

Symposium on Individual differences and universals of human social cognitive development in Heidelberg



Thursday, September 20th

Morning Session: Innate and genetic influences on early emotion processing

Jukka Leppänen (University of Tampere)

Linking genetic variation to individual differences in early emotion processing

Studies have begun to examine how genetic variations give rise to individual differences in brain function and behavior and potentially explain vulnerability to various disorders. In this talk, I examine the hypothesis that some genetic influences arise early in life and are manifested as subtle individual differences in elementary emotional and cognitive processing systems. I present results from a longitudinal study examining how polymorphisms in specific candidate genes are associated with attention and emotion in 7-month-old infants. I also present preliminary data from analyses examining whether early-emerging variations in attention and emotion predict longer-term emotional and social outcome.

Tobias Grossmann (MPI for Human Cognitive and Brain Sciences)

Linking genes, brains, and behavior: Towards an integrated understanding of differences in emotion processing in infancy

Interacting with others by interpreting and responding to their emotional expressions is an essential and early developing social skill in humans. We examined whether and how variation in catechol-O-methyltransferase (COMT) and serotonin transporter (5-HTTLPR) genes is associated with 7-month-old infants' electrocortical responses to emotion expressed in face and voice. The results revealed that COMT variants are associated with differences in infants' brain responses to negative expressions, whereas 5-HTTLPR variants are associated with differences in infants' brain responses to positive expressions. Further support for differential associations of these gene variants with emotional processing came from our analysis of infant behavioral temperament: variation in COMT was associated with differences in infants' regulation of negative affect, whereas variation in 5-HTTLPR was associated with infants' expression of positive affect. These findings have wide reaching implications for our understanding of how genetic variation biases specific brain mechanisms involved in the processing of positive or negative emotions, giving rise to individual differences in emotional sensitivity and temperament.

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Afternoon Session: How rational is rational imitation?

David Buttelmann (University of Erfurt)

Putting the mental into social learning: Old and new evidence for the mentalistic stance

Gergely, Bekkering, and Király (2002) showed 14-month-old infants a demonstrator illuminating a lamp with her head. They found that infants subsequently imitated the demonstrator's action more when the demonstrator's hands were free than when they were occupied. Different researchers have proposed different explanations for this finding. Gergely et al. proposed that infants assumed that adults act efficiently given the observable situational constraints (teleological account), that is, when the demonstrator's hands were free and she still used her head, this must be the most efficient means. In contrast, Buttelmann, Carpenter, Call, and Tomasello (2008) proposed a mentalistic account: infants imitated based on seeing the demonstrator's intention as a rational choice of an action plan: they only imitated when they thought she had freely chosen to use the head action (for some reason unknown to them). Paulus, Hunnius, Vissers, and Bekkering (2011) proposed that infants imitated more when they could map the demonstrator's action onto their own motor repertoire (motor resonance account). Finally, Beisert and colleagues (2012) proposed that the finding by Gergely et al. can be explained best by differences in perceptual distraction in the participants (perceptual distraction account).

In the current studies we pitted these accounts against each other by making the demonstrator's constraints non-observable, and by keeping the demonstrated actions and the perceptual distractions during the demonstration identical in both conditions. In Study 1, we could show that infants attribute different goals to a demonstrator depending on whether she had a mental (not a physical) constraint or not. In Study 2, we demonstrated that infants could use mental constraints to determine what the demonstrator's intention (the means chosen to achieve her goal) was. These results support the mentalistic account of infants' imitation: Although the demonstrators' actions and the levels of perceptual distraction were identical in both conditions (challenging the motor resonance and the perceptual distraction accounts), and all observable constraints were identical (challenging the teleological account) infants imitated selectively based on the demonstrator's knowledge state.

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Markus Paulus (LMU Munich)

Don't neglect the motor system: The impact of motor resonance on infants' social learning

The neurocognitive mechanisms subserving social learning and imitation in infancy have recently become a topic of extensive theoretical discussion in developmental science. Some have argued that infants' imitation is based on rather abstract inferential processes (e.g., the ability to evaluate the efficiency of others' actions; Kiraly & Gergely, 2011). In this talk, I will present a series of behavioral and electrophysiological studies with 8- to 14-month-old infants that challenge this claim. Extending the ideomotor approach of action control to social learning in infancy, I will suggest that - instead of reflecting about the efficiency of others' behavior - infants learn about others' actions and the effects of these actions by means of acquiring bidirectional action-effect associations; and that these associations underlie infants' ability to imitate others' actions when they want to reproduce the same effect.

Moritz Daum (University of Zurich)

Rethinking rational imitation: The contribution of perceptual processes on the interpretation of observed actions

In their widely noticed study, Gergely, Bekkering, and Király (2002) showed that 14-month-old infants imitated an unusual action only if the model freely chose to perform this action and not if the choice of the action could be ascribed to external constraints. They attributed this selective imitation to the infants' capacity of understanding the principle of rational action, that is, to a cognitively demanding interpretation of the observed action. In the present talk, I will discuss and provide empirical evidence for a much simpler approach of perceptual distraction, which may be more appropriate to explain the original results. Manipulating the saliency of the context in the original task had a significant effect on the imitative behaviour of the infants. In fact, the results of a current study were exactly opposite to what rational imitation predicts. Based on these findings, and in accordance with other recent accounts, we suggest rethinking the claim that the notion of rational action plays a key role in selective imitation in 14-month-olds.

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Friday, September 21th

Morning Session 1: Genetic and social cognitive aspects of pathology: The case of autism spectrum disorders

Simone Berkel (Heidelberg University)

Inherited and de novo SHANK2 variants associated with autism spectrum disorder impair neuronal morphogenesis and physiology

Autism is an increasingly recognized, heritable neurodevelopmental disorder that is characterized by deficits in social interaction and communication as well as by the presence of rigid repetitive behaviors.

Using microarrays, we identified *de novo* copy number variations in the *SHANK2* synaptic scaffolding gene in two unrelated individuals with autism-spectrum disorder (ASD) and intellectual disability (ID). DNA sequencing of *SHANK2* in 396 individuals with ASD, 184 individuals with ID and 659 unaffected individuals (controls) revealed additional variants that were specific to ASD and intellectual disability cases, including a *de novo* nonsense mutation and several rare inherited changes. We have analyzed the functional impact caused by the mutations. To demonstrate that a R462X mutation when expressed in the mouse brain can be linked to physiological effects, we analyzed synaptic transmission and behavior and could show a reduction in AMPA receptor currents and altered cognitive behavior.

Herbert Roeyers (Universiteit Gent)

Joint-attention problems in young children with autism spectrum disorder and in their siblings

It is generally accepted that joint attention is impaired in children with autism spectrum disorder (ASD). As joint attention skills have repeatedly been demonstrated to relate to the development of language, cognition, social skills and behavioural competence, a better understanding of this impairment may not only have positive implications for early detection but also for intervention and long-term outcome. The aim of the current study was to compare young children with ASD, children at risk for ASD (siblings) and typically developing children (TD) in their joint attention skills and associated processes. 76 children participated: 22 children with ASD of 3 years old, and 22 siblings and 32 typically developing controls who were seen at 7, 9, 12, 18, 24 and 36 months of age. Siblings and TD children showed more joint attention behaviour in their first and second year of life than 3-year-olds with ASD. Performance of siblings and TD children was usually at the same level, but the control group showed a more stable developmental pathway than the siblings. Different associations were found between joint attention skills and associated processes in the 3 groups. Theoretical and clinical implications of the findings will be discussed.

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Morning Session 2: Identifying universals and cross-cultural differences of human social cognitive development

Heidi Keller (Osnabrück University)

Children's drawings of themselves in different cultural environments. The early expression of cultural selves

Children all over the world like to draw and follow an astonishingly stable developmental sequence from scribbles to tadpoles to realistic human figure drawing. However, drawings are never realistic copies of a reality but represent the inner world of the child, his or her mental images. In recent years there is an increasing interest in children's self and family drawings as expressing broader cultural models with differential emphases on autonomy and relatedness. In a multicultural research program we have collected children's drawings of themselves and their families in German and Turkish urban middle class families, Cameroonian and Turkish rural farmer children as well as in Turkish migrant families in Germany. The results confirm the expression of cultural models in children's drawings across different stages of drawing development. Implications for the educational practice are discussed.

Jürg Wassmann (Heidelberg University)

Theory of Mind. Reasoning across Cultures in Oceania

In this talk the results of five interdisciplinary research projects of anthropologists and psychologists are presented, who did a joint research in different regions in Oceania with the aim of testing the Theory of Mind. Emphasis is given to the more general problems involved that arise when Western theories (with an assumingly universal validity) are being tested in other (non-Western) cultures – among people with differing concepts of personhood and other ways of problem solving or expressing empathy. Just imagine the reverse: they would test us with their own methods and cultural background – we would be in a very difficult situation and with low performing results, similar to the results of non-European cultures since decades of research.

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Afternoon Session: Infant learning and joint attention

Beate Sodian (LMU Munich)

Joint Attention, Perspective Taking and Theory of Mind. Findings from a Longitudinal Study

Theories of joint attention have emphasized its significance for the development of social cognition, but little empirical research has investigated these claims. We present evidence from a longitudinal study of N=88 infants for distinct behavioral and neural correlates of imperative and declarative joint attentional competencies. Furthermore, we show that individual differences in declarative joint attention at the age of 12 months are predictive of mirror self recognition, which in turn predicts Level-1 perspective taking at 30 months. Moreover, declarative joint attention at 12 months predicts false belief understanding at 50 months, independently of general language skills. These findings add to our understanding of conceptual specificity and continuity in social cognitive development from infancy to preschool age.

Eugenio Parise (Central European University, Budapest)

Words Refer to Object Kinds in 9-Month-Old Infants

Even infants below one year of age display recognition and understanding of some words, but the nature of this skill is debated. We used electrophysiological methods to investigate (1) whether young infants' word knowledge reflects referential understanding, and (2) whether they expect that object labels refer to object categories. In the first study, mothers of 9-month-old infants introduced objects to their child by pointing gestures and labels. The objects then appeared from behind an occluder, either matching or mismatching the preceding label. We found a clear N400 effect, showing that semantic priming occurs in young infants. In the second study, we familiarized 9-month-old infants with six novel objects that shared no visual features, three labelled by one nonsense word, and three labelled by another one. A subset of these objects, without labels, were then presented to infants in an oddball paradigm. We found a desynchronization of alpha-band activity in response to the oddball category, showing that young infants form object categories by labels. Together these findings suggest that word meaning is referential from the outset, and object labels are expected to refer abstract categories. Such expectations drive, rather than result from, vocabulary acquisition in humans.

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Sabina Pauen (Heidelberg University)

Learning categories from observing others – A case of natural pedagogy?

From early on infants are able to form categories at different levels of abstraction. Soon, they can identify category membership of exemplars that they never encountered before. What role do social-communicative cues play in the context of learning categories? The role of verbal input for category formation and identification has already been studied extensively but little attention has been given to nonverbal cues so far. As will be demonstrated 12-month-old infants (but not 7 or 9-month-olds) are well able to understand that another person is interested in one kind of object, if they see the other person repeatedly turn her head and gaze towards one kind of thing (sometimes located on the left and sometimes on the right side) while disregarding exemplars from a contrasting category. Infants can even monitor corresponding person-category relations for two people interested in different object kinds in parallel. This effect is no longer present, however, if the other person does not provide ostensive cues before guiding infants' attention towards one specific category. Implications of this set of findings will be discussed.

Rachel Wu (University of Rochester)

Learning from attention cues during infancy

Human infants develop a variety of attentional mechanisms that allow them to extract relevant information from a cluttered world. We know that both social and non-social cues shift infants' attention, but not how infants use these cues to learn basic events. With over 450 infants, three extensive eye-tracking studies showed that infants' ability to learn about structures in their environment (i.e., predicting the appearance of audio-visual events and forming expectations about co-occurring features) is dependent on the presence and nature of attention cues. By 8 months of age, infants learned these events better with social cues (e.g., eye gaze, infant-directed speech, expression of interest) than with non-social cues (e.g., flashing squares) or without any attentional cueing. The last study found that familiar communicative social signals (i.e., an engaging face that spoke to the infant) boosted 9-month-olds' learning about cued events. In particular, the engaging face supported learning from non-social cues, providing evidence for a mechanism explaining how infants learn to learn from unfamiliar attention cues such as pointing or arrows. This research provides compelling evidence that attention cues (in particular, social cues) mediate infants' learning in the typical cluttered environment.

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Saturday, September 22th

Morning Session: Action production and action understanding in early development

Christine Fawcett (Uppsala University)

Action and social understanding in the first years of life

How do infants develop the ability to anticipate others' behavior? I will first discuss the measure of anticipatory gaze and appropriate thresholds to use for deciding whether gaze is predictive or not. Next, I will describe several studies on infants' ability to anticipate others' object-directed actions and how that ability relates to their own action experience from the ages of 6 months to 2 years. For example, one study shows that experience being fed with a spoon predicts infants' anticipation of spoon-feeding actions. Finally, I will introduce studies on infants' anticipation for actions within a social context (e.g., giving and receiving or collaborating toward a goal) and discuss how contextual cues such as social engagement between actors contribute to infants' perception of others' actions and goals.

Birgit Elsner (University of Potsdam)

Processing of others' actions in the first years of life

In the second year of life, imitation is typically taken as an indicator of whether and how infants understand the intentions underlying other persons' behavior. Novel methods like eye tracking promise to give closer insight into how infants perceive and process others' actions. In a first study, we investigated 12- to 14-month-olds' eye movements when they looked at a model performing an unusual action that was or was not justified by situational constraints. In a second study, we examined 14- and 17-month-olds' eye movements while they looked at fully demonstrated actions vs. at failed attempts. Infants' fixations to various functional aspects of the observed actions differed across time and also between the demonstration conditions. We conclude that eye tracking data, which are online-measures of visual attention, give important information on which aspects of others' actions are rendered as significant, and thus are preferentially processed, by infants.

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Sabine Hunnius (Donders Institute for Brain, Cognition and Behaviour, Nijmegen)

Infants' actions broaden their minds: Action experience and action perception in early development

From the first days of life, infants watch their environment and the people acting in it. Although the actions they observe form a continuous, intricate stream of complex information, infants show indications of understanding and predicting other people's actions. How exactly infants come to make sense of actions they observe is still only fragmentarily understood. In adults, the impact of one's own action experience on action processing has been described frequently. According to ideomotor theories observing someone else perform an action activates an internal motor representation of that same behavior within the observer. This activation of the observer's own action system is thought to support action decoding and understanding. In line with this, it has been suggested that infants' experience of carrying out specific actions contributes to their understanding of these actions in others. I will present a series of eye-tracking and EEG experiments that demonstrate how action production and action understanding are deeply intertwined already early during infancy.

Vincent Reid (Lancaster University)

Action perception and action production are linked in infancy: evidence from diverse processes

In order to understand how experience of an action alters functional brain responses to visual information, including the perception of others, I will describe two very different approaches that I have used in order to shed new light on this topic. In one study, we examined the effects of reflex walking on how 9-11-week-old infants processed biological motion. We gave experience of the reflex walk to half the participants, and did not give this experience to the other half of the sample. The participant's electrical brain activity in response to viewing upright and inverted walking and crawling movements indicated the detection of biological motion only for that group which experienced the reflex walk, as evidenced by parietal electrode greater positivity for the upright than the inverted condition. This effect was only consistently observed for the walking stimuli. In another study, infants at 8 months of age were presented with biologically possible or impossible stimuli. We assessed the level of motionese produced by mothers and the motoric capacities of the infants. Only those infants with higher than mean fine motor skill appeared to discriminate the two conditions. Together, these studies indicate that experience must play a role in how infants process information contained in moving stimuli.
