all groups, behavioral responses were fastest for the "phoneme-match, stress-match"- condition, indicating that both types of information are integrated to prepare the response. Furthermore, ERP effects were comparable across all groups. We obtained independent effects in timing and scalp distribution for stress and phoneme priming. The present results reveal that the formerly obtained higher sensitivity to phoneme mismatch between prime and target in readers compared to pre-readers does not generalize to syllable stress. Thus, learning to read does not appear to modulate the sensitivity to all types of information available in the acoustic signal, but selectively shapes the sensitivity to phoneme information.

A-054
The interaction of grammatical and visual information in pre-schoolers' understanding of doubly quantified sentences

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Sentences containing two quantifiers are ambiguous, e.g. (1) Two boys are building three towers can mean (1.1)'There are 2 boys, each building 3 towers', and (1.2) 'There are 3 towers, each built by 2 boys'. In a previous sentence-picture matching experiment (É. Kiss, Gerőcs, Zétényi 2011) we found that Hungarian preschoolers can understand doubly quantified sentences, however, their preferred interpretation is affected by visual cues. Our poster presents a follow-up study testing the role of visual information in children's scope interpretation. We hypothesized that (i) children assign wide scope to the objects that are visually more salient; and/or (ii) they choose the visual representation that is easier to segment into identical sub-events (as found by research on children's interpretation of 'every'). (For (1) under reading (1.1), the sub-events consist of 1 boy+3 towers; under reading (1.2), they consist of 1 tower + 2 boys). We tested Hungarian preschoolers (mean age: 6;6) in a sentence-picture matching task. In one set of picture-pairs, we varied the relative size of the two types of objects. In another set of picture-pairs, the pictures differed in how clearly the sub-events were separated by empty spaces. We found that the relative size of the two types of objects plays no role; children choose the picture which is more clearly segmented into distinct sub-events. Our results confirm that Hungarian preschoolers' interpretation of relative scope is not isomorph with the linear order of quantifiers (contrary to Lidz, Musolino (2002)); they rely on both grammatical and visual resources.

A-055
Toddler's understanding of false beliefs about object identity

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Decades of ToM research revealed 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 might be masked by performance problems in explicit tasks (e.g. Leslie, 2005). More Sceptical positions 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 and features, but not FB's about identity (Apperly & Butterfill, 2009).

Following Buttelmann et al. (2009), we developed a paradigm to contrast 2.5 year olds active helping behavior in a 2 (identity/location) X 2 (false/true belief) design. Preliminary data suggest that infants succeed on the location-change task but do not yet support understanding in the identity-change task.

The data of this study will help to clarify the cognitive structure of early ToM capacities and to test between competing theories.

A-056
How do infants individuate abstract agents?

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Recent research on object individuation found evidence that 10-month-old infants can differentiate a humanlike object from a not humanlike object (Bonatti et al., 2002), a self-propelled agent from an inert object (Surian & Caldi, 2010), but crucially not an agent from another agent, even though the agents had different surface, and dynamic features. This is in contrast with the object domain where function demonstration induces individuation of artifacts (Futó et al., 2009). We propose that in the domain of agents the basis of individuation can be the goal chosen by that agent (similarly to a function of an artifact).

This suggestion is supported by recent evidence on the understanding of goal-directed behavior: various studies reported that while the choice of means and/or outcome is a requirement for attributing goal directedness (Csibra, 2008; Luo, 2011), goal changes (even to previously not available ones) violate infants' expectations (Hernik, & Southgate, 2012). Critically, although there is no apparent reason for choice being a stable characteristic of an agent, in these experiments infants clearly treat it as such.

We are testing our proposal by running an individuation study based on the violation of expectation method of Xu and Carey (1996). But our two abstract animated agents behave like the ones in the Woodward paradigm (Wooodward, 1995): they are choosing their respective outcome from two alternatives. Our hypothesis is that, induced by these kind of differences in choice, 10 month old infants will individuate agents evidenced by expecting two objects behind the occluder.

A-057
Listeners can distinguish non-linguistic infant vocalisations cross-culturally

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Some classes of non-linguistic vocalisations of human infants show systematic acoustic variation that is linked to the contexts in which these vocalisations are produced. In a recent study we demonstrated that infants between 11 and 18 months produced acoustically distinct non-linguistic vocalisations in five different social contexts (declarative pointing, giving an object, requesting an action, protesting, and requesting food). These variations were to a large degree cross-culturally consistent between infants growing up in Scotland and rural Uganda, providing a potential source of information about the infant's emotional state and behavioural activities for the caregiver. Here, we investigated whether listeners can use this information to infer the context in which a vocalisation was produced using a playback paradigm. To control for cultural and linguistic influences, we tested whether listeners (parents and non-parents) from two cultures (Scotland and Uganda) correctly matched audio recordings of infant vocalisations of their own or another culture to their respective production contexts. Results showed that all participants performed above chance level, regardless of prior experience with infants or cultural background. Furthermore, only parents of Scottish infants showed a higher rate of correct classification with audio stimuli from Scottish infants, all other groups did not show sensitivities to the producer's culture.

This suggests the existence of a non-linguistic human vocal system with acoustic variations that contain some information about the signaller's activities and motivations. We suggest that these types of vocal behaviour are referentially more similar to animal signals than language.

A-058
Do you see what I believe? Infants' difficulty to represent a person's belief about the colour of an object

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Recent studies have demonstrated infants' ability to understand that others hold false beliefs (Baillargeon, Scott, & He, 2010). For object representation, it is known that the ventral stream is used to recognize an object, and the dorsal stream is used to code how to act on the object (Milner & Goodale, 1995). In previous infant studies it is possible that participants used these two streams to code the information about the agent's representations. More precisely, in Appearance-Reality-Tasks, infants could represent the apparent identity of the object on the ventral stream and the real function of the same object in the dorsal stream. But are one-year-olds able to show the same understanding when the properties have to be coded within the same stream? In the current study we tested whether 18-month-olds can attribute a belief to an agent about the apparent and the real colour of an object. Infants participated both in a perception-task to check if they considered colour as an important property of an object, and in a belief-task to check if they can attribute a belief about the object's colour to another person. Preliminary results show that, although infants recognize colour as an important object property in the perception-task, they do not seem to differentiate between the agent's true or false belief regarding the object's colour in the belief-task. Thus, processing the information on two different streams seems to facilitate Theory of Mind reasoning in infants in previous studies. Data collection will be completed within the following weeks.

POSTER
SESSION B

B-001
Ostensive and statistical aspects of human learning

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While there have been numerous studies separately supporting both purely statistics-based and ostensive-communicative learning, there is no study that address the question how these two sources of information are handled together. To test this, we made a combined statistical/ostensive learning paradigm, where the statistical and ostensive cues lead to different outcomes. Thus, if one or the other type of cue is more dominant, children would learn the corresponding outcome. We tested forty 18-month-old infants with a wooden experimental box with two switchers on the two sides of the box and a heart-shaped white lamp in the middle. Both switchers could be used to light up the lamp, and when the light was turned on, the box also gave a "bim-bam" sound. Infants were presented with two different demonstrations, one performed in the context of ostensive cues, and the other without any infant-directed communication. Both demonstrators pressed one of the buttons three times, but crucially for the Ostensive Demonstrator the button was effective only once, whereas for the Non-Ostensive Demonstrator the button was effective twice. After the demonstrations the infant could approach the box and manipulate it freely. We recorded which button infants chose to press. According to our results, infants pressed significantly more the ostensively demonstrated button, suggesting that subjects weighted disproportionally more the evidence favoring the ostensively demonstrated buttons. Thus, our results show that, under natural conditions, statistics provided by the sensory input can be overrode by the ostensive signals provided demonstrations.

B-002
The origins of hierarchical representations: Human infants redescribe dominance relations in unified, transitive structures.

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Representing dominance hierarchies requires integrating several relations in transitive structures. We tested the development of this capacity in 15-month-olds with violation-of-expectation paradigms.

In the "continuous" condition of Study 1, infants saw A dominating B (A>B), B dominating C (B>C) and C dominating D (C>D). In the "discontinuous" condition, infants saw the same movies in a different order: A>B, C>D, and B>C. If infants represent isolated relations (e.g. "A>B", "B>C" and "C>D"), the two conditions should be of equal difficulty. Conversely, if infants integrate relations in a single unified structure (e.g. memorising "A>B>C>D"), the discontinuous condition should be particularly challenging. It requires holding in mind two independent relations ("A>B", and "C>D") before integrating them with the third relation ("B>C"). Results indicated that infants remembered the relation between A and B only in the continuous condition.

Study 2 tested whether infants expect dominance structures to have some degree of transitivity. In the transitive condition, A dominated B, B dominated C, and C dominated D. In the intransitive condition, A dominated B, B dominated C, and C dominated A. Infants remembered the relation between B and C in the transitive condition, but not in the intransitive condition. These results suggest that human infants find easier to memorise dominance structures that are hierarchically organised.

B-003
Collaboration elicits equal sharing in 2-year-old children

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Humans are exceptionally prosocial, especially when sharing resources with others. When in receipt of a windfall of resources, children begin to share equitably by about five years of age (e.g. Rochat et al., 2009). When they collaborate in order to obtain goods, already three-year-olds share resources equally (e.g. Hamann et al., 2011). Surprisingly, even though two-year-old children are able to cooperate successfully with peers (Warneken et al., 2006), they were not required to share with others in those scenarios. The current study investigated whether already 2-year-olds share equally after collaboration if study materials are age-appropriate.

In the current study, 2-year-old dyads had to retrieve marbles out of a special apparatus. In the collaboration game both individuals had to push boards simultaneously to gain their rewards; thus children contributed mutually. Alternating, one individual received three rewards whereas the other child just retrieved one. We measured whether the advantaged child chose to equalize the outcome and shared one reward with the play-partner.

Preliminary analyses (n=12 dyads) showed that children shared equally in the majority of successful trials (M = 68%) and produced equal shares significantly more often than expected by chance, $t(11) = 2,59$, $p = .025$. Girls (n = 6) were found to share more often than boys ($F(1,10)=7,81$, $p=.019$). Testing of a control condition in which children retrieve their rewards by windfall is ongoing.

The results are discussed in terms of the hypothesis that peer collaboration might be the evolutionary background for egalitarian sharing and concepts of fairness in humans.

B-004
Functional relation between objects leads to taking their legend names as conventional

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Young children can distinguish the situations where a new word has a conventional meaning from the situations where it has only personal meaning for a speaker so other people don't know it (Diesendruck, Markson, 2001). Previous research found out that in order to determine conventionality of a word children rely on several cues: gaze direction (Henderson, Graham, 2005), linguistic forms (Diesendruck, 2005) and communicative context (Kotov, Vlasova, 2012).

According to our supposition children older than three years of age can determine conventionality of a word not only on basis of social cognition but also through the way word referent is used in the shared activity. If there is coherence between objects' actions, words referred to these objects will be taken as conventional by a child – opposite to words referred to incoherent objects.

In our research 2-4-year-olds got novel objects of simple geometric shape. The experimenter named those objects by legend words and used them to play with a child. In one condition the game contained the functional relation between objects while the other condition didn't. After the game the experimenter placed the objects within the child's view but out of her reach and left the room. The assistant then came in and asked the child which object she wanted to get. We found that children who had played the game without functional relations between objects, named the object by its shape, but children from the other group used the legend word. We will present age difference data in our report.

B-005
Point comprehension in 7-12 months old infants from three cultures

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Recent research shows that 12 -18 months old infants do not only follow other's pointing gestures, but can use this gesture to infer the location of a hidden object in a simple hiding game (Behne, Liszkowski, Carpenter, and Tomasello 2011). This understanding of the pointing gestures as referential and informative has also been demonstrated in infants from Yucatec Mayan families (Salomo and Liszkowski, in press), suggesting that comprehending other's referential gestures is a universal skill amongst infants in their second year of life. The question arises whether younger infants show a similarly complex understanding of this gesture. We investigated how infants between the ages of 7 and 12 months from three different cultures (24 Dutch, 16 Peruvian, and 14 Yucatec Mayan) performed on an object search task. Within the context of a hiding-and-finding game, the experimenter hid a toy for the infant, and then pointed to the location of the toy. Infants were then allowed to search for the toy. Results suggest that infants from all three cultures orient behavioural responses significantly more often to the correct hiding location than the incorrect location. Furthermore, the majority of infants already searched in the correct location on the first trial. Results from this study suggest that infants in their first year of life understand the function of the pointing gesture in a hiding-and-finding game. This rudimentary understanding seems to be a cultural universal, and is observed in infants with diverse experiences of caregiver interactions.

B-006
Context-Dependent Over- and Selective Imitation in Preschoolers

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Children from two years of age tend to over-imitate the casually irrelevant action steps (e.g. Horner & Whiten, 2005; Lyons et al, 2007); however, selectivity in children's imitative behaviour is also evidenced (e.g. Meltzoff et al., 1995; Carpenter et al., 1998; Gergely et al., 2002; Bekkering et al., 2000). Therefore, the challenge for research on imitation is to explain this seemingly contradiction in children's behaviour (Over & Carpenter, 2011). We suppose that the level of over-imitation depends on the perceived context and the instruction which deter-

mine the children's goal in their imitative behaviour. The present study aims to investigate how preschoolers imitate a long action sequence with relevant and irrelevant intentional steps if they understand the goal and can evaluate the relevance of the steps. The preliminary data show that in Condition 1, where children were not given any extra instruction (except for 'It is your turn.'), they reproduced the relevant steps and tended to skip the irrelevant ones. The children in Condition 2 were instructed to copy the action as faithfully as they could. This condition aimed to exclude the explanation that they imitated selectively in Condition 1 because they did not remember the irrelevant steps. As we predicted, while they reproduced more relevant steps than irrelevant ones, they imitated more irrelevant steps than the children in Condition 1. This suggests that preschoolers tend to imitate selectively if they unambiguously understand the modelled action and do not have social goals to copy the modelled actions exactly.

B-007
Action interpretation and rationality assumptions of preschoolers in overimitation scenarios

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Three broad types of accounts have been suggested to explain "overimitation"- the reproduction of elements in observed action sequences without obvious causal function: affiliation, causal confusion, and normativity accounts. The current studies tested between these accounts. Study 1 showed that children's action interpretation in overimitation-scenarios was flexible such that children considered the performance of an irrelevant action as more important in some contexts than in others:, children criticized a puppet for not performing the irrelevant action more frequently in a means condition in which means to reach an outcome were emphasized during action demonstration (35 % of trials), compared to an instrumental condition which focused on the goal of the action (19 %). Children thus interpreted the irrelevant element as obligatory in the means condition, but as optional in the instrumental condition. And they did so even without the model watching directly, and even after having witnessed the causal irrelevance – a finding incompatible with purely affiliation and causal confusion accounts. Study 2 (ongoing) further investigates children's flexible rational action interpretation under conditions of varying costs of overimitation: if children's behavior is flexibly guided by conventional or instrumental rationality, overimitation and protest will not be affected by costs in the means-condition (omission of irrelevant action violates conventional rationality). In the goal-condition, overimitation will be less frequent when costly, and protest might occur in response to puppet performing the costly irrelevant act (violation of instrumental rationality).

B-008
26-Month-Olds Use Iconic Gestures to Correct Ignorant Others

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Iconic gestures are pictorial representations of events and objects (e.g. a fist shaped hand moving up and down to depict hammering). Although previous research has claimed that infants aged 11-20 months use iconic gestures (Acredelo & Goodwyn, 1988), recent studies have shown that both comprehension (Namy, 2008) and production (Özçalışkan & Goldin-Meadow, 2011) of these gestures develop after the age of 26 months. Production studies, however, have focused on the natural gestures of toddlers. Here, we investigate whether they spontaneously create iconic gestures in an elicitation paradigm and use them communicatively.

We presented fourteen 26-month-olds with a puppet that performed incorrect actions with objects (e.g. spinning a hammer in the air). Children not only tended to correct the ignorant puppet explicitly (e.g. protesting "no"), they used iconic gestures to demonstrate the right action. These gestures were as likely to express actions done on one's own body (e.g. tooth brushing) as those performed in space (e.g. shoveling). Interestingly, although children used the relevant action/object labels as frequently as gestures, their gestures rarely co-occurred with these words.

Our results indicate that children can create iconic gestures on the spot, and use them communicatively to correct others by 26 months. They also contribute to studies which have shown that children protest against violations of known actions (Rakoczy, 2008; Schmidt, Rakoczy & Tomasello, 2010) by revealing that two-year-olds use gestures to do so. We currently investigate the emergence of the ability to use iconic gestures in normative protests by extending our findings to 20-month-olds.

B-009
Developmental changes in fixation durations in naturalistic and non-naturalistic complex scenes: A cross-sectional study

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Fixation durations in infancy research have long been considered to be indicative of cognitive processes such as attention and information processing. Previous studies showed how fixation durations can be affected by (a) individual differences between short lookers and long lookers, (b) stimulus characteristics (e.g. static vs. dynamic), and (c) developmental changes in saccadic inhibitory control. However, the influence of these factors, and particularly of the stimulus complexity, in infant fixation durations remains poorly understood. The present study investigated the developmental changes in fixation durations in complex naturalistic and non-naturalistic scenes and static images during the first months of life. Three groups of infants aged 3, 6 and 9 months were presented with (1) a set of customized naturalistic videos whereby three people perform several baby-friendly actions, (2) a second set of abstract non-social videos created from the first set, and (3) static complex images. Further, all the infants performed a gap-overlap task. Preliminary results revealed stable individual differences in fixations durations as well as systematic changes across viewing conditions in the 6-months-old group. Corroborating previous research, the gap and overlap measures correlated with individual mean fixation durations evidencing the influence of inhibitory control on gaze allocation. Developmental changes in fixation durations will be analyzed in respect to correlations with gap-overlap measures. These findings form the basis for building the first computational model of fixation durations in complex scenes in early infancy, enabling valuable insights into oculomotor control in typically developing children.

B-010
Tracking others' perspective in a MOT paradigm

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Recent research (Kovács et al., 2010) has shown that in a visual object detection task humans are not only capable of encoding and sustaining others' beliefs, but they do it automatically. It was argued that these automatic computations of others' beliefs modulate responses even when those should be based solely on own beliefs.

However, it is still a debate how could such a system work and why these beliefs modulate participants' responses when they are irrelevant.

One possibility is a low-level explanation based on findings about the object indexing system (Pylyshyn,1989;Kahneman & Treisman,1984). It might be hypothesized that there is a separate indexing system for tracking objects from others' perspective with similar characteristics as the object indexing system. This would explain a) the automaticity of the process - as object indexes get placed automatically, or even in a data driven manner (Pylyshyn & Annan, 2006) b) how the 'belief' of others' interfere with our own belief - as the identity of indexes are not necessarily accessible for all cognitive mechanisms (Pylyshyn, 2004).

For testing the hypothesis of this separate perspective tracking system we designed a version of the multiple object tracking paradigm (Pylyshyn & Storm, 1988). We placed it in a social context where another agent also attends to the stimuli and we measure how this affects the number of simultaneously traceable objects. An increase would indicate that there is additional capacity for tracking objects from perspective of others', opposed to a decrease which could show that while the tracking is automatic, it uses the same indexing system.

B-011
Lost memories: Verbal labels influence object recognition at 12 months of age

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Learning verbal labels modulates how the objects associated with them are perceived by 12 month-olds (Gliga et al., 2010). The goal of the current study was to explore whether verbal labels also affect the way in which object representations are maintained in memory. We recorded scalp EEG of 12 month old infants presented with an occlusion paradigm in which they saw objects being revealed, occluded and then either replaced by another object belonging to the same object kind (within-category change) or an object from a different object kind (across-category change) or revealed as they were before occlusion (no change). We tested two group of infants: the first group saw objects with labels familiar to infants (label group), the second group saw objects with unfamiliar labels (no label group). We predicted that the difference in object processing and maintenance over occlusion would manifest itself in infant's subsequent ability to recognize a change in the encoded objects as assessed by event-related potentials. Preliminary ERP analyses suggest that the knowledge of verbal labels does influence object recognition after occlusion. As expected, infants in the label group detected across-category changes but not within-category changes. Infants in the no-label group did not seem to detect any of the changes. Further analyses will investigate gamma-band oscillatory activity during the occlusion and during the reappearance of the object to understand how labels affect the maintenance of featural information in memory.

B-012
The Coupling of Infant-Parent Pointing from 8 to 13 months

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Despite the ubiquity of pointing in human communication, its origins remain controversial. Whereas individualistic accounts have claimed that early pointing is non-communicative (Bates et al., 1975; Vygotsky, 1978), social-pragmatic approaches have maintained that pointing is a social activity from the start (Bruner, 1983). Here we studied 19 infants longitudinally from 8 to 13 months of age, along with their parents, in order to shed light onto the emergence of pointing.

We first examined the morphology of points. Infants started index-finger pointing at 9 months. Both infants and parents pointed more with their index finger from 11 months onwards compared to earlier ages. Whole-hand points were present at 8 months but remained infrequent and constant over development. We then investigated how infants and parents coordinated their points, and examined the tendency of an individual to point at the same referent that their interaction partner had just pointed at. Both infants and parents increased their use of same-referent points from 8 to 13 months. Infants' same-referent points started correlating with those of their parents from 10 months onwards.

The different developmental patterns of index-finger and whole-hand points show that, in contrast to Vygotsky (1978), index-finger pointing does not emerge from the act of reaching. Moreover right from the time when they start pointing, infants coordinate their points with those of their parents, indicating that early points are social and communicative. Overall, our results lend support to a social-pragmatic account, and further demonstrate infants' abilities to share and understand referents in interactions.

B-013
Automatic belief-reasoning affects choice of response

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Recent research demonstrated that adults and 7-month-olds automatically encode others' beliefs (Kovács, Téglás, & Endress, 2010). In a visual–object-detection-task, an agent's belief influenced adults' reaction times and infants' looking times, even though the agent's belief was irrelevant to the task. By using an avoidance-false-belief-task we investigated behavioural consequences of this automatic belief-tracking in six-year-olds and adults. We used a computer-based task in a within-subjects design.

Participants observed as a dog passed one box, entered another one and finally jumped into a third box. Their task was to put a cat into one of these boxes but to avoid the angry dog. An agent appeared or disappeared in the background during the dog's performance. In the false belief condition (FB), this agent held a false belief about the current location of the dog. In the true belief condition (TB) the agent shared participants' representation of the location of the dog.

Preliminary results show that adults avoided the box where the agent falsely believed the dog was, although the agent's belief was irrelevant to the task, and chose the box that never contained the dog (t(7)=-2.546, p=.038), whereas in the true belief condition they chose randomly between the two empty boxes (t(7)=.001, p=n.s.). Children showed the same pattern of results: a preference for avoiding the false belief box in FB (t(10)=-2.070, p=.065), and a random choice in TB (t(11)=-0.906, p=n.s.). Thus, automatic belief-reasoning affects participants' choice for one of two response alternatives. Final data collection is in progress.

B-014
Nine-Month-Old infants use Labels to Categorize Objects: an EEG Study

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Recent work (Bergelson & Swingley, 2012; Parise & Csibra, 2012) strongly suggest that preverbal infants understand objects labels referentially, as symbols standing for the objects in some sense. Previous research (e.g. Ferry, Hespos & Waxman, 2010) has shown that spoken words, but not tones, facilitate the categorization of perceptually similar objects. The present study addressed the question of whether labels alone, without shared visual features, could make adults and 9-month-olds group objects together. Specifically, we hypothesized that if infants understand words as referring to object categories, they might exploit object labels to create new categories when no common visual features are available. To test this hypothesis, we used electrophysiological meth-ods. In a live adult-infant interaction, 9-month-old infants were familiarized to six novel objects that shared no visual features. Three of these objects were labelled by one nonsense word, the other three were labelled by another one. A subset of these objects, without labels, were then presented to infants on a screen in a classic oddball paradigm. Similarly to results with adults, we found a desynchronization of frontal alpha-band activity in response to the pictures of objects that belonged to the oddball category, though neither visual features nor linguistic labels differentiated them from the other objects. This result demonstrates that young infants form object categories by labels, and maintain them beyond the immediate context. Together these findings suggest that object labels are expected to refer to abstract categories as soon as word learning starts in infancy.

B-015
Infant Negative Affectivity and Event-Related Potentials Response to Auditory Novelty and Deviance

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Infant temperament reflects differences in emotional reactivity and self-regulation. The temperamental dimension termed "negative reactivity" describes some negative response to environmental factors, including fear, and may be related to auditory processing (Marshall, Reeb, & Fox, 2009). Event-related potentials (ERP) allow assessing early auditory processes. We investigated whether negative reactivity is associated with auditory novelty and deviance processing in young infants.

ERP measurements were conducted in 65 two-month-old infants at the Babylab of Tilburg University, The Netherlands. Mothers reported infant negative reactivity using the Infant Behavior Questionnaire. ERPs were recorded using an auditory oddball paradigm. Auditory stimuli comprised standard tones (0.7 probability), environmental ("novel") sounds, white noise segments, and tones identical to the standards but delivered with shorter inter-stimulus intervals (ISI) (0.1 probability, each). Mean ERP amplitude in the 100-300 ms post-stimulus time window was used as outcome measure.

A repeated-measures ANCOVA adjusted for gender and gestational age revealed no main effect of stimulus type, electrode site, and negative reactivity. However, we observed a significant interaction between stimulus type and negative reactivity (F=(2.49, 149.47)=3.04, p=.04). Higher negative reactivity was associated with larger ERP amplitudes for ISI deviants at frontal electrode locations (F=(1, 64)=5.38, p=.02) and smaller ERP amplitudes for novel sounds at parietal sites (F=(1, 64)=6.55, p=.01).

Thus, infant negative reactivity was positively associated with ERP responsiveness to temporal deviance and negatively with responsiveness to auditory novelty. These results suggest that infants with high negative reactivity may be more easily overstimulated, whereas less sensitive infants are more likely to seek stimulation.

B-016
Do 4-year-olds choose referential expressions according to speaker-specific referential pacts?

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Conversational partners form referential pacts (Brennan & Clark, 1996). When a conversational partner switches terms, comprehension is slowed (Metzing & Brennan, 2003). Pacts formed by adults are partner specific, but children's explicit responses suggest they expect all their conversational partners to use the same term. The current study asks whether children adhere to referential pacts in production and whether individual differences in this production are correlated with individual differences in social skills.

Twenty-three children (15 girls) between 51 and 62 months of age participated in four within-subjects conditions. Using a picture book, a child's canonical term for several objects was determined. A first puppet referred to the object he introduced either by the child's canonical term (control condition) or by another, equally applicable, term (pact condition). The child was then asked by the first puppet (same partner condition) or that puppet's friend (other partner condition) what was in the suitcase. The dependent measure was how often children use their own preferred, canonical referring expression. Children's social skills were assessed with a modified Social Skills Rating System (Gresham and Elliot, 1990).

It was found that children use the canonical object label significantly less after a non-canonical term was introduced as compared to the control condition when the puppet used the child's canonical term ($Z=-4.148$, $p=0.00$). However, no effect of conversational partner was found ($Z=-0.113$, $p=0.910$). Furthermore, no correlation was found between children's adherence to referential pacts and their social cognitive skills ($r = -0.152$, $p = 0.488$).

B-017
Maternal depressive symptoms during pregnancy alter auditory information processing in the two-month-olds offspring

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Background: High levels of maternal anxiety during pregnancy have been linked with alterations in early postnatal neurocognitive development. However, maternal depressive symptoms, which are another measure of psychological distress, have received less research. The present study examines whether prenatal maternal depressive symptoms may be related to how auditory information is processed in two-month-old infants. Methods: Maternal depressive symptoms were measured with the Edinburgh Pregnancy Depression Scale ($n=36$) in the first trimester. Two months after birth, infants' ERPs were measured during a passive auditory oddball paradigm with 4 types of stimuli: a complex tone of 500Hz base frequency (standard, $p=70\%$) delivered with 300 ms inter stimulus interval (ISI), the same tone preceded by a deviant (100 ms) inter-stimulus interval (ISI-deviant, $p=10\%$), white noise ($p=10\%$), and novel sounds ($p=10\%$). Results: Preliminary analysis by means of repeated-measures mixed-mode ANOVAs with "Depressive symptoms" (low vs. high) as a between-subject factor, using a cut-off score of 12 for low vs. high ($n=6$) depressive symptoms, and electrode positions factors Frontal-Central-Parietal x Left-Medial-Right as within-subjects factor revealed longer peak latencies for the P2 of the standard and the P350 of the noise deviant. Conclusion: Our preliminary data show that how the two-month-olds' brain reacts to deviant stimuli is influenced by maternal depressive symptoms during the first trimester of pregnancy. Thus, sensory cognitive processes involved in detecting irregularities in spectral and temporal sound features may be programmed differently for infants who early in utero have been exposed to maternal depression.

B-018
14- and 17-Month-Olds' Understanding of Failed Actions: An Eyetracking and Imitation Study

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The purpose of this study was to (1) examine 14- and 17-month-olds' re-enactment of unseen outcomes, (2) use a delayed imitation technique to test infants' memory capacities in re-enactment, and (3) compare eye tracking and behavioral data thereby considering infant attention during action observation.

The sample consisted of 36 14-month-olds (18 females; mean age = 14.66 months, SD = 0.48) and 36 17-month-olds (18 female; mean age = 17.60 months, SD = 0.48). Infants were randomly assigned to one of two conditions (full demonstration; failed attempt). Additionally a control group of infants is currently being analysed and this data will be presented also. Infants saw four out of six video clips, showing a person performing either full demonstrations with the objects (demo of target act) or failed attempts (target act never demonstrated). Afterwards, infants had the opportunity to handle all six test objects. The first two objects (not seen on video) were presented as baseline toys (no demonstration). The other four toys were familiar from the video demonstration (recall). Analyses of the imitation scores show that all infants showed imitative learning from video (recall > baseline: F(1,68) = 23.50; p < .01). No difference between experimental groups, and no main effect of or interactions with age were found. Hence, infants as young as 14 months fulfilled the model's intention even when demonstrations were on video and when infants' memory capacities were challenged by a delay. Comparisons of eye tracking and behavioral data will be reported on the poster.

B-019
Assessing Emotion Recognition with FACS-coded stimuli presenting childrens' facial affective expressions

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We introduce a new and suitable test of emotion recognition based on stimuli presenting spontaneous facial affective expressions of children out of genuine interactive play situations. Facial expressions were coded objectively with the Facial Action Coding System (FACS). Based on this unique method, we present two studies focusing on age and gender differences in facial emotion recognition of children and young adolescents. In a first study 275 children and adolescents aged 8 to 14 years (M = 10.46, SD = 1.45) rated 24 pictures that showed expressions of the basic emotions: happiness, anger, sadness, surprise, fear and disgust. The overall recognition rate was 55.4% with girls showing significant better results than boys. Happiness was rated best, followed by disgust, surprise, sadness, anger and fear. No age differences were found in Study 1. In Study 2 the ability of emotion recognition was investigated in preschoolers. 62 children aged between 3 and 6 years (M = 4.84, SD = 0.93) rated 12 pictures (2 of each basic emotion). Overall 41.4% of the stimuli were rated correctly. Happiness was recognized best, followed by sadness, surprise, anger, disgust and fear. In Study 2 age differences between an older (5-6 years) and a younger (3-4 years) group were found. Older children showed better emotion recognition abilities and recognized surprise and sadness significantly better than younger children. In study 2 no gender differences were found.

B-020
German-Turkish Bilingualism, the Use of Evidentiality, Cross-linguistic Transfer, and its Implications for Cognitive Development

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Although all languages of the world have means to express evidentiality, an aspect of language that expresses the source of a speaker's knowledge, they differ in their encoding. This can be observed in German and in Turkish, where German marks evidentiality lexically, whereas Turkish marks evidentiality grammatically. Consequently a research is proposed here, which aims to fill the gap of looking at child bilingualism, evidentiality and crosslinguistic transfer from a language dominance and cognitive conceptual developmental lens, by investigating whether or not there is a crosslinguistic transfer of evidentiality markers observable in German-Turkish 8-10-year-old bilinguals. The proposed hypothesis states that bilingual children that grow up simultaneously with one language with grammatical evidentiality markers (Turkish) and one without (German), will show crosslinguistic transfer and that the use of evidentials will depend on the bilingual child's language dominance, expressing itself as the dominant language influencing the weaker language. A part of linguistic relativity entails the Sapir-Whorf hypothesis, which claims in a simplified form that language influences the way that people think (Whorf, 1956). This hypothesis can be related to evidentiality through the following question: Does linguistic marking of evidentiality affect non-linguistic source reasoning in speakers of different languages? Is the evidential distinction more prominent in the mental life of speakers of a language that grammaticalizes evidentiality? Consequently a potential link can be established between the way in which conceptual ideas are pronounced through the presence of linguistic encoding and its visibility through crosslinguistic transfer and language dominance.

B-021
Correlates of Number Processing

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Purpose
The ability to rapidly compare approximate quantities at one gaze using a ratio-based system of representation has been investigated in animals and human infants, children and adults. This has been distinguished from the ability to differentiate small exact numbers up to 4, which are counted and remembered together with their individual characteristics. Studies of infants have so far focused on these two systems in different groups of infants, leaving unknown how they interrelate across developmental time (e.g. Xu & Spelke, 2000; Xu, 2003; Xu et al., 2005). Furthermore, development is an interactive process, yet it is hitherto unknown whether these systems develop in isolation or in interaction with other aspects of cognitive and social development. Only results of one study which found differences in number processing in children with William and Down Syndrome leads to the hypothesis that this ability relates to visual exploration patterns (van Herwegen et al., 2008).

Method
Forty 4- and 6-month-old babies participated in experimental tasks, using familiarisation and eye tracking, investigating small and large number processing. Further measures were: performance in visual attention, memory abilities, parent-child interaction, and parent-reported sleep patterns. These infants will be followed up at 8- and 10-months longitudinally.

Results
The results will be examined in terms of correlations across the different measures and which factors at T1 predict outcome measures at T2 focusing on number sensitivity. Once we have understood these factors in typical development, we will use the same protocol to explore similar questions in neurodevelopmental disorders.

B-022
Action experience facilitates 3.5 month-old infants' sensitivity to efficiency of reaching actions

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Recent research suggests that experience producing an action enhances an infant's ability to infer the goal of a similar action (Sommerville et al., 2005). Such findings have been taken as evidence that goal concepts are built from motor experience, or that goal attribution depends on sensorimotor representations. We propose instead that aspects of an inferential goal schema (e.g. a principle of efficiency) exist independently of action experience, and that first-person experience provides information relevant to inferring particular goals. We find that 3.5-month old infants given action experience (using a sticky-mittens training manipulation) are sensitive to the efficiency of simple reaching actions. Specifically, when habituated to an actor reaching over a barrier for an object, infants look longer on trials in which the actor continues to perform an arching reach in the absence of a barrier, relative to trials in which the actor reaches straight for the object. Infants trained with non-sticky mittens did not show this pattern. Crucially, these expectations about efficiency are unlikely to be derived from the action training, as infants did not themselves update actions based on physical constraints. This finding replicates the role of first-person experience in early goal inference, but suggests that the abstract principles brought to bear in interpreting others' actions may be independent of action experience, and be applied whenever sufficient information is available to infer an agent's goal. Furthermore, these data suggest that infants can make sense of actions that are motorically distinct from the actions they themselves produce.

B-023
The time course of phonological and semantic knowledge retrieval in language-mediated visual search in 24- and 30-month-olds

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Introduction
Previous studies have shown that infants actively extract phonological and semantic information during spoken word recognition, which in turn modulates infants' looking behaviour (e.g. Fernald et al. 2001). The current study investigates the time course of the retrieval of phonological and semantic knowledge in infants using a four-picture eye-tracking paradigm.

Method
Thirty 30-month-olds and thirty-two 24-month-olds were shown 24 experimental trials, in which they saw four pictures and heard one of the pictures being named: the target (the named object), phonological competitor (same onset consonant as target), categorical competitor (same category as target) and unrelated distractor. Infants' eye-movements on the screen were recorded with an automatic eye-tracker.

Results
Overall, toddlers fixated the named target picture more than both the competitors and distractor (p < .001). When examining the data in separate time windows after audio label onset, we found that 30-month-olds demonstrated an early phonological effect – increased fixations towards the phonological competitor (p < .01), followed by a later categorical effect – increased fixations towards the categorical competitor (p < .01). By contrast, 24-month-olds showed only a late categorical effect (p < .001).

Discussion
These findings demonstrate that retrieval of phonological knowledge precedes that of semantic knowledge when processing a spoken word, suggesting that phonological and semantic knowledge are processed separately in the early lexicon, a pattern only evident in the older age group. Furthermore, this is the first study to show that 24- and 30-month-olds are capable of demonstrating preferential looking in an adult visual world paradigm.

B-024
Rule learning in two-day-old domestic chicks (Gallus gallus)

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Sequence learning allows the encoding of the properties of event sequences, discriminating series composed of identical items presented in altered order, while rule learning allows the recognition of a familiar sequence-structure, even when composed of perceptually unfamiliar items. Human infants are capable of rapidly encoding serial order in event sequences. Moreover infants can recognize and generalize abstract algebraic-like patterns, a process that might be crucial for language development. Similar abilities have been uncovered also in non-human animals (including some recent and highly debated reports of sophisticate rule learning in avian species), consistent with an adaptive role of sequence and rule learning in a variety of sophisticate non-linguistic cognitive operations. In the present study, we imprinted naïve newborn chicks on a sequence of arbitrary visual elements (e.g. geometric shapes ordered according to an ABA rule, creating sequences such as circle-cross-circle). Afterward, we tested chicks' choice between this familiar sequence and a structurally different one, composed of the same elements in altered order (e.g. AAB, circle-circle-cross). We also tested chicks' ability to generalize the structure of the sequence they have learnt to sequences composed of novel elements (unfamiliar geometric shapes). Chicks successfully generalized, showing preferential approach of the perceptually-novel sequence whose structure resembled that of the imprinting stimulus. In a further experiment we extended our initial results, investigating whether this same generalization ability can be revealed also in a non-social context, employing a learning paradigm in which chicks are trained to find food hidden behind screens depicting one type of sequence.

B-025
Executive Function task contributions to Tower of London problem solving in Williams Syndrome, Down Syndrome and typical development

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While different cognitive skills have been researched in isolation, real-life problem solving is rarely studied, and yet it calls on many of these abilities in combination. The current study focused on how problem solving develops in typical and atypical populations, and on which executive functions contribute to problem-solving abilities in these groups. In a cross-syndrome comparison, individuals with Williams syndrome (WS) aged 12:4 to 24:3 (N = 19), with Down syndrome (DS) aged to 12:7 to 24:2 (N = 20) and typically developing (TD) children aged 4:9 to 11:5 (N = 56) completed a Tower of London (TOL) task. There were no significant differences in overall TOL performance across the WS, DS and a TD subgroup matched on non-verbal ability (RCPM), demonstrating that TOL performance was in line with non-verbal mental age for both of the atypical groups. Participants also completed measures of verbal (BPVS-III) ability and a range of measures of executive functioning (EF) (inhibition, planning, shifting and working memory). While verbal and non-verbal abilities as well as chronological age yielded significant positive correlations with TOL performance for the TD group (all p < .001), these associations did not hold for either of the atypical groups (all p > .05). Furthermore, the patterns of EF task contributions to TOL performance revealed marked differences across the groups. This suggests that problem solving draws on different skills for individuals with different genetic disorders. Implications of the findings for everyday problem-solving ability are discussed in relation to these differing profiles.

B-026
Long-term Recall of Rhyming text: Preschoolers Are Better Than Adults

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Most research on the capacity and reliability of children's long-term recall has found protracted development. Here we show, remarkably, that 4-year-old children's recall can equal, or indeed exceed, adults'. 11 middle-class families in Budapest, Hungary participated in the study. Parents read a novel, rhyming verse ("The Radish-nosed King") as their child's bedtime story (followed by a list of random words and nonsense words) for 10 consecutive days. Children's and adults' recall performance was then measured. Participants were asked to recall the story verbatim using only the original storybook's illustrations as visual cues. This was followed by recall of the word list, and finally, questions about the content of the story. Not only did the children readily recall the story, but their verbatim recall performance significantly exceeded that of their parents (who, it should be noted, even knew that they would be tested). Both groups recalled the gist of the story, and performed about equally well on the word lists (allaying concerns about differences in attention or motivation). We view rhythm and rhyme as ('surface') constraints on candidate words during recall (Rubin, 1985). While such constraints are beneficial independent of age, we argue that children memorizing children's verse presents a fortuitous coincidence: due to their limited, specialized vocabulary, surface constraints are more efficient, paring down possibilities to a smaller set of candidate words. Encoding and retrieval for explicit memories in 4-year-olds can be just as efficient as in adults, and due to the combinatorial explanation provided above, potentially even more so.

B-027
Cognitive processes underlying children's social status

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The relationship between cognitive processes and social skills are still not fully characterized. The aim of our study was to investigate cognitive processes underlying children's social status. We examined 72 typically developing children in two age groups. The younger group aged 8-10 years (N=36) and the older group aged 12-14 years (N=36). Cognitive processes were assessed with theory of mind, implicit learning and working memory tasks. Theory of mind (ToM) functioning was measured with Faux Pas and Faces tests. The Alternating Serial Reaction Time task (ASRT) was administered to examine implicit learning processes, and general cognitive functions were measured by the Counting Span test of working memory. We used sociometric status, defined by the number of positive and negative choices for evaluating children's peer status. We formed popular and rejected groups, based on children's peer nominations. We found no relationship between working memory capacity and peer acceptance either in younger or in older age group. In contrast, there was a link between sociometric status and the performance on implicit learning task: popular children performed better on the ASRT task than their rejected peers. This effect was only observed in the younger age group. Theory of mind performance did not differ by children's social status in either age group. According to our results, implicit learning and children's social status are linked in the younger age group. These results suggest that implicit processes are crucial in younger children's social behavior, but this relationship seems to disappear in older ages.

B-028
Kindernomics: Other-regarding Preferences and Game Behaviour in Children

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Human decision-making in social scenarios is often guided by other-regarding preferences, a phenomenon that makes us unique as a species. A common means of exploring such preferences in adults experimentally is through the use of behavioural economics. Although this methodology's use with adults is well established, its use with children is comparatively rare, something that needs to be rectified in order to properly chart the ontogenetic development of other-regarding preferences. We present here the results of a novel behavioural economics experiment, originally designed for primates (Kaiser, Jensen, Call & Tomasello, 2012), but performed in this case on both child (n=150) and adult (n=60) participants. This paradigm adapts the traditional ultimatum game by adding theft to the first player's decision options. Results show a highly significant difference in the response patterns of adults and children, with the former demonstrating markedly greater pro-sociality in their decision-making, and the latter's decision-making influenced by a significant effect of age. Nevertheless, the children in the present study did show clear evidence of emerging other-regarding preferences, something completely absent in the primate participants tested in Kaiser et al, 2012. The extent to which the public experimental setting may have influenced these results is discussed, as are implications for other-regarding preferences in general. By the time of the conference, additional data collection on this and other closely related experiments will have been performed on up to 1000 further participants. These data should also be available for presentation.

B-029
Young children care more about their reputations with ingroup than with outgroup members

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A concern for one's reputation represents a crucial device for maintaining cooperation in human societies (e.g. Nowak & Sigmund, 1998, 2005). A vast literature demonstrates that adults selectively modify their behaviors in the presence of others and behave more cooperatively when they are being observed (Reis & Gruzen, 1976; van Vugt & Hardy, 2010; Milinski, Semmann, & Krambeck, 2002). However, the ontogeny of such behavior has received very little attention. The only studies to date focus on schoolage children and, using verbally based tasks, report reputation management only in children of 8 years and older (Aloise-Young, 1993; Banerjee, 2002a, 2002b; Banerjee, Bennett, & Luke, 2010). In the current study, we investigated reputation management in 5-year olds using a novel methodology. More specifically, we focused on two variables crucial to reputation management, indirect reciprocity and group membership. Regarding the former, we investigated whether participants strategically invest in their reputations when doing so can benefit them in a subsequent interaction. Regarding the latter, we investigated whether particpants show an increased concern with their reputation when they are observed by an ingroup compared to an outgroup member. This study shows that even 5-year-old children strategically manage their reputations. Children shared significantly more resources with an anonymous recipient when the child watching them could reciprocate later. Furthermore, children shared significantly more resources when the child watching them was an ingroup rather than an outgroup member (as established by minimal group markers).

B-030
The verbal and schematic markers in overimitation effect

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We conducted our study to explore the idea of overimitation mechanism and social learning as a whole. The overimitation effect is a specific human way of children's behavior resulted from adult's demonstration of irrelevant actions on a new object. Children imitate these actions though don't make them without such adult's demonstration. We suppose that children take such demonstrated actions as an invitation to form convention for objects' use and a row of our previous research confirm it (Kotova, Preobrajenskaya, 2009; Kotova, Preobrajenskaya, Spiridonova, 2010).

Overimitation effect thus appears to be a culture learning mechanism and it reveals that different behavioral markers in adult's actions have an impact on children's behavior: which actions they will choose to copy in order to support convention. In a certain way our model is close to idea of ostensive features as pedagogical intention cues automatically percepted by each child from birth (Gergely, Csibra, 2009). But we expect different behavioral markers to be effective on different ages.

In particular we replicated Lyons et al. (2007) procedure where they directly instructed 4-year-olds not to make irrelevant actions. Our 7-year old subjects didn't overimitate under such instructions. Similarly the presentation of an object's drawing or its scheme during actions demonstration has different impact on overimitation level in children of school age and preschoolers. Thus children under certain age don't use verbal or schematic markers in adult's behavior to pick out the conventional actions though they understand these markers and use them for other purposes since early childhood.

B-031
Do infants represent ostensively demonstrated opaque means actions as culturally shared common knowledge?

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Accoding to natural pedagogy theory communicative demonstrations can induce trust-based learning of cognitively opaque novel means actions that infants acquire as socially shared normative cultural knowledge (Király, Csibra & Gergely, 2012). In this study our aim was to test the theory's central assumption, namely, that ostensively demonstrated opaque means actions are represented as normative cultural knowledge that are assumed to be shared and adhered to by other (unfamiliar) members of the community as well. The participants were 12-month-old infants, who were familiarized with a video display of a communicative agent ostensively demonstrating a novel means action to operate an unfamiliar artefact (a touch-sensitive lamp). In the experimental condition the demonstrator presented an unfamiliar and cognitively opaque novel means action: bending forward and touching the lamp by her forehead. In contrast, subjects in the control group saw a demonstration of an efficient hand action to light up the touch lamp. In the test phase both groups were presented with videos of a novel person operating the

artifact in two novel ways (turning on the light either by touching it with the elbow, or by raising it by hand to the head to establish contact). We tested the prediction that in the opaque-action demonstration condition infants' looking times will reflect their expectation that the unfamiliar agent ought to use the normatively demonstrated action type. The results show different looking times between the experimental and control group, supporting the idea that infants formed a normative expectation about the ostensively demonstrated action type.

B-032
Implicit Contrast to the stronger alternative improves SI generation in 5-year-old children

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Young children typically fail to spontaneously generate scalar implicatures (SIs; "Some elephants have trunks" = Not all elephants have trunks), without the assistance of training or context (Noveck, 2001; Papafragou & Musolino, 2003; Guasti et al, 2005;). Here we explore the possibility that children's difficulty lies with generating appropriate scalar alternatives (e.g. all when some has been uttered, cf. Chierchia et al, 2001, Barner et al, 2011) rather than inability to calculate SIs.

We tested 90 5-year-old children and 36 adults in a statement judgment task were a silly puppet provided true, false, felicitous and infelicitous statements with the quantifiers all and some. By manipulating the order of the statements within the experimental paradigm, we provided the stronger alternative all, either intermixed with the critical infelicitous some trials, or after the block of infelicitous some trials.

Adults were at ceiling in all trial types regardless of the order of the statements. Children's performance in the infelicitous some statements was hugely affected by the order they received the statements. Their overwhelmingly generated the relevant SI when they received statements featuring the stronger alternative all intermixed with the weaker some, but their performance dropped significantly when they received the weaker infelicitous some statements before they had a chance to see the stronger all statements (M:MIXED=.88, M:SOME-FIRST=.57 p<.01). We conclude that the availability of alternatives plays an important role in SI generation and might constitute a significant difficulty for young children. Implications for the relevant context and speaker intentions are also discussed.

B-033
Expectations about giving and taking actions in 12-month-olds

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Recent research have shown that infants are able to differentiate between dyadic and triadic, object-oriented interactions, such as giving events (Schoppner et al., 2006), suggesting that giving actions are encoded in a three-argument structure that relates two actors and an object. Moreover, giving actions are necessary for infants to interpret resource allocation events in terms of distributional fairness (Sloane et al., 2012). The present research adds to this literature by investigating whether infants ascribe giving or taking action roles to agents (Study 1), expect reciprocity (Study 2), and generalize giving and taking actions to new recipients (Study 3). For each study, 16 12-month-olds were tested using a violation of expectation paradigm. Infants were familiarized with two events showing an agent giving an apple to a Receiver and a second agent taking an apple from the same Receiver. In Study 1, infants looked significantly longer when in the test events the agent performed an action (giving/taking) that was opposite to the one performed in the familiarization, suggesting that infants ascribed the role of Giver or Taker to the agent. When the Giver/Taker was the Receiver shown during familiarization (Study 2), no difference between congruent and incongruent events was found, suggesting that infants did not expect Receivers to reciprocate giving or taking. Finally, when a new agent was used as recipient (Study 3), infants looked longer when giving (but not taking) actions were generalized to a new Receiver, suggesting that only giving events are represented as object-mediated interactions between two specific agents.

B-034
Infants' expectations about fronts, backs and action directions of novel agents

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Animal action is almost universally constrained by the animal's anteroposterior structure. We hypothesize that action processing in humans may benefit from a cognitive adaptation that enables (i) inferring the anteroposterior organization of novel agents from their behaviour, and (ii) action anticipation on the basis of an agent's current anteroposterior orientation.

We tested this hypothesis in 12-month-old infants who were exposed to a novel agent, an elongated yellow box, with unfamiliar morphology. The box had a single red spot either on its fore end (anterior-feature group) or on its back (posterior-feature group). First, infants watched the box chase a ball across a plane and off the screen. Next, on two consecutive test trials, the box-agent did not resume the chase while being oriented either towards the entering ball (facing trial), or away from it (behind-the-back trial). We measured infant's anticipatory waiting operationalized as the length of initial visual scanning of the motionless box-ball dyad. If infants spontaneously encoded the anteroposterior organization of the box during familiarization, and appreciated that it constrained the agent's actions, they should show longer anticipatory waiting on the facing test-trial (when the box's orientation was consistent with the direction of the anticipated chasing action) than on the behind-the-back trial (when it was not).

Infants displayed this predicted difference in anticipatory waiting, but only in the anterior-feature group. These results show previously undocumented abilities of human infants to appreciate dependencies between novel agent morphologies and actions, and point to a special role of frontal features in this processing.

B-035
Outcome variability in third-party contingent interactions as a cue to communicative agency
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Previous research has shown that based on distal, self-induced, high but imperfect contingent reactivity infants attribute communicative agency to an object. When such an object turns towards a target, infants interpret it as a referential gesture.

In this study instead of varying the degree of temporal contingency between two agents' actions, we varied the predictability of the sequential content of the vocal displays exchanged between two agents. We hypothesized that infants would attribute agency if the predictability of the reaction is not perfect.

We tested 10-month-old infants (n=48) in an eye-tracking experiment. In the learning phase, infants were presented videos of two stationary unfamiliar, figures that emitted triplets of tones in a turn taking manner. In the Imperfect Contingency condition the first tone of each sound triplet was always repeated by the second agent, while the second and third tones were varied and so

were not repeated exactly. In the Perfect Contingency condition the tone triplets were the same and were consecutively repeated by the two figures. After twelve triplet-pairs infants were presented 4 test videos in which one of the figures turned toward one of two lateral target objects.

We found that the proportion of looking to the target was significantly higher than chance in the Communicative (p=0.001; one-sample t-test), but not in the Mimicry condition (p=0.946; one-sample t-test). The difference between conditions was also significant (p=0.012; independent sample t-test). This suggests that the attribution of communicative agency could be induced by the perceived variability in the contingent.

B-036
Evidence for rapid word learning in 14-month-old infants: an eye-tracking study
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We investigated rapid word learning in 14-month-old infants using automatic eye tracking and the intermodal preferential looking (IPL) paradigm.

Thirty-four infants from English speaking homes took part in the study. Following familiarisation to two novel word-object pairings in a play phase, infants took part in two blocks of on-screen train-test IPL task, while their eye movements were tracked remotely. The labels (teʃand gɪnn) were repeated 17-17 times during the experiment. In the test trials, two pictures of the novel objects appeared simultaneously on the left and the right side of the screen and after 2500 ms one of the pictures was labelled.

We compared the proportion of target looking (PTL) between the pre-naming and two post-naming time windows in the two blocks separately. A significant effect of time window was observed in the second block only, indicating that the onset of the label caused a change in children's looking toward the named target picture. Pairwise comparisons revealed that the PTL in the first post-naming time window was significantly higher than in the pre-naming time window. Disengagement analysis of the first fixations also confirmed that infants learned the new object-label mappings.

Our findings indicate that infants showed learning in the second block only, suggesting that 17 repetition of a new object – label pair is sufficient for learning. Our analyses revealed that instead of analysing the PTL for the whole post-naming period, using shorter time windows is more sensitive to the effects of labelling on looking behaviour in this context.

B-037
Delayed imitation with change of contextual relevance suggests inflexible processes in early childhood

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Results on selective imitation suggest that children are able to encode the features of a situation and leave out unnecessary components during re-enactment of the actions.

With delayed imitation we addressed the question, whether memories of young children are flexible enough to adapt during retrieval processes to the characteristics of the situation. We presented 24-month-old children (n=58) with a four-step event with two 'irrelevant' components open to imitation, and varied whether one of the steps (a tool use) was relevant during encoding and irrelevant in retrieval phase or vice versa. The other step was irrelevant in both cases. One group of children participated in two sessions: first time including a presentation and second time after a week delay with no presentation. The other group participated one time, and was presented with the changed situation already during immediate re-enactment.

According to our results, children tend to selectively imitate the necessary components in immediate re-enactment. However, after the delay, in the changed context children follow their original strategy irrespectively of the contextual cues in the retrieval phase. Children showed a similar pattern of behaviour if presented with the changed context in immediate re-enactment. This suggests that selective processes take place during encoding, and are followed by relatively inflexible retrieval processes.

Furthermore, from delayed re-enactment they leave out the fully irrelevant component more frequently in the condition, where the tool use was relevant during demonstration.

B-038
Looking at upside-down body in children

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Like faces, bodies are significant sources of social information. Many studies have found that face recognition is impaired by stimulus inversion comparing other classes of visual stimuli. The aim of the present study is to investigate the mechanism of underlying the perception of human body shapes in childhood. Three experiments compared the recognition of upright and inverted houses, and body positions using a forced-choice, same / different paradigm in 4-year-old children. The results showed that for both reaction time and error data, the recognition of possible human body postures was more affected by inversion than the recognition of houses. The inversion effect was diminished for faceless and headless body positions. Results confirm configural processing for visual-spatial representation of human body in children as human body detection is disrupted by inversion, but the body posture discrimination relies on the head postion.

B-039
Reading intentions improves performance in the picture-based retrieval task

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2.5-year-olds readily solve the picture-based retrieval task (e.g. DeLoache, 2002). The present studies aim to improve the picture comprehension in younger children. We suppose that children perform better in picture understanding if they can interpret pictures as a result of intentional actions. The Study-1 investigated 24-30-month-olds. In the 'Experimental condition with representational intention' the children followed how the Experimenter was looking at different objects and then drew one of them. In order to involve the children into the intentional action, they could colour the drawings. Finally, children identified the depicted objects (four target objects). In the 'Control condition without representational intention' the children had to identify the replicas of the target objects. In the Test phase children in both conditions took part in a classical retrieval task with six trials.

The Study-2 repeated the experiment with 26-month-olds. In order to understand better the cause- effect relationship and to test young toddlers more effectively, we introduced three modifications in the procedure. During the Experimental treatment the children did not colour the pictures. Additionally, the retrieval task included four trials and applied a simpler spatial setting than the Study-1.

As we predicted, children in the Experimental condition performed significantly better in the retrieval task in both studies. Our data confirm the assumption that a brief treatment highlighting the intentional nature of pictures can help children use pictures as representations in the retrieval task. Nevertheless, the results raise the question how the applied intentional treatment could influence the understanding of other representational objects.

B-040
Habituation to repeated auditory sounds in two-month-old infants: influence of infant state and prenatal maternal anxiety

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Background: Neural habituation is a process in which repeated exposure to a stimulus leads to a decrease in neural response. Most studies into neural habituation have been conducted on adults and (to a lesser extent) children but little is known about this process in early infancy. Extending our knowledge about neural habituation is important for understanding both typical and atypical development of more complex cognitive abilities. Method: We recorded event-related potentials (ERPs) in an auditory oddball paradigm to assess whether: 1) two-month-old infants show a decrease in neural responses to repeated exposure of identical sounds, and 2) the infants' state of alertness influences neural habituation. Subjects were 26 infants whose mothers have been taking part in a longitudinal study on prenatal early life stress (PELS project). The auditory stimulus sequences consisted of 4 types of tones, one standard (70%) and three deviants (10%), each of 200 ms duration. Results: Preliminary analysis of the ERP responses elicited by the standard sounds revealed significant differences within task blocks as well as between the first and the last task block. Despite the fact that the ERP responses to the standard sounds were smaller in infants who were asleep than in infants who were awake during assessment, neural habituation took place during both states. Conclusion: These results suggest that neural habituation is already functional within the first few months of life. Future plans include examining the effect of prenatal maternal anxiety, as measured through the State-Trait Anxiety Inventory (STAI), on infant neural habituation.

B-041
Developing Representations of Compound Stimuli

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Classification based on multiple dimensions of stimuli is usually associated with similarity-based representations, whereas uni-dimensional classifications are associated with rule-based representations. This paper studies classification of stimuli and category representations in school-aged children and adults when learning to categorize compound, multidimensional stimuli. Stimuli were such that both similarity-based and rule-based representations would lead to correct classification. This allows testing whether children have a bias for formation of similarity-based representations. The results are at odds with this expectation. Children use both uni-dimensional and multidimensional classification, and the use of both strategies increases with age. Multidimensional classification is best characterized as resulting from an analytic strategy rather than from procedural processing of overall-similarity. The conclusion is that children are capable of using complex rule-based categorization strategies that involve the use of multiple features of the stimuli. The main developmental change concerns the efficiency and consistency of the explicit learning system.

Highlights:
• Children can learn to classify multi-dimensional, compound stimuli
• Children use both uni- and multi-dimensional rules in categorization learning
• The use of uni- and multi-dimensional rules increases with age
• Multi-dimensional classification of stimuli is the result of analytic processing

B-042
Development of spatio-temporal binding: Integration of spatial sequence and temporal order information
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Studies in adults have shown that the integration of spatial and temporal information in working memory is an effortful process. However, the exact mechanism behind the cognitive effort is not entirely clear. In order to explore this subject more deeply we created a new method for measuring spatio-temporal memory. Furthermore, we have investigated the development of binding processes. The sample consisted of preschool children, elementary school children and young adults. The simple tasks assess the memory span separately for the spatial localization of images (spatial task) and for the temporal order of objects's apparance (verbal serial task). Taking the dual nature of the temporal information into account, in the complex tasks we have separated the spatial-sequential organization of identical items (sequential task) and the combined verbal and spatial-sequential order of concrete objects (verbal-sequential task). The results highlight the distinction of the verbal-temporal order and spatial-sequential organization as well as the necessity of the integration of these information in a real-life situation. From a developmental view, memory for spatial information was found to be prior to temporal information even at the expense of language based order information. Consequently, these findings point out verbal and non-verbal aspects of spatio-temporal organization of memory.

B-043
Pre-linguistic vocal and gestural predictors of conventional word learning
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Prior to the onset of conventional language, infants lay the foundation for this transition with the acquisition of pre-linguistic vocal and gestural skills. However, until now the literatures focusing on early phonology and gesture have tended to remain isolated from one another despite calls for a more integrated approach to the study of early word learning (Hall & Waxman, 2004). It is therefore not known if these different aspects of early communicative development make independent contributions to later word learning or if in fact they are expressions across modalities of a shared underlying construct indicative of the infant's communicative maturity (Bates & Dick, 2002). This study, drawing on an existing longitudinal dataset of naturalistic video-recorded dyadic interaction (DePaolis & Keren-Portnoy, under revision), measured and weighted the onset of the primary pre-linguistic vocal (babble (Vihman, 1996)) and gestural predictors (pointing (Colonnesi, Stams, Koster, & Noom, 2010)) of vocabulary development in a single cohort. We controlled for environmental differences by considering maternal education. Infant pointing onset and babble onset were not correlated (r=-.130;p=.391), indicating they are not different measures of a single 'communicative readiness' construct. Moreover, regression analyses revealed that pointing onset was a significant predictor of receptive vocabulary whereas babble onset was a significant predictor of expressive vocabulary at 18 months. Maternal education was a significant predictor of both vocabulary outcome measures. These findings highlight how vocal and gestural abilities, while often produced in an integrated fashion early on, make independent but equal contributions to word learning.

B-044
Supporting early vocabulary development: What sort of responsiveness matters?
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Maternal responsiveness is a multi dimensional construct that has been positively related to the infant's later socio-emotional and cognitive development including a variety of language outcomes (Tamis–LeMonda, Bornstein & Baumwell, 2001). Encompassing "prompt, contingent and appropriate" responses (Bornstein & Tamis-LeMonda (1989)), a substantial body of research has sought to deconstruct this concept by considering different aspects of infant directed speech and interaction style. Drawing on an existing longitudinal dataset of naturalistic video-recorded dyadic interaction (DePaolis & Keren-Portnoy, under revision), maternal responsiveness toward their 9.5 month old infants was considered in relation to expressive vocabulary at 18 months. Three dimensions of responsiveness were operationalised: Semantic responsiveness: maternal utterances that referred to the infant's current focus of attention; Temporal responsiveness: maternal utterances occurring within two seconds of an infant vocalisation; Temporal and semantic responsiveness: semantically appropriate utterances occurring within two seconds of an infant vocalisation. Mothers who responded more often to their infant's vocalisations tended to do so in a semantically appropriate manner,

however, only utterances that were both semantically appropriate and temporally linked to an infant vocalisation were related to later expressive vocabulary development. Regression analysis revealed that prompt and semantically appropriate maternal language at 9.5 months was a significant predicator of expressive vocabulary at 18 months. This finding underlines the dyadic nature of the responsiveness construct and draws attention to the importance of early vocalisations as potential markers of infant attention. Further coding and analysis will consider other aspects of infant directed speech alongside non-verbal markers of infant attention.

B-045
Known verbs facilitate novel noun reference resolution in 20-month-olds

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Word learning involves identifying the referent categories for novel words. One way infants solve this problem is to use the words they have already acquired to reduce ambiguity in novel naming episodes. Recent evidence has shown that known verbs can facilitate noun acquisition: given a sentence such as "You can eat the manju", 24-month-olds select an edible object as the most likely referent for manju (Zangl & Fernald, 2005). This demonstrates that infants understand the known verb's selectional restrictions on the nouns in its object position and exploit these in judging referent candidate likelihoods.

Using an eye-tracking task, we presented 18-22-month-old children with two unfamiliar objects side-by-side on screen, one animate and one inanimate. Next, the objects were covered while the infants heard a novel noun, introduced in either a sentence including a verb that selected for animate subjects ("The vep is eating") or a neutral sentence ("The vep is over here"). At test, the two objects re-appeared and children were asked "Where is the vep?".

The results showed that when participants, who heard a verb that selected for an animate subject, were prompted to find the novel noun, they looked to the animate referent significantly more than did participants in the neutral condition. Thus, at 18 months, children (1) have abstracted the subject selectional restrictions of several known verbs, (2) make rapid language-relevant conceptual inferences regarding potential referents (e.g. animacy) and, (3) relate these two sources of information to resolve ambiguity in novel word reference.

B-046
Generalising beliefs from non-human to human agents

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In this looking-time study, infants watch videos of human or non-human agents performing actions, more precisely making a contrastive choice between two objects (Buresh & Woodward, 2007; Y.; Luo & Baillargeon, 2005; Luo, Kaufman, & Baillargeon, 2009). During the videos the agents are switched from robot to human in order to test whether children generalise the attitude they observed from the first to the second agent. A second independent variable is the robot's perceptual access towards the objects in front of it. Thus, the agent's mental attitude is induced not only by a contrastive choice between two objects, but also by her incomplete perceptions. In the test phase, the agent makes a choice that is consistent or inconsistent with the first one, this is our third variable. The first hypothesis was that consistently with results in literature, infants show different looking times according to the robot's preferential choice and perceptual access, showing their appreciation of the robot as intentional. The second hypothesis was that our young subjects will mainly adopt the object-centred or person-general learning mode, showing surprise when the preferred object changes on the video, but not reacting to a change in the agent, even when a robotic agent is switched to a human one. We believe that in this phase, the teacher is merely conveying information regarding the referred object; her person is therefore of less importance.

B-047
Prosodic exaggeration in infant-directed speech: Consequences for vowel learnability

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Infant-directed speech is characterized by prosodic exaggeration, such as increased pitch, larger intonation contours, and stretched durations. Prosodic exaggeration modulates infants' attention, and possibly facilitates language learning (e.g. Fernald & Kuhl, 1987). However, it is unknown how linguistically relevant properties of the speech signal are affected by changes in prosody. The current study investigates whether prosodic exaggeration results in an enhanced vowel space that supports the learnability of vowel categories. Specifically, we hypothesize that infant-directed vowels that are prosodically exaggerated are clearer instances of their categories than infant-directed vowels that are not exaggerated. Vowels were extracted from natural mother-infant interactions (the Brent corpus, Brent & Siskind, 2001), and annotated along prosodic dimensions (pitch, pitch range, duration). Two different vowel representations were used: formants (F1, F2) and Mel-Frequency Cepstral Coefficients (MFCCs). The learnability of different sets of vowels (i-a-u, i-ih-eh, eh-ae-a) was simulated using multivariate Gaussian Mixture Models. We found that models trained on formant values of prosodically exaggerated tokens showed higher classification accuracies than models trained on non-exaggerated tokens. In addition, we found positive effects of combining high pitch with long duration, indicating that combined cues give particularly good tokens. Models trained on MFCCs showed better overall performance, but still showed improved classification of prosodically exaggerated data. Taken together, these findings show that vowel distributions are enhanced by the way we speak to infants. The prosodic properties of infant-directed speech might thus be a helpful cue for infants in learning the phonetic categories of their native language.

B-048
Development of retrieval processes in source monitoring

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Recall, and – especially – source monitoring processes rely partly on conscious, willful control, but partly on automatic associative processes lacking conscious awareness, according to current cognitive psychology models. Several studies suggest that the two kinds of processes develop at different pace. However, models disagree as to what may be the source of seemingly surprising experimental results, i.e. fewer wrong memory responses in DRM tests in childhood. A plausible model involves the immature inhibitory processes in children. In our experiments children and adults had to remember the color of the presented object. The objects had either congruent (as in reality), incongruent (unreal) or neutral (indifferent) color. Our hypothesis – based on the immature inhibitory process model - predicts that while in the congruent category no difference can be observed, there will be a characteristic difference in the performance in the incongruent category, due to more erronous „congruent response" when remembering incongruent category objects (in the children age group). These errors may be attributed to the weaker inhibitory control at the young age. These results confirm our hypothesis, showing that the responses of the children are determined by a dominant tendency to respond based on associative processes, and an immature inhibitory apparatus.

B-049
Motor cortex activation during the observation of a novel action: the effects of visual, motor, and visuomotor experience

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Although perceptual-motor couplings have often been assumed to be innately specified, recent studies with adults suggest that they may instead develop through associative learning during the simultaneous observation and execution of actions (ASL hypothesis, Heyes, 2010). However, these studies do not provide direct evidence for the hypothesis that associative learning also underlies the initial formation of perceptual-motor couplings in the brain. The aim of the present study was to test this hypothesis by investigating how visual, motor, and visuomotor experience with a novel action influences infants' motor cortex activation when they observe others perform the same action.

Thirty 7-9-month-old infants were encouraged to perform stepping movements on a special infant treadmill while they either observed their own real-time leg movements (contingent training), or the previously recorded leg movements of another baby (non-contingent training). Infants in the control group did not receive any training. Before and after the training we measured the infants' sensorimotor alpha suppression (6-9Hz) when they observed other infants' stepping actions. Preliminary analyses demonstrated that all groups showed more motor cortex activation at post- than pre-test. However, we found no differences between

the groups, suggesting that motor activation when observing others perform an action does not depend on the amount of motor, or visuomotor experience infants received and that the visual experience of the pre-test alone was sufficient to result in motor cortex activation. These results suggest that, sometimes, visual experience alone can result in greater motor cortex activation during action observation.

B-050
Learning stress-position regularities at 8 months

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By 7 months, infants learn lexical stress regularities of their language. They can also learn other types of regularities. However, they seem to have difficulties with learning multiple regularities simultaneously. In the present experiments, we tested whether the familiarity with native stress-patterns helps infants to learn two regularities simultaneously and whether gaze-dependent reinforcing helps them to make cross-modal associations.

We tested 40 8-month-old Italian infants with 16 bi-syllabic words (12 familiarization and 4 test-words), stressed finally or initially. Each of the regularities was associated to one side of the screen where reinforcers could appear; in each trial, infants heard one word from either of the regularities. First group of infants saw reinforcers only when they fixated the correct side of the screen shortly after hearing the stimulus, and the second group saw reinforcers after a fixed time-period, independently of their looking.

In the test phase, only the infants from the first group exhibited learning. Nonetheless, they learned but one association. In the test phase, they correctly anticipated the side of the reinforcer only when they heard stress-final, and not when they heard stress-initial words. During the familiarization, the proportion of correct anticipations significantly increased in the stress-final and decreased in the stress-initial condition.

We conclude that gaze-dependent cross-modal reinforcing can facilitate learning. Nonetheless, the familiarity with predominant native stress pattern couldn't override the difficulties infants have with multiple cross-modal associations. Forced to attend to one only, they chose the less familiar regularity.

B-051
Cross-modal Attention: When does a sound hurt visual detectability?

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Previous studies in adults suggest that auditory information can influence visual detectability. Little is known regarding the development of such influences. Our study examined whether auditory cues could alter visual detectability in infancy. We used forced choice-preferential looking (FPL) to obtain contrast detection thresholds for a visual stimulus, a square,11x11 degrees, centered 15 degrees left or right of monitor center. The visual stimulus fluctuated in luminance at 1 Hz, under four different auditory conditions: (1) IP: an auditory stimulus, white noise modulating in loudness at 1 Hz, fluctuated in-phase with the visual stimulus, (2) OP: the auditory stimulus fluctuated out-of-phase with the same visual stimulus, (3) NS: no auditory stimulus was presented, or (4) CS: a constant auditory stimulus was presented. The visual stimulus was presented at one of five contrasts, randomized across trials. Threshold was defined as the contrast yielding 75% correct performance in the FPL task. For each subject, visual thresholds were obtained for two of the four possible conditions. If synchronized auditory information enhances visual detection, we expect lower contrast thresholds for the IP condition relative to the other conditions. Our data in 3-month-olds show that synchronized auditory information can worsen visual detectability. Such a counter-intuitive finding can be explained by the reallocation of cross-modal attention. If attention is a limited resource across modalities, a highly salient auditory stimulus can direct attention away from a near-threshold visual stimulus, worsening visual detectability most when visual and auditory information are changing in the same way over time (IP).

B-052
Shared knowledge as the basis of social categorization

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Children have been shown to possess a sensitivity to perceive the boundaries of certain social categories. We propose that this sensitivity serves the function of identifying culturally knowledgeable individuals, and thus it helps children to select reliable informants during the process of knowledge transmission. If this is in fact true, children should be sensitive to cues indicating that

another person shares the same cultural knowledge. To test this hypothesis we first familiarized 2-year-old children with videos depicting a male model who performed either conventional or unconventional tool-use. In the first test, children were shown two photographs on the screen simultaneously: one of the model and one of a stranger. Meanwhile from the speakers a man was heard speaking in a foreign language. We measured direction of first fixation as an indication of children's expectations about which person is more likely to be the source of the voice. The second test phase consisted of three imitation tasks. Our preliminary results show that children associated the foreign language to the model, if he had acted unconventionally and to the stranger if the model had exhibited conventional behavior. However, we found no clear evidence for selectivity in the imitation tasks. We propose that by two years of age children form representations of cultural group membership based on cues of shared knowledge, but they do not yet use this information to guide their learning processes.

B-053
Lie or Mistake? Deaf and Hearing Children's Understanding of Beliefs and Intentions

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Understanding the beliefs and intentions behind what people say is critical to interaction. For example, determining if a false statement is a lie or a mistake depends on our assessment of the speaker's awareness that the statement is false. Deaf children from hearing families are significantly delayed in their ability to pass false belief tasks compared to hearing peers and deaf children from deaf families (Meristo et al., 2012; Woolfe et al., 2002). We investigated children's ability to identify false statements as either a lie or mistake. Children were presented with a scenario where one protagonist had seen that some food was unfit to eat whereas another had not. Both uttered false statements to a third that the food was acceptable to eat. All children passed control questions, demonstrating they had understood the scenario and remembered who had seen what. However, hearing children and deaf of deaf children significantly outperformed the deaf of hearing group in their ability to correctly identify the lie and mistake. Since deaf of hearing children demonstrate delays in language acquisition, it is often argued that access to language plays a key role in social-cognitive development. The deaf of hearing children were therefore matched to hearing children with the same language age, revealing no significant differences in ability to detect lies and mistakes. Findings suggest that access to language is key to explaining why deaf children from hearing families have difficulty inferring communicative intentions based on reasoning about the mental states that underpin speech acts.

B-054
Meta-represenations of Moral Action: Support for the Universal Moral Grammar Thesis

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Mikhail (2011) has proposed that moral intuitions can be understood as the output of a computational process conducted over structured mental-representations of moral acts. Known as the Universal Moral Grammar (UMG) thesis, this suggestion is analogous to Chomsky's notion of an innate set of rules which guide the comprehension of language. The first step in providing support for the UMG thesis is to provide evidence that subjects are mentally representing moral actions in accordance with the highly structured ("grammatical") rules proposed by the theory. In order to do this, we developed a new methodology to assess subjects' representations of the basic structure of an action and meta-representations of the intentional structure of an action directly. Subjects read the classic "Footbridge" and "Sidetrack" trolley problems. They were asked to respond to true/false questions about the action of the agent. To assess basic representations, subjects were asked if sentences such as the following were true: "Hank turned the train by throwing the switch" (representationally correct); "Hank threw the switch by turning the train" (representationally incorrect). To assess intentional meta-representations, subjects were asked to respond to sentences such as, "Ian saved the five men on the tracks in order to throw the man off the bridge" (meta-representationally incorrect). Subject judgments followed the rules proposed by the UMG thesis – subjects were significantly more likely to affirm sentences in the "representionally-correct forms". Implications for the development of moral judgment are discussed.

B-055
Children and the Ultimatum Game: The Road to Hell Paved with Good Intentions

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The study used an Ultimatum Game (UG) to test the hypothesis that Theory of Mind (ToM) would enhance fairness per se against the hypothesis that ToM helps children understand others' minds' and reasons for rejection, generating fair offers.

35 early school-aged children participated in 4 standard false belief tasks and a false-belief UG.

In the UG children only participated as Proposers and received stickers. Two different colored boxes presented two possible distributions, either 3-2 or 4-1 (always favoring the Proposer).

After the distributions were counted loudly into different colored boxes and closed, a dark curtain was drawn hiding the demonstration table. Four trial demonstrations and pre-test questions checked that children knew that 4-1 offers always got rejected. In test trials the curtain "got stuck", so children could see a figure either take out and replace the stickers with the distribution unchanged (no-switch condition) or swap the distribution of the two boxes (switch condition) and also see that the Responder's curtain was closed.

Our hypothesis was that in switch conditions children would take into account the false belief of the Responder and offer less. However, difference only emerged among those who passed second-order-false-belief tasks. On the first trial even 75% of them chose the "fair" distribution, only on the second trial did they switch.

Children's good intentions of donating first lead them to loose stickers to finally prompt them to represent the Responder's false belief.

B-056
Differences between noun and verb learning periods from comprehension to production in early language development
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The assumption that noun acquisition predominates verbs remains controversial (Gentner, 1982). To investigate this assumption, we obtained word learning periods from comprehension to production in Japanese-learning children using the MacArthur Communicative Development Inventories (CDI) (Fenson, 1993), which assesses the early comprehensive and productive vocabulary skills of toddlers based on parental reports. By calculating when 50% of the children comprehend and produce each word, we estimated word-comprehension and word-production days:

$x \mid P(x)=a*exp(c*x+b)/(1+exp(c*x+b))=0.5$, (1)

where P(x) is the logistic cumulative probability density distribution for the comprehension and production words. To obtain their distributions (to obtain the parameters a, b, c), we assumed that toddlers first comprehend and then produce words, and next we simultaneously calculated both distributions using the Japanese version of CDI (Ogura and Watamaki, 2004) from 1,699 our neighborhood toddlers whose ages ranged from 10 to 32 months. We eliminated words without sufficient data to estimate the distributions. The results, which averaged the learning periods of nouns and verbs, were 189 and 249 days, showings significant differences between them (p<0.001) and strongly supporting the previous assumption of noun predominance in early lexical development. We also investigated the distribution shapes and identified overlap between them; they resemble the distributions of the shape, individuation, concreteness, and image ability (SICI) continuum hypothesis (Hirsh-Pasek, and Golinkoff, 2005). Such similarity suggests the existence of a SICI structure. Future work will investigate the learning periods of other languages to confirm our present findings.

B-057
Understanding deceptive intentions behind the communicative gestures
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Joint attention behavior and the ability to share experience with others serves a significant communicative function during the prelinguistic period of early ages, and along with facial and bodily gestures plays a salient role in the process of recognizing deceptive intentions of others. The aim of the present study is to discover how children (12-15-month-old) read the deceptive intentions from others' gestures. In Exp 1 we examined infants' reaction to an unreliable adult's behavior in a problem solving situation, where the teaching person behaves ambiguously. Infants are enable to discriminate the reliable and the deceptive communication of adults. Based on the previous results in Exp 2 we tested how infants respond to a new persons' communicative gestures following a deceptive condition. Our findings suggest that even 12-month-old infants understand deceptive intentions behind the communicative gestures in the unreliable teaching situation, but they do not generalize their previous experience for a new person who is treated as reliable source of information and teaches relevant information. These findings are consistent with the assumption based on natural pedagogy, that infants eventually treat adults as a reliable sources of information.

B-058
Language as meddler in infants' proactive gaze behavior

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Language can influence thoughts without being meaningful in the linguistic sense, e.g. for 3 month-olds, words but not other tones highlighted commonalities between objects [1]; 9.5-month-olds considered those sequences of actions as belonging together which were overlapped with speech [2]. To date, however, it has barely been investigated whether language can be a meddler in the proactive behavior typical of the observation of a goal oriented actions. In this study, using a Tobii eye tracker, we analyzed gaze behavior of a group of thirty-two 14 month-old infants, who were presented with video, in which an actor reached for three balls on a table and transported them into a box, in sequence. We considered three different conditions: the Base condition, in which no audio was associated to the video; the Sound condition, in which a sine-wave sound was added in correspondence of the reaching movements; and the Speech condition, in which a woman voice saying "Jag tar bollen" [I take a ball] "packaged" the reaching movements. The results of our experiments show that at 14 months of age, infants proactive gaze bahavior can be significantly influenced by acoustic packaging, i.e. to a verbal narrative concurrent with action observation. The presence of a social signal in form of a sentence "Jag tar bollen [I take a ball]" underlining the movement phase, rather than the action goal, reduced substantially the gaze proactivity exhibited by infants at this age in other conditions.

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RESTAURANTS
AND MAPS

Restaurants

1. Arriba Taqueria
  1067. Teréz körút 25.
  www.arriba.hu

2. Barokko Club & Lounge
  1065. Liszt Ferenc tér 5.
  www.barokko.hu

3. Braseiro Étterem
  1061 Teréz Krt. 23.

**4. Broadway Garden Étterem
  és Kávézó**
  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

8. Dimitrisz Étterem
  1067 Eötvös utca 25/a
  www.dimitriszpub.hu

**9. Westend underground
  food corner**
  (for example:
  Don Pepe pizzeria,
  Istanbul turkish restaurant,
  Thai restaurant,
  Chinese restaurant,
  Nordsee,
  Mediterranian Grill restaurant)

10. Grappa Étterem
  1067 Teréz Krt. 25.

11. Hang Zhou Kínai Gyorsbüfé
  1065 Podmaniczky u. 1-3.

12. Horvát Étterem
  1065 Nagymező u. 49.

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

14. Istambul Török Étterem
  1067 Teréz Krt. 23.
  www.istanbuletterem.hu

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